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ABSTRACT BOOK

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Oral Session -
Invited, Keynote Speakers, Awards
100 - Welcome and INSAR President Address
8:30 AM - 9:00 AM - Grote Zaal

8:30 Welcome and INSAR President Address.

Oral Session -
Invited, Keynote Speakers, Awards
101 - Keynote Address - Geraldine Dawson, PhD
9:00 AM - 10:00 AM - Grote Zaal

Geraldine Dawson is Professor in the Departments of Psychiatry and Behavioral Sciences, Pediatrics, and Psychology & Neuroscience at Duke University. She is Past-President of the International Society for Autism Research and a member of the Interagency Autism Coordinating Committee. She is Director of the Duke Center for Autism and Brain Development, an interdisciplinary autism research and treatment center, and Chair of the Faculty Governance Committee for the Duke Institute for Brain Sciences. Dawson has published extensively on early detection, brain function, and treatment of autism. With Sally Rogers, she developed the Early Start Denver Model, a comprehensive early behavioral intervention for young children with autism. Her awards include a Lifetime Achievement Award from the Association for Psychological Science and the NIH Top 20 Advances in Autism Research Award in 2007, 2008, 2009, 2010, 2012, 2013, 2014, 2015, 2016, and 2017. TIME magazine recognized her work as a top 10 medical breakthrough of 2012. She completed a Ph.D. in Developmental/Child Clinical Psychology from University of Washington and clinical internship at UCLA.

9:00 Paradigm Shifts in Approaches to the Early Detection and Treatment of Autism

***G. Dawson**, Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Over the past few decades, scientists have discovered how early brain development differs in infants and young children with autism, which has helped explain both the challenges and the strengths and abilities that are associated with autism. Furthermore, research has demonstrated the potential of early behavioral intervention to positively influence the trajectory of both behavioral and brain development in children with autism. As our understanding of the biological basis of autism increases, new treatments designed to enhance neuroplasticity and improve outcomes are currently being developed and tested. Clinical trials evaluating these new treatments are incorporating brain-based measures and quantitative, digital assessments of behavioral outcomes. Such digital approaches to behavioral assessment are transforming how we detect and understand autism and improving our ability to assess the efficacy of novel treatments.

Panel Session
Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
102 - Translational Electrophysiological Predictors of Individualized Treatment Response in School-Age and Adolescent Individuals with ASD
10:30 AM - 12:30 PM - Grote Zaal

Panel Chair: Tessa Clarkson, *Stony Brook University, Stony Brook, NY*

Discussant: Shafali Jeste, *University of California, Los Angeles, Los Angeles, CA*

A variety of empirically-supported treatments for individuals with autism spectrum disorders (ASD) exist, however given the vast heterogeneity and comorbidity in ASD (Simonoff et al., 2008), predicting an individual's likelihood to respond to treatment remains challenging. Subjective-report and behavioral measures capture a broad-range of symptoms collapsed within a single measure, which are not ideal for understanding within- and between-person variability in discrete constructs that might best predict treatment response. In contrast, electroencephalography (EEG) provides unique insights into the neural mechanisms of discrete constructs in ASD such as threat sensitivity in anxiety (Meyers et al., 2013), approach-withdrawal behaviors (Sutton & Davidson, 1997), incidental face-memory (Key et al., 2013), and suppression of interfering information (Faja et al., 2016). This specificity makes EEG measures ideal predictors/outcome measures of construct-specific treatment response. The coordination of these presentations aims to outline "who will respond to which treatment" by discussing the development and application of specific EEG measures that either suggest an individual has a propensity to improve or experience an attenuation in social skills and anxiety after targeted intervention. The goal of this panel is evaluate different EEG measures for their use in determining the best course of treatment for a particular individual with ASD.

10:30 **102.001** Developing ERP Biomarkers of Social Cognition: The Journey from Task Design to Treatment Outcome Measures

***A. Key**[1], B. A. Corbett[2] and D. Jones[3], (1)Vanderbilt Kennedy Center; Dept. of Hearing and Speech Sciences, Dept, of Psychiatry and Biological Science, Vanderbilt University Medical Center, Nashville, TN, (2)Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN*

Background: Successful development of effective treatments targeting social cognition in children with autism spectrum disorder (ASD) depends in part on the availability of objective outcome measures. Multidimensional approaches combining traditional behavioral assessments with psychophysiological measures yield more detailed information about treatment effects than standardized tests alone.
Objectives: The purpose of this series of studies was to develop and validate the nonverbal measure of social interest (incidental face memory) as a brain-based marker of social cognition suitable for use as a treatment outcome measure in children with autism.

Methods: Brain responses associated with spontaneous face perception and memory were evaluated using visual event-related potentials (ERPs)

in a pre-post design in four groups of children with ASD (age 7-16 years, total n=90), including three treatment cohorts (peer-implemented social skills program). Additional data from typical controls (age 7-46, total n=37) and children with Prader-Willi syndrome (PWS; age 7-16 years, n=28) who demonstrate social deficits overlapping with ASD were used to further validate the proposed ERPs as a measure of social interest. All subjects viewed a series of color photographs depicting unfamiliar smiling young adults or house facades. One image of each type was randomly selected and repeated throughout the test session while the rest were shown only once. Social interest was quantified as the increased parietal ERP amplitude (300-600 ms) to repeated faces vs. those seen once. Behavioral measures of social cognition included NEPSY Memory for Faces test, caregiver reports (Social Communication Questionnaire, Social Responsiveness Scale, Child Behavior Checklist), and coded observations of playground behaviors with peers.

Results: All participants demonstrated perceptual discrimination of faces vs. houses as reflected in the larger N170 responses to the former. Increased parietal ERP responses to the repeated faces indicative of incidental memory traces were present in typical controls and in children with PWS with more typical social functioning, but not in children with ASD prior to treatment or in children with PWS with greater ASD-related symptomatology. Following the social skills intervention, children with ASD in the treatment group demonstrated increased ERP amplitudes to repeated faces compared to the baseline assessment, while the waitlist control group showed no change. This pattern of results was replicated in each of the three treatment cohorts. The ERP index of social interest did not correlate with IQ or ADOS severity scores, but showed associations with behavioral measures of social skills and behavior.

Conclusions: ERP-based measure of social cognition obtained in the incidental memory paradigm is a promising treatment outcome measure. It fits the biomarker definition as an objective and reproducible measure of neural activity differentiating typical and atypical social information processing. The replicated evidence of its sensitivity to treatment effects, good test-retest stability in the control groups, correlations with behavioral endpoints, and reduced susceptibility to the placebo effects due to the passive nature of the task further support its value as a treatment outcome measure.

10:55 **102.002** Does Baseline Frontal Alpha Asymmetry Moderate the Effect of the PEERS® Intervention in Adolescents and Young Adults with ASD?

H. K. Schiltz[1], *A. J. McVey*[1], *A. D. Haendel*[2], *A. Barrington*[3], *B. Dolan*[4], *K. Willar*[5], *S. Pleiss*[6], *A. Carson*[7], *F. Mata-Greve*[8], *C. Caiozzo*[9] *and A. V. Van Hecke*[10], *(1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Biomedical Engineering, Marquette University, Milwaukee, WI, (4)Medical College of Wisconsin, Milwaukee, WI, (5)Children's Hospital Colorado, Aurora, CO, (6)Great Lakes Neurobehavioral Center, Edina, MN, (7)Baylor College of Medicine, Houston, TX, (8)Marquette University, Shorewood, WI, (9)Psychiatry and Behavioral Sciences, Children's Hospital of Philadelphia, Philadelphia, PA, (10)Psychology, Marquette University, Milwaukee, WI*

Background: Challenges in social relationships are at the core of ASD. Previous research suggests that social skills interventions are beneficial (Miller, Vernon, Wu, & Russo, 2014), although they are not one-size-fits-all; variability exists in the degree of change even for studies demonstrating mean-level improvements. The heterogeneity in ASD, in terms of behavior and neurobiology (e.g., Sutton et al., 2005), likely contributes to the differences in intervention outcome. Thus, this necessitates further investigation of the question: for whom are particular interventions most beneficial (Lerner, White, & McPartland, 2012)?

Objectives: The current study examined whether patterns of neurological activity, as indexed by frontal alpha asymmetry, might impact outcomes of the PEERS® intervention. Alpha asymmetry has previously been related to motivational systems involving tendencies for withdrawal (rightward) and approach (leftward) patterns of behavior (Sutton & Davidson, 1997).

Methods: One-hundred and one adolescents and young adults with ASD participated in this randomized controlled trial (RCT) of PEERS® and PEERS® for Young Adults. Diagnoses of ASD were confirmed using the ADOS-G (Lord et al., 2002). The KBIT-2 (Kaufman & Kaufman, 2004) was used to assess IQ; participants had an IQ of 70 or higher. Measures were taken at pre- and post-intervention for the experimental group (EXP), and occurred approximately 14 or 16 weeks apart for the waitlist control group (WL) for teens and young adults, respectively, followed by participation in PEERS®. Measures included caregiver-report on the *Social Responsiveness Scale* (SRS: Constantino, 2005) and a 3-minute resting state EEG paradigm, from which frontal alpha asymmetry was calculated with larger asymmetry values reflective of more leftward dominant alpha activity.

Results: A multiple linear regression was employed to test the effect of Pre-SRS scores, Group (WL as the reference group), frontal alpha asymmetry, and the interaction between asymmetry and Group on Post-SRS scores $F(4,96)=47.23$, $p < 0.001$. Results indicated a significant effect of Pre-SRS scores $b=0.83$, $p < 0.001$ and Group $b=-19.73$, $p < 0.001$ and a significant interaction between Group and Asymmetry $b = 18.68$, $p = 0.05$. This interaction was probed by regressing Post-SRS on Pre-SRS and plotting the residuals against alpha asymmetry. Examination of the plot revealed a positive slope in the EXP group and a negative slope in the WL group. Thus, in the EXP group, those with more negative residuals and, thus, a lower-than-predicted SRS score at post-intervention, had more negative asymmetry scores indicative of a more rightward dominant frontal alpha activity before intervention.

Conclusions: These findings suggest that the impact of the PEERS® intervention may be moderated by frontal alpha asymmetry. Those with the greatest improvement seem to be participants with a more rightward asymmetry before intervention. Thus, participants with a neurobiological profile suggestive of withdrawal seem to receive the most benefit from the intervention, even when controlling for initial levels of social functioning. Considering the practice of approach-related behaviors involved in PEERS®, perhaps those with a tendency towards withdrawal have the most room for improvement in this domain that can be further compounded with the acquisition of social skills.

11:20 **102.003** Discrete Electrophysiological Indices of Anxiety Differentially Predict Anxiety Symptom Reduction Following Group Social Skills Interventions

T. Clarkson[1], *E. Kang*[1], *C. M. Keifer*[1], *T. Rosen*[1] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: While anxiety symptom reduction is a frequent target for common autism spectrum disorder (ASD) treatments such as Group social skills interventions (GSSIs; McMahon et al., 2013), individual differences in baseline anxiety can make it difficult to predict such response. Parent and child reports of anxiety symptoms are often highly discrepant and likely measure different anxiety constructs (White et al., 2015). Additionally, there are two established electroencephalography (EEG) indices that measure different manifestations of anxiety; 1) the error-related negativity

(ERN), an EEG response to the commission of errors, which reflects endogenous threat sensitivity (Meyer, 2013), and 2) resting-state EEG frontal hemispheric asymmetry (HA) within the alpha frequency band, wherein left- and right-dominant patterns of HA relates to observable-approach motivation and withdrawal/anxiety, respectively (Coan & Allen, 2004; Thibodeau, Jorgensen, & Kim, 2006). However, whether these EEG indices of anxiety relate to discrete subjective reports of anxiety symptom reduction in GSSIs among youth with ASD has yet to be determined.
Objectives: We aim to measure the ERN and HA in ASD youth to predict anxiety symptom reduction in response to GSSI.

Methods: Fifty-three youth (M_{age}=11.60, SD_{age}=2.96; 38 male) with IQ≥70 (M_{IQ}=103.49, SD_{IQ}=15.40) and ADOS-2-confirmed ASD diagnosis participated in a 10-week GSSI. Pre-post anxiety symptoms were measured via self- and parent-report (MASC-2; March et al., 1997). Baseline ERN responses to the Flanker Task (Eriksen & Eriksen, 1974) were measured, such that more negative ERNs indicated greater threat sensitivity (Figure 1A). Baseline frontal alpha-band (7.5-12.5 Hz) power during eyes-open rest was measured, such that positive HA scores indicated greater relative left frontal alpha power (Figure 1B). ANCOVA-of-change models controlling for baseline anxiety symptoms were used to examine both neural measures' ability to predict GSSI response.

Results: ERN amplitudes predicted changes in *self-reported* total anxiety symptoms (Figure 2A), generalized anxiety, social anxiety (including humiliation and rejections), and performance anxiety symptoms (all B>0.39, p<0.04), such that larger ERN amplitudes predicted *greater* improvements, but *smaller* ERN predicted *attenuated* improvements. In contrast, HA predicted changes in *parent-reported* total anxiety (Figure 2D), generalized anxiety, social anxiety (including humiliation and rejections), and *self-reported* tense and restlessness symptoms (all B>0.31, p<0.05), such that more right-dominant HA predicted *greater* improvements, but more left-dominant HA predicted *attenuated* improvements.

Conclusions: These results suggest that the ERN specifically predicted *subjective* anxiety symptom changes, which further validates its use in measuring internally oriented threat sensitivity as an anxiety construct in ASD. In contrast, HA predicted *parent-observable* anxiety symptom changes, consistent with previous work suggesting it relates to overt approach-withdrawal behavior (Coan & Allen, 2004) and parent-reported treatment response (Burnette et al., 2011). Thus, results suggest that individuals with ASD that exhibit a smaller ERN or left-dominant HA may experience attenuated improvement of anxiety symptoms after GSSI, and utilizing these neural indices may be especially useful in social skills treatment planning for youth with ASD and comorbid anxiety.

11:45 **102.004** Event-Related Potentials Linked to Executive Function Predict Intervention Response and Later Social-Emotional Function Among Children with ASD

R. Gilbert[1], A. Vaidyanathan[2], D. Hyatt[3], T. Clarkson[4], G. Greco[5], D. P. Carroll[6] and ***S. Faja****[1], (1)Boston Children's Hospital, Boston, MA, (2)The Banyan Academy of Leadership in Mental Health, Mugappair west, Chennai, India, (3)Medicine, University of Illinois Chicago, Chicago, IL, (4)Psychology, Temple University, Philadelphia, PA, (5)University of Washington, Seattle, WA, (6)Autism Spectrum Center, Boston Children's Hospital, Boston, MA*

Background: Executive function (EF) underlies the ability to strategically approach novel and complex problems. By mid-childhood, it is comprised of inhibition, set-shifting, and working memory. Understanding individual differences in EF and its underlying neural profile is critical because subsequent social function and anxiety are predicted by EF in children without ASD. The N2 event-related potential (ERP) is thought to measure monitoring of conflicting information, enabling inhibition of extraneous information. We have shown that children with ASD have less efficient neural response (i.e., larger overall N2 amplitudes) than children without ASD and larger relative amplitude for more challenging trials related to EF behavior (Faja et al., 2016). The predictive utility of this neural EF signature for changes in social functioning and anxiety in ASD is relatively unexplored.
Objectives: To examine individual differences in ERPs as a predictor of later social function and anxiety. To examine whether ERPs predict social and anxiety changes related to an intervention that targets EF, metacognition, and emotion regulation.

Methods: As part of a clinical trial of EF intervention, 71 children (7 female) with ASD aged 7-11 years with full-scale IQ of M=106 (range: 80-135) participated; 49 provided adequate ERP data at baseline. Thirty-five were randomly assigned to an EF training program and 33 to a waitlist (3 were lost to attrition). Parents responded to the CBCL about emotional and behavioral challenges and the SSIS regarding social functioning. Electrophysiological recordings were collected to examine the N2 during a Flanker task. Mean amplitude was computed for each condition (congruent/incongruent). Regression models controlling for baseline social functioning and anxiety symptoms were used to examine whether baseline N2 predicted changes over a 3-month intervention period.

Results: Regardless of training assignment, baseline N2 amplitudes predicted social function on the SSIS at post-test controlling for baseline social function, such that more inefficient (larger) neural responses to incongruent flankers relative to congruent predicted *smaller increases* in social function (β = -.21, p=.045). Similarly, CBCL Anxiety at post-testing relative to baseline was predicted by overall N2 amplitude (β = -.24, p=.045), such that more efficient amplitudes predicted *lower* levels of anxiety. Within the intervention group alone, SSIS social change was no longer significant, but CBCL Anxiety was predicted by overall N2 amplitude at baseline (β = -.33, p=.06). That is, children who had smaller initial N2 amplitudes had a greater reduction in anxiety symptoms after treatment. Data from 5 subjects who are currently in progress will be included for final analyses.

Conclusions: Efficient neural response to extraneous stimuli may be an important predictor of individual differences in social skills growth and anxiety symptom reduction among children with ASD. In particular, overall social function and anxiety symptom improvements appear related to more efficient interference suppression. Moreover, more efficient interference suppression, as measured by the N2, predicted greater anxiety reduction among children in the EF training group. Thus, the N2 may provide a biomarker for predicting best responders to targeted intervention.

Panel Session
Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
103 - Reaching Children Where They Are: The Promise and Challenge of School-Based Intervention for Autism
10:30 AM - 12:30 PM - Willem Burger Zaal

Panel Chair: Lauren Kenworthy, *Children's National Health System, Washington, DC*

Discussant: Aubyn Stahmer, *Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA*

Schools are the primary service provider for children with ASD over five. They are accessible to more children than the clinic and offer greater opportunities for generalization of treatment effects. Yet there is a lack of evidence-based intervention in schools related to difficulties with adoption and implementation of treatments that were developed in research settings (Weisz et al, 2005). Effective school-based interventions are developed within the systems in which they will be delivered, with stakeholder involvement, appropriate training, and fidelity monitoring. They acknowledge the time and financial constraints driving schools, and provide low-intensity treatments where appropriate, and adaptive methodologies that allow rapid tailoring of treatments (Wood et al, 2015). Moderated by an expert in the translation of evidence-based autism research to the community (Stahmer), this panel will share knowledge gleaned from experience working in schools, as well as empirical evidence for specific school-based interventions. Data will be presented on: Positive outcomes following novel executive function interventions in elementary (Anthony) and middle-school classrooms (Strang); Application of innovative SMART methodology and the adaptive interventions it enables (Sturm); and a survey of school professionals about their knowledge of evidence-based interventions and how they select interventions to implement (Kenworthy).

10:30 **103.001** Improving the Executive Functioning of Adolescents with ASD through School-Based Intervention: The on Target for Life Curriculum

J. F. Strang[1], *L. Anthony*[2], *C. E. Pugliese*[3], *L. Cannon*[4], *M. A. Werner*[5], *S. Seese*[3], *M. F. Skapek*[6] *and L. Kenworthy*[3], *(1)Center for Autism Spectrum Disorders, Children's National Health System, Washington, DC, (2)University of Colorado, Denver, Aurora, CO, (3)Children's National Health System, Washington, DC, (4)Ivymount School, Rockville, MD, (5)Program Development and Training, Ivymount School, Rockville, MD, (6)Psychological Sciences, University of Connecticut, Storrs, CT*

Background: Executive function (EF) challenges increase as youth with ASD enter the teen years, and executive dysfunction is related to long-term adaptive outcomes. The On Target for Life (OTL) school-based curriculum is the upward age-extension of the empirically supported Unstuck and On Target curriculum.

Objectives: OTL is a Cognitive Behavioral Therapy intervention employing a neurodiversity framework, drawing on specific learning strengths in autism, such as the particular ability to get “stuck” on key details, in this case self-regulatory EF scripts (e.g., “stuck on a detail”, “big picture”, “flexible thinking”, etc.) OTL was developed through a community-based participatory process, engaging key stakeholders (autistic youth and their parents, teachers and administrators) in the objectives and design of the curriculum.

Methods: A randomized comparative trial (n=33) was conducted in 9 public middle schools (five schools receiving OTL and four schools receiving the school version of PEERS, an empirically supported social skills intervention). Intervention “dosages” were matched across the two treatments, and curricula were administered by school staff. The fidelity of intervention delivery was measured twice through in vivo observations. Masked (i.e., blinded to treatment condition) pre-post assessments were conducted with youth and their families, including classroom observations in the students’ English classes conducted at the beginning and end of the school year and a masked in vivo behavioral assessment measure of flexibility and planning skills in a one-on-one interactive context (Executive Function Challenge Task; EFCT). Youth and parents also completed a standardized pre- and post-battery: Behavioral Rating Inventory of Executive Function II (BRIEF II; parent and self report); Social Responsiveness Scale II (SRS II); and the Tower of London DX (TOL DX), a measure of a high-order planning skills. A newly developed autism-specific anxiety measure (Scahill et al., 2016) was completed by the parents.

Results: Pre-post paired sample t-tests indicated significant improvement for both intervention groups in social functioning as measured by masked classroom observations of social functioning, standardized parent report (SRS II), and autism-specific anxiety symptoms (all p’s < 0.05). Both groups also showed increased convergence between standardized parent and youth self-report of everyday behavioral functioning (BRIEF II; $p=.035$), considered a marker of increased self-awareness in the youth. The OTL group, but not the comparison intervention group, made significant gains (p’s < 0.05) on classroom observations of executive functioning, the EFCT, as well as on the average of key indices of the TOL DX.

Conclusions: Both treatments were associated with greater convergence between parent and youth report of a young person’s functioning, suggesting improved insight/self-awareness in the youth. Similarly, both interventions were associated with improvements in the youth’s social functioning and anxiety; OTL-related gains in social skills are in accordance with previous evidence linking EF intervention and improved socialization. OTL was uniquely associated with improvements in flexibility and planning skills measured with treatment blind tools across multiple modalities, including observed classroom behaviors, suggesting that CBT-informed EF treatment with repeated exposure to/practice with self-regulatory scripts may have a generalized effect on EF-related behaviors across real-world settings.

10:55 **103.002** What Matters?: An Examination of Implementation Factors in the Effectiveness of Two Tier 2 School-Based Interventions

L. Anthony[1], *A. Verbalis*[2], *C. E. Pugliese*[2], *K. Hardy*[2], *J. F. Strang*[2], *B. J. Anthony*[1], *A. B. Ratto*[2], *S. Seese*[2], *J. Safer*[3], *A. C. Armour*[2], *M. Troxel*[1], *Y. Myrick*[2], *D. Limon*[2] *and L. Kenworthy*[2], *(1)University of Colorado, Denver, Aurora, CO, (2)Children's National Health System, Washington, DC, (3)Georgetown University, Washington, DC*

Background:

The intervention research field for children with neurodevelopmental disorders is increasingly moving beyond efficacy towards effectiveness, dissemination, and implementation trials. As this shift occurs, we must continually examine which implementation factors do – and do not - influence outcomes in order to consider the likelihood of broad dissemination and implementation.

Objectives:

This study presents the exploratory analyses of the effects of possible implementation factors on classroom-based outcomes from a comparative effectiveness research (CER) trial, factors that may be used for hypothesis generation for future studies.

Methods:

The CER trial compared two Tier 2 interventions for students with ASD or ADHD, Unstuck and On Target (UOT) and Contingency Behavior Management (CBM), in 21 Title I (low-income) elementary schools in three districts. Both interventions targeted executive functioning skills in the classroom. The primary outcome for these analyses are change in pre-post academic classroom observations on the following behaviors: demonstrates social reciprocity, follows rules, transitions appropriately, gets stuck, displays negativity, and participates in class (total raw scores ranging from 0 (worst) to 6 (best)). Family income ranged from $8,796-400,000. There were fewer than 30% White Non-Hispanic/Latino students in the study and only about 51% of the families spoke only English at home.

Results:

Diagnosis was an important moderator for this outcome, with ADHD students making significant treatment gains in both interventions, while ASD students only showed a positive effect in UOT. The following implementation factors did not have a significant impact on effectiveness (whether separated by intervention, diagnosis or when combined): Treatment fidelity, number of intervention sessions completed, profession of the school-based interventionist, and amount of knowledge that the parent gained.

Some important acceptability factors were significant, though. Students reported that they enjoyed UOT more than CBM (t=2.018,df=128,p=.046), though there was no significant relationship between how much they enjoyed the group and how much they improved within intervention group. Parents also reported that they felt that UOT helped their child more (t=2.767,df=117,p=.007), they were more satisfied with UOT (t=3.015,df=116,p=.003) and are more likely to use UOT techniques in the future (t=2.055,df=90,p=.043). Improvements measured by masked classroom observations were significantly correlated with parents' report of how much they felt the interventions helped their child (r=.267,p=.005,N=109) and how satisfied they were with the intervention (r=.336,p<.001,N=108). Qualitative analyses of student and parent responses will also be presented.

Conclusions:

The lack of relationship between most standard implementation factors, such as fidelity, training of interventionist, and completion of the intervention, and outcome is unexpected and difficult to explain. First, it is possible that the participating schools delivered both interventions with exceptional skill, though the fidelity and completion rates ranged considerably. It may also be that these implementation factors do not matter as much in Tier 2 (middle intensity, group-based) as in Tier 3 (High-intensity, individualized, and more frequently studied) interventions designed to be delivered in schools to students experiencing disparities. Finally, it could be that providing *any* explicit training of EF skills can have positive effects for these at-risk students.

11:20 **103.003** Acceptability and Feasibility of a Pilot SMART Design in a School Setting

A. Sturm[1]*, A. J. Schlink*[2]*, S. Y. Shire*[3]*, W. I. Shih*[4]*, D. Almirall*[5] *and C. Kasari*[4]*, (1)UCLA, Los Angeles, CA, (2)UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA, (3)University of Oregon, Eugene, OR, (4)University of California, Los Angeles, Los Angeles, CA, (5)University of Michigan, Ann Arbor, MI*

Background:

School-aged children with ASD require interventions that are evidence-based and adaptable if there are indications of slow-response to treatment. Adaptive interventions (AI) are sequences of individually-tailored interventions over time that can address this need. Yet, more work is needed to determine the acceptability and feasibility of AIs employing empirically-supported interventions in schools.

Objectives:

The present study aimed to evaluate the acceptability and feasibility of an AI in a school setting by assessing (1) the acceptability of AI changes to school staff (i.e., teachers and aides) delivering the component interventions and (2) the fidelity of AI components delivered by school staff.

Methods:

The 18-week AI was composed of initial randomization to Remaking Recess (RR; delivered by playground aide), or RR plus Classroom Supports (CS; delivered by teacher), both environmental modification interventions. After 8 weeks, the environmental modifications were then augmented with Parent-Assisted Home Intervention (Parent) or Peer- mediated School Intervention (Peer) delivered by research staff. Twenty-four children ages 5 to 10 (M=7.2, 74% male, 67% Hispanic/Latino, 87% free or reduced meals) from 18 classrooms and five schools participated. Outcome measures included researcher-rated CS (teacher; N=22) and RR (aide; N=18) fidelity, teacher-rated treatment expectations (N=17), aide-rated treatment acceptability (N=18), and structured aide (N=17) and teacher (N=17) diaries assessing implementation issues.

Results:

Nearly all teachers surveyed held positive opinions regarding the potential for adaptive change in (82%), or intensification of (100%), student's treatment and 100% endorsed that they were likely to agree to potential changes in intervention. Surveyed after intervention, 83% of aides held positive opinions about changes made to their student's treatment. When no change in treatment was indicated, aides who felt negatively about lack of change (0.7%) would have preferred to add the intervention that their student had not received (Peer/Parent).

Aides (RR) and teachers (CS) found the respective intervention strategies to be natural and relatively simple. While most aides felt confident (82%) and comfortable (94%) in their delivery of RR strategies, teachers felt less so with CS (confident: 60%; comfortable 66%). However, fidelity at the end of treatment varied widely (RR, aides: 0-100%, *M*=58%; CS, teachers: 22-67%, *M*=37%). Aides and teachers reported the most difficulty finding time to implement the respective strategies, most often during Phase 2 when 76% of aides and 53% of teachers endorsed this to be at least "somewhat true". Several aides (29%) and teachers (33%) reported that strategy implementation required substantial work. This was reflected in qualitative feedback from some aides who reported that they would have liked more time to review the RR strategies, and that they struggled with juggling strategy implementation and their other responsibilities on the playground.

Conclusions:

The present study found that AIs are acceptable to school staff, however adjustments are required to ensure feasibility of school staff implemented intervention components. In planning for a fully-powered AI, variability in degree of successful strategy implementation suggests that researchers must provide sufficient individualized support to quickly ensure a high level of school staff comfort with intervention strategies and their flexible and accurate use.

11:45 **103.004** How Do We Disseminate?: What School Staff and Parents Need to Implement Evidence Based Interventions in Public Schools

L. Kenworthy[1]*, M. D. Powers*[2]*, A. Verbalis*[1]*, M. Troxel*[3]*, L. Anthony*[3] *and Y. Myrick*[1]*, (1)Children's National Health System, Washington, DC, (2)Children's National Health System, Rockville, MD, (3)University of Colorado, Denver, Aurora, CO*

Background: Public schools are the primary service provider for children with ASD over three, and unlike clinic settings, they are accessible for all children. School staff encounter significant obstacles to the adoption and implementation of evidence based (EB) autism treatments, however, including: a lack of cost/time-effective lower intensity interventions; ineffective training methods; and limited emphasis on the scientific evidence for various treatments (Wood et al., 2015; Stahmer et al., 2015; Stormont et al., 2011). Children without intellectual disability are the fastest growing segment of the burgeoning school-aged ASD population (CDC, 2014) and are often placed in mainstream educational classrooms, where they can succeed at basic academic skills, but struggle to access the educational curriculum related to social and executive function deficits (APA, 2013). There is a developing EB for lower-intensity, or Tier 2, school-based social and executive function interventions for these children (Kasari et al., 2016; Kenworthy, Anthony et al., 2014).

Objectives: Survey educational stakeholders across the nation regarding their: commitment to using EB interventions, knowledge of the EB for the interventions they use, and current and preferred methods for learning about interventions. Also, survey parents regarding their interest in school-based services.

Methods: Participants were English speakers/readers, >18 years old, with internet access and were either school staff/officials or parents of children in 3rd – 5th grade with ADHD or ASD. Recruitment was through advertising on online platforms, including Facebook "Boosted Posts" and nationally-read education publications. The educator survey focused specifically on Tier 2 educational interventions, defined in the survey as small group or classroom strategies targeting the 10-20% of students who need more intensive support than Tier 1 (=universal strategies), but less support than is provided in intensive, individualized Tier 3 interventions. Definitions were also provided in the survey for EB practices and executive function.

Results: Survey respondents reflected a nation-wide sample (223 zip codes). 76.3% of the 227 school-staff respondents reported a school policy of using EB practices. Yet, when asked to list the EB social skills and executive function interventions they use, they reported few interventions, and, identified many interventions as being EB that have no peer-reviewed published evidence of efficacy (Figure 1, details to be presented). School personnel report a discrepancy between how they get information about EB interventions and how they would like to get information (Figure 2), indicating that they rely heavily on personal research, but would like more mentoring and outside training (e.g., workshops, conferences). 85.6% of the 125 parent survey respondents want to devote substantial time (mean= 32(±58) hours/school-year) to school-based trainings to help them support school-based interventions for their children.

Conclusions: School personnel want to use EB interventions but do not have accurate information on the EB for the programs they use. They would like more professional training and hands-on mentoring, which aligns with research indicating long-term on-site training improves implementation. Parents want to partner with schools to support interventions. Future research should investigate the dissemination of EB Tier 2 interventions with self-sustaining school-based training models for teachers and parents.

Panel Session
Adult Outcome: Medical, Cognitive, Behavioral

104 - Tapping the Talent: Strategies to Address the International Employment Problem in Autism

10:30 AM - 12:30 PM - Willem Burger Hal

Panel Chair: Alycia Halladay, *Autism Science Foundation, New York, NY*

Discussant: Anne Roux, *A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA*

About half of individuals with autism spectrum disorder (ASD) around the world are un- or under-employed, making ASD among the least effectively- or consistently-employed group worldwide. Unfortunately, there is very little known about factors affecting employment in people with ASD, as well as effective interventions and services to prepare and maintain employment for people with autism. Last year, in order to translate scientific knowledge into actionable policy in this area, INSAR awarded researchers from the Autism Science Foundation, Stony Brook University (US), Curtin University (Australia) and the Karolinska Institute (Sweden) support to develop an international policy brief around employment targeting the specific needs of those with ASD. This panel will present the scientific studies and community partnerships to inform this policy brief. They included: 1. a scoping review of the literature on employment organized in the framework of the ICF, 2. results of direct interactions and collaboration with various community stakeholders to inform suggested policy, 3. a survey filled out by individuals with ASD, and 4. a parallel survey completed by other relevant stakeholders, both internationally, which assessed needs, challenges and opportunities for employment. Finally, a discussant will then integrate the specific policy recommendations that arose from these activities.

10:30 **104.001** Factors Impacting Employment for People with Autism Spectrum Disorder: A Scoping Review

M. T. Scott[1], *B. T. Milbourn*[2], *M. Falkmer*[3], *S. Bolte*[4], *A. Halladay*[5], *M. D. Lerner*[6], *J. L. Taylor*[7] *and S. J. Girdler*[2], *(1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (3)Curtin University, Bentley, Australia, (4)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (5)Autism Science Foundation, New York, NY, (6)Psychology, Stony Brook University, Stony Brook, NY, (7)Vanderbilt Kennedy Center, Nashville, TN*

Background:

Adults with Autism Spectrum Disorder (ASD) demonstrate not only difficulties, but possess unique strengths and abilities which can be harnessed in the work environment often performing well in jobs requiring systematic information processing, precision and repetition. However, despite increasing recognition of the potential contribution that individuals with ASD can make in the workplace, they continue to experience challenges in finding and maintaining employment. Given that employment research in ASD is progressing there is a need to synthesize research to enable an understanding of those factors impacting employment, and a description of the targets and effectiveness of various intervention approaches. This scoping review examined the extent and range of literature relating to the employment of individuals with ASD.

Objectives:

The primary objectives of this review were to: 1) comprehensively review employment literature relating to ASD and employment; 2) explore measures used in evaluating employment outcomes; 3) identify the strengths and abilities of individuals with ASD in the workplace; 4) classify and link ASD employment interventions to the International Classification of Functioning, Disability and Health (ICF) Core Sets for ASD; and 5) summarise the targets and outcomes of employment interventions.

Methods:

Database searches of Medline, CINAHL, PsychINFO, Scopus, ERIC, Web of Science and EMBASE were conducted. Studies describing adults with ASD in competitive, supported or sheltered employment, the role of vocational support, or the evaluation of employment interventions were included. Data were extracted in relation to author, year of publication, country, design, participants, outcome measures and nature stage of employment. Quality of the evidence was assessed. Content analysis of results identified the strengths and abilities of employees with ASD in the workplace. Lastly, meaningful concepts relating to the evaluation of employment interventions were extracted and linked to International Classification of Functioning, Disability and Health (ICF) Core Sets for ASD.

Results:

The search identified 3,701 references, of which 117 were include for review. Methodological quality of the articles ranged from limited to strong. Of the 117 articles, only 14 explored the strengths and abilities of individuals with ASD in the workplace including attention to detail, high quality of work, strong sense of morality and precise technical abilities. Thirty-two studies evaluated employment interventions for adults with ASD, primarily focusing on modifying autism-related characteristics such as social interaction, communication skills and executive functioning for improved performance in acquiring a job. While environmental factors such as technology, employer and co-worker support and job coaches were utilised in facilitating work participation, these were never the focus of interventions.

Conclusions: The ICF Core Sets for ASD enabled a holistic review of the employment literature relating to individuals with ASD. While employment interventions targeting intrinsic personal factors of adults with ASD are beneficial in improving work-related outcomes, there has been limited consideration of the role that environmental factors may play in the workplace. This review highlighted the need for the development of more holistic approaches, which consider the influence of both personal and environmental factors in improving the employment outcomes of people with ASD.

10:55 **104.002** An International Survey on Barriers & Access to Employment: Perspectives of Adults with ASD

M. D. Lerner[1], *C. M. Esposito*[2], *A. H. Gerber*[3], *B. T. Milbourn*[4], *M. H. Black*[4], *S. Bolte*[5], *S. Mahdi*[6], *A. Halladay*[7] *and S. J. Girdler*[4], *(1)Psychology, Stony Brook University, Stony Brook, NY, (2)Stony Brook University, Staten Island, NY, (3)Stony Brook University, Stony Brook, NY, (4)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (5)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (6)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (7)Autism Science Foundation, New York, NY*

Background: Across the globe, adults with autism spectrum disorder (ASD) are among the most underemployed populations (Carter et al. 2012). For instance, in the United States, 33% of adults with ASD are currently employed, while in Australia – where considerably more support services are available – that number remains only 42% (Standifer, 2011; Australian Bureau of Statistics, 2010; United Nations, 2007). A number of factors including stigma, lack of information and training, and insufficient supports have been identified by researchers as impacting the process of finding and keeping a job among those with ASD (Scott et al. 2015; Chen et al. 2015; Muller et al. 2003). However, little research has sought to understand the perspectives *of individuals with ASD* on the factors that influence their ability to obtain and maintain a job. Given the wide range of services, supports, and norms across countries, the establishment of common goals regarding employment require an international perspective.

Objectives: This study aimed to assess the self-reported factors contributing to employment among adults with ASD across three different countries: the United States, Australia, and Sweden.

Methods: Using items derived from a previous mixed-methods study designed to identify common factors regarding employment in ASD, a standardized survey instrument was deployed (and translated) in the three target countries. Fifty-one, 28, and 37 adults with ASD completed the survey online in the United States, Australia, and Sweden, respectively. An examination of distribution of responses was conducted. Data from additional participants will be included in the final presentation.

Results: There was international consensus that work experience and vocational training are important to helping individuals with ASD to obtain a job (>89% rating across countries). However, only 68% (stable across countries) of participants indicated that educating staff about ASD prior to the individual being hired was important to obtaining a job. 100% of participants across countries indicated that focusing on individuals' strengths in the workplace was important for maintaining a job. However, only 50 – 75% of participants across countries indicated that increased or modified pay rates would be valuable for maintaining a job.

Conclusions: This survey – the first to ask individuals with ASD across nations their perspective on obtaining and maintaining employment – highlights key areas of international consensus regarding getting and keeping a job. Hands-on work experience was considered extremely important for obtaining a job, while educating staff at the new place of employment was considered less so. In terms of maintaining a job, every participant indicated that focusing on their strength was essential, while comparatively fewer wished for greater pay. These results highlight the unique goals and priorities of individuals with ASD as they enter – and try to remain – in the workplace around the world.

11:20 **104.003** Seeking and Maintaining Employment Among Adults with ASD: Clinician, Family and Employer Views in Australia, Sweden and the USA

S. Bolte[1], *S. Mahdi*[2,3], *C. M. Esposito*[4], *M. Falkmer*[5], *M. H. Black*[6], *M. D. Lerner*[7], *S. J. Girdler*[6] *and A. Halladay*[8], *(1)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (2)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (3)Center for Psychiatry Research, Stockholm, Sweden, (4)Stony Brook University, Staten Island, NY, (5)Curtin University, Bentley, Australia, (6)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (7)Psychology, Stony Brook University, Stony Brook, NY, (8)Rutgers University, Piscataway, NJ*

Background: Employment rates for adults with disabilities are low, including those for autism spectrum disorder (ASD). Research on facilitators and barriers for seeking and maintaining jobs is limited in ASD, particularly from a multi-informant and cross-cultural perspective.

Objectives: The aim of this study was to collect views on factors potentially promoting or hampering access to jobs and long-term employment in the eyes of family members, clinicians, care providers, researchers and employers across Australia, Sweden and the USA.

Methods: Based on previous research a standardized online survey was developed, translated and further adapted to each country's setting based on national clinical and practical experience, and requirements. The survey contained three parts: informed consent, socio-demographic background information and 65 to 70 Likert-scaled items of seeking and maintaining employment, taking about 25 minutes to complete. As of October 2017, a total of 134 family members, 73 professionals (clinicians, service providers and researchers) and 6 employers had completed the survey, 113 from the USA, 53 from Australia and 47 from Sweden.

Results: Across countries and informants there was more convergence than divergence regarding views on facilitators and barriers of findings and maintaining employment. Especially, there was a robust consensus on the relevance of matching skills and job demands in ASD, as well as the decisive role of one responsible manager at the workplace being approachable to assist in avoiding and solving conflicts. Informants also agreed of the necessity to destigmatize ASD, to stress ASD-related strengths, and whenever possible to adapt the workplace environment to need and skills of individuals with ASD.

Conclusions: Our findings demonstrate a broad consensus across stakeholders in high income countries concerning factors promoting and hampering employment of adults with ASD. The survey results provide many options to derive recommendations for private and public employers, policy makers, interest organizations, and individuals on the spectrum to achieve higher employment rates in autism.

11:45 **104.004** A Cross-Cultural Perspective of the Views of Stakeholders on the Employment of Individuals with ASD

S. J. Girdler[1], *M. Falkmer*[2], *M. T. Scott*[3], *M. D. Lerner*[4], *C. M. Esposito*[5], *A. H. Gerber*[6], *B. T. Milbourn*[1], *M. H. Black*[1], *S. Mahdi*[7], *A. Halladay*[8] *and S. Bolte*[9], *(1)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (2)Curtin University, Bentley, Australia, (3)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (4)Psychology, Stony Brook University, Stony Brook, NY, (5)Stony Brook University, Staten Island, NY, (6)Stony Brook University, Stony Brook, NY, (7)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (8)Autism Science Foundation, New York, NY, (9)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: The right to employment for all is enshrined in Article 23 of the Universal Declaration of Human Rights; however, for many people living with Autism spectrum disorder (ASD) this right is yet to be realised. While there is a clear need to improve employment outcomes, developing appropriate services depends not only on systematic empirical measurement, but on an in-depth understanding of the perspectives of key stakeholders.

Objectives: This study aimed to elicit an in-depth understanding of the perspectives of stakeholders, including adults with ASD, their families, clinicians and service providers and employers, on the processes associated with employment across Australia, Sweden and the United States.

Methods: Focus groups and interviews were held across countries, guided by questions reflecting the process of employment from job preparation through to maintaining a job, the contribution of people with ASD to the workplace, and the meaning of employment for people with ASD. As of October 2017 three community forums have been held in Australia, in partnership with the Autism Association of Western Australia, including 24 people with ASD and family advocates, and 14 Service providers. Additional findings from the perspective of employers and Sweden and the United States will be included in the final presentation.

Results: Across forums discussions in relation to preparing for employment focused on job-match, social communication, preparing for interviews and building independence in other major life areas. Considerations of gaining and maintaining employment were employer and co-worker's knowledge of ASD, support from mentors, the social demands of the workplace, and understanding of job requirements. People with ASD were described as having attributes of value in the workplace including focus, loyalty, honesty, reliability, directness, creativity and impartiality. The meaning of employment for people with ASD included increased independence, specifically financial, improving mental health and quality of life, and reducing parental stress.

Conclusions: Findings point to the importance of adopting a holistic view of employment and the need for interventions to focus on aspects beyond individuals with ASD themselves to factors in the environment, including workplace relationships, available supports and the attitudes of employers and co-workers towards ASD. Discussions highlighted that people with ASD commonly possess attributes highly valued in the work environments. As is recognised globally that employment is key in improving outcomes for all, findings from this study highlight that employment is key to improving outcomes in other major life areas for adults with ASD.

Panel Session
Genetics

105 - Next Steps in Autism Genetics: Leveraging Genetic Variation to Understand Risk Mechanisms and Phenotypes

10:30 AM - 12:30 PM - Jurriaanse Zaal

Panel Chair: Stephan Sanders, *Psychiatry, University of California San Francisco, San Francisco, CA*

Discussant: Stephan Sanders, *Psychiatry, University of California San Francisco, San Francisco, CA*

Large-scale genomic analyses have identified genetic variants with a causal relationship to autism. These variants provide a starting point from which we can explore the etiological mechanisms between genotype and phenotype, including the neurological mechanisms, developmental changes, and cell types involved in autism. This panel describes several approaches to developing this genetic foundation and leveraging it to understand autism biology and phenotype. Parallel genetic approaches and consistent gene discovery methods in autism and developmental delay help distinguish genes shared between these disorders from those with more specific roles. Integrating new autism data into this gene discovery approach, alongside population-level allele frequencies, refines and expands the autism gene list. Whole genome sequencing data allows us to also investigate the role of rare noncoding variation in autism, potentially increasing the resolution to detect specific cell types, brain regions, and developmental stages involved in autism risk. Finally, integrating whole genome sequencing with RNA expression data in the developing human brain provides a complementary approach to identify the critical processes and genomic regions involved in brain development and assess how these intersect with known ASD risk factors such as disruptive variation, expression changes, and sex differences.

10:30 **105.001** Genotype-Phenotype Relationships: Exploration of Shared and Distinct Genetic Risk for ASD and ID

L. Klei[1]*, S. De Rubeis*[2]*, S. Sanders*[3]*, X. Xu*[4]*, B. K. Sheppard*[5]*, C. Betancur*[6]*, M. State*[3]*, E. Cook*[7]*, J. Buxbaum*[8]*, K. Roeder*[9] *and B. Devlin*[10]*, (1)University of Pittsburgh, Pittsburgh, PA, (2)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Psychiatry, University of California San Francisco, San Francisco, CA, (4)Icahn School of Medicine at Mount Sinai, New York, NY, (5)Johns Hopkins School of Public Health, Baltimore, MD, (6)Sorbonne Universite, Paris, France, (7)University of Illinos at Chicago, Chicago, IL, (8)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (9)Carnegie Mellon University, Pittsburgh, PA, (10)Univ of Pittsburgh School of Medicine, Pittburgh, PA*

Background: Whole-exome sequencing has identified dozens of genes affecting risk for autism spectrum disorder (ASD) and even more for severe developmental disorder (SDD). SDD typically involves intellectual disability (ID), which is often comorbid with ASD.
Objectives: Because these discoveries intersect for some genes and not others, we hypothesized that the joint study of data from ASD and SDD subjects could reveal the patterns of genetic overlap and etiology of these disorders.

Methods: We assessed rare *de novo* variants identified via exome sequencing of 4,109 ASD trios from the Autism Sequencing Consortium (ASC) and 4,293 SDD trios from the Deciphering Developmental Disorders (DDD) Study. We applied the same statistical algorithm, TADA (Transmission And *De novo* Association), to both datasets to identify likely risk genes in each disorder based on identical criteria.

Results: We find substantially greater clustering of probably damaging mutations in specific genes in SDD than ASD subjects, consistent with there being a greater role for polygenic risk in ASD than SDD. We identify 33 and 149 genes associated with risk for ASD and SDD, respectively (FDR < 0.05), with 17 falling in both gene sets. Meta-analysis of the two datasets yields additional significant genes, while also producing evidence for genetic heterogeneity: disruption of some genes confers risk predominantly for one disorder whereas disruption of others affects risk for both. Genes implicated in SDD alone or in risk for SDD and ASD have an impact on the IQ of ASD subjects, whereas mutations in genes conferring predominantly ASD risk tend to have smaller impact.

Conclusions: Our analyses identify genes that appear to have a more direct role in ASD traits and others with greater impact on general neurodevelopment. The gene sets we identify should be useful for understanding early developmental similarities and differences that lead to ASD with and without ID.

10:55 **105.002** Improving Genetic Association Approaches for Risk Gene Discovery in ASD

B. K. Sheppard[1]*, J. Wang*[2]*, M. Peng*[2]*, J. Y. An*[1]*, M. State*[1]*, B. Devlin*[3]*, K. Roeder*[2] *and S. Sanders*[1]*, (1)Psychiatry, University of California San Francisco, San Francisco, CA, (2)Carnegie Mellon University, Pittsburgh, PA, (3)Univ of Pittsburgh School of Medicine, Pittburgh, PA*

Background: Sequencing studies of autism spectrum disorder (ASD) have successfully identified dozens of risk genes, particularly through loss of function (LoF) *de novo* mutations (DNMs). However, it has been estimated that hundreds of genes contribute to the genetic architecture of ASD. Recent work by the Daly lab has shown that using Exome Aggregation Consortium (ExAC) allele frequencies can help distinguish risk from non-risk variants (Kosmicki et al. 2017). Here we assess the impact of this on gene discovery.
Objectives: Our study aims to adapt existing gene discovery methods to incorporate ExAC allele frequency data. Additionally, we will present a new ASD gene list based on this methodology after incorporating additional samples.

Methods: We used the Transmission and De Novo Association (TADA) method to identify ASD risk genes using LoF and probably damaging missense (Mis3) DNMs in whole exome sequencing (WES) data on 4,109 ASD probands. TADA is a hierarchical Bayesian model that incorporates information from various functional categories by parameterizing each category by its average relative risk derived from estimates of genome-wide burden and hypothesized number of risk genes. Burden estimates were obtained using a subset of 1,911 probands and their unaffected siblings. TADA was used to identify gene lists passing false discovery rate (FDR) at 10% for: 1) the full set of high confidence LoF and Mis3 DNMs and 2) a subset of DNMs after filtering mutations present in the ExAC database. These two gene lists were then compared using the GeNets Metanetwork protein-protein interaction algorithm. We will also incorporate data from targeted sequencing of 250 putative ASD risk genes in 14,208 samples from 5,357 ASD families, incorporating additional priors based on allele frequency observed in ExAC and gene-based conservation scores.

Results: Using the full set of mutations, genome-wide burden estimates for LoF and Mis3 DNMs were 1.99 (average RR = 20.74) and 1.08 (average RR = 2.64), respectively. Multiple testing correction yielded 57 genes with FDR q-value < 0.10. After filtering DNMs present in the ExAC database, approximately 9% of LoF and 29% of Mis3 mutations were removed, increasing the LoF burden estimate to 3.16 (average RR = 44.18) and the Mis3 burden estimate to 1.11 (average RR = 3.11). This resulted in 55 genes with FDR q-value < 0.10. Fourteen genes identified by the previous analysis slipped below the detection threshold, while 12 new genes from this list were raised above this threshold. Despite minimal change in the number of associated genes, network analysis revealed improvement in overall functional connectivity for the new gene list (network p-value = 0.002) compared to the list identified in the first analysis (network p-value = 0.09).

Conclusions: As hypothesized, filtering ExAC variants from our DNM list resulted in higher estimates of genome-wide burden when compared to unaffected siblings. This yielded a refined list of ASD risk genes, which was similar in size, but overall more functionally connected based on network analysis. Incorporation of additional priors to the model and new samples are expected to further improve quality of ASD gene lists.

11:20 **105.003** Whole-Genome Sequencing to Detect Rare Noncoding Variants in Autism Spectrum Disorder

J. Y. An[1], *D. M. Werling*[2], *H. Brand*[3,4,5], *M. R. Stone*[3], *S. Dong*[6], *R. L. Collins*[3,4,7], *K. Roeder*[8], *M. State*[1], *B. Devlin*[9], *M. E. Talkowski*[3,4,5,10] *and S. Sanders*[1], *(1)Psychiatry, University of California San Francisco, San Francisco, CA, (2)Psychiatry, UCSF, San Francisco, CA, (3)Center for Genomic Medicine and Department of Neurology, Massachusetts General Hospital, Boston, MA, (4)Department of Neurology, Harvard Medical School, Boston, MA, (5)Program in Medical and Population Genetics and Stanley Center for Psychiatric Research, Broad Institute, Boston, MA, (6)University of California San Francisco, San Francisco, CA, (7)Program in Bioinformatics and Integrative Genomics, Division of Medical Sciences, Harvard Medical School, Boston, MA, (8)Carnegie Mellon University, Pittsburgh, PA, (9)Univ of Pittsburgh School of Medicine, Pittburgh, PA, (10)Departments of Pathology and Psychiatry, Massachusetts General Hospital, Boston, MA*

Background: Genomic studies in autism spectrum disorder (ASD) have largely focused on high impact *de novo* mutations that disrupt protein-coding sequence. Given the size of the noncoding genome and its regulatory role in gene function, it is likely that rare, noncoding variation could be an important component of the genetic architecture of ASD. Characterization of noncoding mutations could also provide insights into the cell types and critical developmental stages involved in ASD. After correcting for multiple comparisons we observed no clear enrichment for noncoding risk in 519 families. Other groups have described nominally significant association at DNase sites, UTRs, and Promoters.
Objectives: To assess whether existing hypotheses regarding noncoding risk in ASD replicate in new datasets and to perform an unbiased analysis corrected for multiple comparisons across the combined dataset.

Methods: Whole genome sequencing (WGS) of an additional 1,024 individuals from 256 quartets (256 cases, unaffected sibling controls, and both parents) were compared alongside the existing WGS data for 2,076 individuals in 519 families. *De novo* SNVs, indels, and structural variants (SVs) were identified using 12 variant discovery algorithms; cross-site validation exceeded 93% for all variant classes. Variants were annotated using an extensive series of noncoding functional annotations at the level of nucleotides, genes, and regulatory regions, resulting in 51,801 combinations of annotation categories. ASD association within each category was assessed using a binomial test to compare variant counts in cases and controls in a Category-Wide Association Study (CWAS). To account for multiple testing, correlations of p-values were assessed between the 51,801 categories from 20,000 sets of simulated variants. Eigenvalue decomposition estimated that 4,123 effective tests explained 99% of the variation.

Results: We did not observe replication of prior hypotheses for noncoding variation in the new samples. Combining these samples with existing data, no annotation category was significant after correcting for 4,123 tests in the CWAS. As before, the lowest p-values were observed in coding regions, including missense variation and SVs not detected by previous technologies. Similarly, no category of rare inherited variants demonstrated parental transmission bias or ASD association.

Conclusions: Our results suggest that there is no clear category of rare noncoding variation with equivalent impact on ASD risk as large SVs or protein-disrupting mutations. Furthermore, given the lack of replication of previous hypotheses, we conclude that identifying noncoding disease associations and quantifying this risk will require a statistically rigorous approach that includes stringent multiple testing correction for this multitude of plausible hypotheses. Analogous to genome-wide association studies of common variation, this approach is likely to identify sound and replicable noncoding associations, but will require substantially larger sample sizes, likely in excess of 5,000 cases.

11:45 **105.004** Functional Impact of ASD-Associated Genetic Risk Variants in Human Cortical Development

D. M. Werling[1], *S. Pochareddy*[2], *J. Choi*[2], *J. Y. An*[3], *C. Dastmalchi*[3], *M. Li*[2], *M. State*[3], *K. Roeder*[4], *B. Devlin*[5], *N. Sestan*[6] *and S. Sanders*[3], *(1)Psychiatry, UCSF, San Francisco, CA, (2)Yale University, New Haven, CT, (3)Psychiatry, University of California San Francisco, San Francisco, CA, (4)Carnegie Mellon University, Pittsburgh, PA, (5)Univ of Pittsburgh School of Medicine, Pittburgh, PA, (6)Yale School of Medicine, New Haven, CT*

Background: Establishing clear links between genetic variation and gene function is a critical step toward translating genetic association into a mechanistic understanding of the etiology of autism spectrum disorder (ASD). Variants identified by genome-wide association studies (GWAS) and whole-genome sequencing (WGS) are frequently noncoding, but do not clearly implicate a specific gene or the manner in which the gene is impacted. Expression quantitative trait loci (eQTLs) can help clarify these questions by demonstrating functional impact on the expression of specific genes. Though ASD risk genes are strongly expressed during prenatal development, available eQTL discovery data sets are based largely on data from adult brains.
Objectives: To test adult brain eQTLs for intersection with ASD biology and to validate and extend these findings in the human cortex across brain development. Then, to apply these functional data to determine the developmental gene regulatory targets of noncoding ASD risk variants from recent WGS and GWAS data.

Methods: We tested gene targets of the eQTL SNPs identified in adult brain from the Common Mind Consortium (CMC) for enrichment with gene sets implicated in ASD. We also generated WGS and RNA-sequencing (RNA-seq) data from post-mortem dorsolateral prefrontal cortex (DLPFC) samples from 200 individuals aged 6 post-conception weeks (PCW) through 22 years. Gene-level transcript counts have been identified across the dataset. We are in the process of identifying high-quality common and rare single nucleotide variants and indels, allowing eQTLs to be identified using Matrix eQTL. We will identify eQTLs in mid-fetal (13-24 PCW) and adolescent (12-20 years) brains, along with a combined analysis. As with adult eQTLs, we will test for enrichment in ASD-related gene sets. Finally, we will use all of these eQTL sets to assess help identify and interpret variants in GWAS and WGS data from ASD samples.

Results: We find that CMC eQTL gene targets are enriched for CHD8 binding targets (adjusted p=4.1e-31) and an astrocyte-associated, ASD brain-up-regulated co-expression module (adj. p=0.003), but depleted for FMRP targets (adj. p=5.1e-13), genes with higher expression in the female brain (adj. p=0.03), and ASD-associated risk genes (adj. p=0.04). Our DLPFC expression data also confirmed published findings that age is the most significant biological driver of expression differences sample-wide, suggesting that fetal eQTLs are likely to differ substantially from those identified in adult brains.

Conclusions: eQTLs offer an opportunity to identify genomic regions that play important regulatory functions in the human brain and that are also sensitive to genetic variation. The enrichment for CHD8 binding sites and depletion for FMRP targets suggest that eQTLs in adult brain are capturing an important, but complicated, dimension in ASD biology. Replication of the observation that developmental stage is the most important component in determining cortical gene expression suggests that there are likely to be considerable differences between fetal and adult eQTLs. We therefore anticipate fetal eQTLs providing important and novel insights into the role of ASD genes in cortical development and illuminating genomic regions likely to contain noncoding ASD risk factors in GWAS and WGS data.

Panel Session
Epidemiology
106 - Prenatal Nutrition and Risk for Autism Spectrum Disorders: Major Findings and Emerging Evidence across Four Cohorts
10:30 AM - 12:30 PM - Arcadis Zaal

Panel Chair: Renee Gardner, *Karolinska Institutet, Stockholm, Sweden*

Discussant: Cheryl Walker, *University of California, Sacramento, CA*

Maternal nutrition during pregnancy influences the neurodevelopment of the fetus, as is strikingly apparent in the case of folate deficiencies and increased risk for neural tube defects. Given the crucial role that many micronutrients play in the development and functioning of the central nervous system, it is plausible that maternal nutrition during pregnancy may also influence offspring risk of developing autism spectrum disorders (ASD). Numerous studies have now been conducted examining a variety of aspects of maternal nutrition in pregnancy and risk of ASD. The aim of this panel is to present key findings from four cohorts representing a diversity of epidemiological study designs, source populations, and geographic regions. Data will be presented regarding offspring risk of ASD in relation to pre-conceptual and prenatal micronutrient supplementation, maternal BMI, weight gain during pregnancy, prenatal vitamin D exposure, and prenatal polyunsaturated fatty acid exposure.

10:30 **106.001** Prenatal Nutrition and Risk of Child ASD: Findings and Updates from the Stockholm Youth Cohort

B. K. Lee[1], *C. Dalman*[2], *H. Karlsson*[3], *E. A. DeVilbiss*[4], *D. Rai*[5], *C. J. Newschaffer*[6], *J. McGrath*[7], *D. Eyles*[8] *and C. Magnusson*[9], *(1)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (2)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden, (3)Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden, (4)Drexel University, Philadelphia, PA, (5)Population Health Sciences, Bristol Medical School, Centre for Academic Mental Health, Bristol, United Kingdom, (6)AJ Drexel Autism Institute, Philadelphia, PA, (7)Queensland Brain Institute, University of Queensland, Brisbane, Australia, (8)Queensland Brain Institute, University of Queensland, St Lucia, Australia, (9)Karolinska Institutet, Stockholm, Sweden*

Background:

Early life nutrition is critical for proper neurodevelopment. Whether this paradigm extends to risk of autism spectrum disorders (ASD) is not established.

Objectives:

Our goals were to assess whether prenatal nutritional factors, including 1) maternal body mass index (BMI) and gestational weight gain (GWG); 2) nutritional supplementation, and 3) gestational vitamin D were associated with risk of ASD in a population-based electronic register and biomarker study taking place in Sweden.

Methods:

The Stockholm Youth Cohort is a total population register-based study consisting of all individuals born from 1984 onwards and resident in Stockholm County, Sweden for ≥4 years. ASD and intellectual disability (ID) diagnoses were extracted from electronic health and services registers using a validated approach covering all pathways to care in Stockholm County. Maternal sera and neonatal dried blood samples were available for a subsample of births. Data on maternal BMI at first antenatal visit, GWG, and nutritional supplementation were extracted from registers. Concentrations of total 25-hydroxyvitamin D (25[OH]D) were assessed from maternal and neonatal samples using a highly sensitive liquid chromatography tandem mass spectrometry method. The associations of prenatal nutritional factors and ASD, ASD without co-occurring ID, and ASD with ID were analyzed in logistic regression models adjusting for a large number of covariates, and odds ratios (ORs) and 95% confidence intervals (CI) were estimated. Sibling-matched samples of ASD cases and their unaffected siblings were analyzed to address potential familial genetic or environmental confounding.

Results:

We found in a sample of 333,057 individuals that maternal overweight/obesity and either insufficient or excessive GWG was associated with increased risk of child ASD. However, in sibling analyses, the relationship between elevated maternal BMI and ASD was not apparent, suggesting that maternal BMI may be a proxy for other risk factors. In a sample of 273,107 individuals, maternal multivitamin use with or without additional iron or folic acid was associated with lower odds of ASD with ID, when compared to mothers who did not use multivitamins, iron, and folic acid (OR: 0.69, 95% CI: 0.57-0.84).

In an analysis of 1,230 ASD cases and 1,500 controls. 25[OH]D deficiency (< 25 nmol/L serum equivalent) was associated with 1.35 times higher odds of ASD (95% CI: 1.04-1.75) as compared with 25[OH]D sufficiency (≥ 50 nmol/L serum equivalent). ORs were similar for associations of 25[OH]D deficiency with ASD without ID (1.36, 95% CI: 1.10-1.82) and ASD with ID (1.30, 95% CI: 0.87-1.96), although the latter was not statistically significant. Sibling-matched control analyses suggested these associations were not due to familial confounding. Maternal sera analysis is ongoing and results will be presented.

Conclusions:

In epidemiological studies based in the Stockholm Youth Cohort, we found that diverse prenatal nutritional factors may be associated with later risk of child ASD.

10:55 **106.002** Gestational Nutrition and Autism in the Charge Case-Control Study, with New Findings for Neonatal Vitamin D

R. J. Schmidt[1,2], *Q. Niu*[3], *D. Eyles*[4], *R. L. Hansen*[3] *and A. M. Iosif*[1], *(1)Public Health Sciences, University of California Davis, Davis, CA, (2)MIND Institute, University of California, Davis, Sacramento, CA, (3)University of California Davis, Davis, CA, (4)Queensland Brain Institute, University of Queensland, St Lucia, Australia*

Background:

Gestational nutrition has critical influences on neurodevelopment and evidence is building for a role in autism etiology; this includes associations with folate, iron, and potentially vitamin D.

Objectives:

To review findings from the population-based CHARGE (Childhood Autism Risks from Genetics and Environment) case-control study on gestational nutrients in relation to autism spectrum disorders (ASD) in the child, discuss potential mechanisms, and present new findings on neonatal vitamin D.

Methods:

Children with clinically-confirmed diagnoses of ASD, developmental delay (DD), or typical development (TD) were included. We collected through structured telephone interviews maternal intake of supplements for the three months before pregnancy, each month of pregnancy, and during breastfeeding. We then calculated total average values of selected nutrients for each month. Total 25-hydroxyvitamin (25OHD) was measured using sensitive isotope dilution LC-MS/MS in archived newborn screening dried blood spots.

Results:

Maternal folic acid near conception was associated with decreased ASD, especially in those genetically susceptible to inefficient metabolism. Iron intake also was associated with decreased ASD especially in combination with conditions associated with functional iron insufficiency. Newborn 25OHD was associated with significantly reduced ASD only in females (OR_{adj}=0.66; 95% CI: 0.48, 0.91, P_{intxn}=0.01). 25OHD was significantly associated with reduced DD (OR=0.84, 95%CI: 0.73, 0.97), cognitive and adaptive function prior to but not after adjustment for factors that contributed to vitamin D status (OR_{DD_adj}=0.91, 95%CI: 0.78, 1.06). Significant interaction by race/ethnicity was observed (p=0.02), with an association between 25OHD and DD only in non-Hispanic white children (OR_{adj}=0.76; 95% CI: 0.61, 0.95).

Conclusions:

Evidence for a role of nutrition in ASD etiology is similar to that observed for other neurodevelopmental conditions. Maternal folic acid, iron, and vitamin D could potentially reduce ASD in certain genetically and environmentally susceptible subgroups. Further investigation of nutritional contributions and mechanisms are needed to identify targeted ASD prevention strategies.

11:20 **106.003** Maternal Folic Acid and Multivitamin Supplementation and Risk of Autism Spectrum Disorders Among an Israeli Birth Cohort

***S. Sandin**, Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Background:

The role of maternal folic acid and multivitamin supplement use before and during pregnancy and the risk of Autism Spectrum Disorders (ASD) in offspring is unclear.

Objectives:

To examine the associations between maternal folic acid and multivitamin supplement use before and during pregnancy and the risk of ASD in offspring.

Methods:

Design: A case-cohort of 45,300 Israeli children born 2003 – 2007, followed-up from birth to January 26th, 2015 for the risk of ASD. The cases comprised of all children diagnosed with ASD by an Israeli health provider and controls comprised of a random sample of 33% of all live born children in Israel 2003 to 2007.

Exposures: Maternal vitamin supplements were classified for folic acid (B9), multivitamin supplements (ATC A11 vitamins: A, B C and D), and any combination thereof, exposed in the intervals before and during pregnancy.

Main outcome(s) and Measure(s): The association between maternal vitamin supplementation and the risk of ASD in the children was quantified with relative risks (RR) and their 95% confidence intervals (CI) fitting Cox regression models and adjusting for year of birth, parental psychiatric history, Socioeconomic status, maternal and paternal age and parity. Extensive sensitivity analyses were performed to test the robustness of the results.

Results:

Maternal folic acid and/or multivitamin supplement exposure ***before*** pregnancy was statistically significantly (P<.01) associated with a lower likelihood of ASD in the offspring compared to no exposure before pregnancy, RR=0.39 (95% CI: 0.30-0.50). Maternal folic acid and/or multivitamin supplement exposure ***during*** pregnancy was statistically significantly (P<.01) associated with a lower likelihood of ASD in offspring compared to no exposure during pregnancy, RR=0.27 (95% CI: 0.22-0.33). Corresponding RR's was estimated; for maternal folic acid ***before*** pregnancy at RR=0.56 (95% CI: 0.42-0.74); ***during*** pregnancy at RR=0.32 (95% CI: 0.26-0.41) and for multivitamin supplements ***before*** pregnancy at RR=0.36 (95% CI: 0.24-0.52) and ***during*** pregnancy at RR=0.35 (95% CI: 0.28-0.44). The results remained statistically significant across sensitivity analyses.

Conclusions: Maternal intake of folic acid and multivitamin supplements before, and during pregnancy are associated with a reduced risk of ASD in the offspring, compared to offspring of mothers without such intake.

11:45 **106.004** Prenatal Polyunsaturated Fatty Acid Levels in Association with Autism Spectrum Disorder

***K. Lyall**[1], G. C. Windham[2], N. Snyder[1], J. Carver[3] and C. J. Newschaffer[4], (1)A.J. Drexel Autism Institute, Philadelphia, PA, (2)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (3)Sequoia Foundation, La Jolla, CA, (4)AJ Drexel Autism Institute, Philadelphia, PA*

Background: Polyunsaturated fatty acids (PUFAs) are critical to neurodevelopment. Though emerging work has identified associations between certain prenatal nutrients and reported supplements in association with autism spectrum disorder (ASD), and suggested altered levels of PUFAs in individuals already diagnosed with ASD, no prior study has examined the association between measured levels of prenatal PUFAs and ASD in order to determine potential etiologic involvement of these fats.

Objectives: To determine whether levels of PUFAs, measured in stored mid-pregnancy serum samples, differ in mothers who go on to have a child with ASD as compared to those who have an unaffected child.

Methods: This population-based statewide case-control study includes approximately 500 cases and 500 general population (GP) controls, matched on sex and month and year of birth (2011-2013). Cases of ASD were identified from the California Department of Developmental Services (DDS), and GP controls were randomly selected within strata of matching factors from birth certificate files after excluding DDS clients. Prenatal serum samples were drawn from the California Biobank Program, and levels of specific omega 3 and omega 6 PUFAs were measured using liquid chromatography-mass spectrometry/high resolution mass spectrometry (LC-MS/HRMS). Conditional logistic regression analyses, accounting for matching factors and adjusted for potential confounders, were used to examine the association between PUFAs (as individual fatty acids and as classes) and ASD.

Results: In preliminary analyses, mean levels of PUFAs did not significantly differ. In adjusted analyses examining associations with extremes of the distribution, there was a suggestion of an increase in odds of ASD for individuals in the lowest 5th percentile of linoleic acid levels (OR=1.57, 95% CI 0.90-2.76), relative to those with mid-distribution levels. Reductions of approximately 20% in odds of ASD for those in the highest 5th percentile of total PUFAs and total omega 6, were also observed, though these associations also did not reach statistical significance (OR=0.83, 95% CI 0.44, 1.56, respectively). Analyses will be updated as final samples are processed. Additional analyses will also investigate potential non-linear relationships between these fats and ASD using cubic splines, as well as associations with PUFAs measured in neonatal bloodspots in a subset of 400 cases and controls. Secondary analyses will examine the odds of ASD with and without comorbid intellectual disability (ID), relative to GP controls.

Conclusions: Preliminary findings from this large population-based case control study did not reveal significant associations between prenatal PUFA levels and ASD. However, associations similar in direction and magnitude for extremes of total PUFA, as well as linoleic acid specifically, are generally consistent with our previous results based on reported maternal diet, suggesting potential influences of very high and very low levels of these fats. Given the critical role of PUFAs in fetal brain development, and their influence on mechanisms with evidence for involvement in ASD etiology (inflammation and oxidative stress), further exploration of these potential associations is needed. Findings here will be updated using the full study group, exploring more complex exposure distribution relationships, and considering additional outcome subtypes.

Poster Session
107 - Animal Models
11:30 AM - 1:30 PM - Hall Grote Zaal

1 **107.001** A Novel Vasopressin V1a Antagonist Restores Social Behavior in the Mouse Cntnap2 KO Model of Autism

C. Grundschober[1], *A. Genet*[2], *M. Saxe*[2], *P. Schnider*[3] *and B. Biemans*[1], *(1)Neuroscience Discovery, Roche Pharma Research and Early Development, Roche Innovation Center Basel, F. Hoffmann-La Roche, Basel, Switzerland, (2)Neuroscience Discovery, Roche Pharma Research and Early Development, Roche Innovation Center Basel, Basel, Switzerland, (3)Medicinal Chemistry, Roche Pharma Research and Early Development, Roche Innovation Center Basel, Basel, Switzerland*

Background: The neuropeptide vasopressin is mainly produced in the lateral hypothalamus and plays an important role in regulating aggressive and social behavior by activating the V1a vasopressin receptor. A missense mutation in the human contactin-associated protein-like 2 (*CNTNAP2*) gene has been identified in an Amish family, leading to cortical dysplasia–focal epilepsy (CDFE) syndrome. Out of the 9 originally reported cases, 6 have autism. *CNTNAP2* is a cell adhesion molecule, important for AMPA receptor trafficking, development of dendritic arborization, and stabilization of dendritic spines. *Cntnap2* knockout mice (*Cntnap2* KO) demonstrate reduced social behavior and increased repetitive behavior (grooming).

Objectives: Investigate the effect of central V1a receptor blockade on the phenotype of the mouse *Cntnap2* KO model of autism.

Methods: *Cntnap2* KO mice were treated daily during 3 weeks with a novel brain penetrant V1a receptor-specific small molecule antagonist, starting at postnatal day 40. Social behavior and self-grooming was assessed during a direct social interaction test at P48. Self-grooming was measured again in a single setting at P52, and locomotor activity was assessed at P62.

Results: At postnatal day 48, chronic treatment with our V1a receptor-specific small molecule antagonist completely reversed the impairment in social behavior seen in *Cntnap2 KO* at 15 and 30 mg/kg i.p., which are doses predicted to block 77 to 88% of brain V1a receptors. The exaggerated grooming was also reduced at the highest dose tested (60 mg/kg i.p). None of the tested doses affected locomotor activity at P62.

Conclusions: Our data show that sub-chronic inhibition of vasopressin V1a receptors restores normal social behavior in *Cntnap2* KO mice. The effect on repetitive behavior is only apparent at the highest tested dose, suggesting that grooming is either less sensitive to V1a inhibition or not directly mediated by V1a activation. Further experiments will be needed to clarify this finding.

These results suggest that V1a antagonists have the potential to improve social interaction in autism, a core symptom for which there is currently no drug treatment.

2 **107.002** Defensive Response to Whisker Stimulation and Reduced Somatosensory Cortex Activation in the Engrailed-2 Mouse Model of Autism

G. Chelini, L. Cimino, A. Grigoli, M. Gadler, S. Miorelli, S. Casarosa, G. Provenzano and ***Y. Bozzi****, University of Trento, Trento, Italy*

Background:
Increased responsiveness to somatosensory stimuli is a common symptom in autism spectrum disorders (ASDs), which often leads to defensive behaviors in response to tactile stimulation. Recent studies performed in mouse models of ASDs confirm these findings. As an example, *Fmr1* knock-out (KO) mice (a model of syndromic autism) present a marked adaptation deficit of somatosensory cortex neurons in response to repetitive whisker stimulation, which is not observed in wild-type (WT) controls.

Objectives:

Here we evaluated the behavioral response to whisker stimulation in *Engrailed-2* (*En2*) KO mice, another model of ASDs characterized by a significatly reduced expression of *Fmr1*.

Methods:

Ten WT and 10 En2 KO mice of both sexes were assessed for whisker-guided, somatosensory functions using the sensory maze exploration and whisker nuisance test. The two tests were performed in sequence on the same groups of animals. At the end of the whisker nuisance test, brains were dissected and processed for c-Fos immunohistochemistry as a marker of neuronal activity.

Results:

When tested in the sensory maze, adult *En2* KO mice spent a comparable whisker-guided exploration time as their WT controls, thus indicating that whisker-mediated exploratory behavior is preserved in these mutants. Conversely, *En2* KO mice showed aggressive and active avoidance responses to repeated whisker stimulation in the whisker nuisance test, which instead resulted innocuous to WT controls. Quantitative analysis of c-Fos immunohistochemistry showed that in *En2* KO mice, avoidance behavior to whisker stimulation was paralleled by a significantly lower number of c-Fos positive neurons in layer IV of the primary somatosensory cortex, as compared to WT controls.

Conclusions:

These results suggest that tactile defensiveness is accompanied by a reduced activation of somatosensory cortical circuits in *En2* KO mice. Thus, impaired signal processing in the somatosensory cortex seems to be a common feature in different mouse models of ASDs, and might be a cause of tactile defensiveness in ASDs.

3

107.003 Effects of Riluzole and Gabapentin on Learning, Anxiety and Social Behaviors in Autism-like Rat Model

S. Karakoç Demirkaya[1]*, C. Orak*[2]*, F. Şirinyıldız*[2]*, G. Taşlı Yeşilçayır*[2]*, G. Cesur*[2] *and R. O. Ek*[2]*, (1)Child and Adolescent Psychiatry, Adnan Menderes University School of Medicine, Aydın, Turkey, (2)Physiology, Adnan Menderes University School of Medicine, Aydın, Turkey*

Background: Autism spectrum disorder (ASD), is a neurodevelopmental disorder, characterized by difficulties in social interaction and communication and as well as repetitive and ritualistic behaviors. Despite the burden of the ASD on individual, family and community is high, no specific causes and optimal treatment modalities have not been identified yet. Dysfunction in the glutamatergic and GABAergic systems contributing the neurobiology of ASD have recently been proposed.

Objectives: We aimed to investigate effects of the riluzole, an antiglutamate agent, and gabapentin which increases GABAergic transmission, on learning, anxiety and social behaviors in autism-like rat model.

Methods: On the 12.5th gestational day, valproic acid was applied parenterally to the female *Wistar Albino* rats, except for the autism-negative control group, to create autism-like model (ALM). Newborn male rat pups (n=40) divided into 5 equal groups; negative control, ALM-nontreated (sham control), ALM+ riluzole treated, ALM + gabapentin treated, and ALM + combination of gabapentin & riluzole treated (n=8). Riluzole (10 mg/kg/day p.o) and gabapentin (300 mg/kg/day p.o.) were administered via orogastric gavage in the 3rd postnatal week for 2 weeks. Behavioral tests, Morris water maze (MWM), open field test (OFT) and three-chambered social approach test (TSAT) were applied in the 6th postnatal week.

Results: Both sociability and social preference indices with strangers in TSAT were lower in the ALM rats than the negative groups ($p<0.01$) indicating that the model was well fitted. Among the drug groups, combined treated rats showed the highest sociability index and social preference index ($p<0.01$). In the OFT, riluzole treated group had spent more rearing behaviors and spent less time in the outer squares (periphery) ($p<0.05$). Gabapentin treated rats showed the least rearing and grooming behaviors in the OFT. In the MWM test, the percent of the time spent in the previously learned platform was the highest in the riluzole only group ($p<0.05$) and this learning was the worst in the gabapentin treated rats ($p>0{,}05$).

Conclusions: All these results suggest that riluzole, an antiglutamatergic agent, seems to have some possible positive effects on social interaction, anxiety level and spatial learning in an autism-like rat model. If gabapentin is used alone, limitedly play a positive role on social behavior whereas a negative role in learning. However gabapentin may attenuate the social behaviors in combined treatment. Gabapentin may also decrease exploratory motions as well as anxiety levels. Further molecular and biochemical studies are needed to reveal the underlying etiological and therapeutic mechanisms of these neurotransmitter modulators.

4

107.004 From Genetic Modification to Seizure-Induced Hyperactivity; Insights from SYNGAP1 Zebrafish Models of ASD

S. H. Sumathipala*, R. A. Kozol and J. E. Dallman, Biology, University of Miami, Coral Gables, FL*

Background: Autism Spectrum Disorders (ASD) are a collection of inherited neuro-developmental disorders characterized by social and cognitive impairments, communication deficits, and repetitive behaviors. With the increasing prevalence of ASD, insights from genetics and gene-environmental interaction studies are helping to explain unique symptoms found in different individuals. Significantly high number of ASD cases are reported from gene variations associated with synaptic proteins such as *shank3*, *cntnap2*, *nrxn* and *nlgn*3, which play important roles in synapse formation, modification, and maintenance. Alterations associated with the synapses may result in disrupted synaptic function, thereby causing neuro-developmental and behavioral phenotypes linked with ASD.

This study focuses on Synaptic Ras-GTPase Activating Protein 1 (*SYNGAP1*), a gene encoding the post-synaptic protein *syngap1,* known to cause intellectual disability (ID) and Autism in humans. *syngap1* is a component of the post synaptic density of glutamatergic synapses and plays an important role in receptor trafficking and synaptic strengthening allied with learning and memory. In our lab, we have generated a stable *syngap1ab* zebrafish models of Autism using CRISPR/Cas 9 genome editing. High conservation of *syngap1* between humans and zebrafish make it a favorable model to study the mechanisms underlying neuro-developmental and behavioral phenotypes associated with ASD.

Objectives: Using *syngap1* zebrafish models of ASD our aims are, (i) To identify and quantify comparable ASD-related behaviors and, (ii) To delineate the molecular mechanisms underlying those behaviors in zebrafish larvae to gain insight to symptom etiology in humans with *SYNGAP1* variants.

Methods: s*yngap1* models of ASD were generated using the CRISPR/ Cas 9 genome editing method by injecting *SYNGAP1A and SYNGAP1B* gene specific guide RNA, and Cas 9 nuclease into zebrafish embryos at one cell stage. Resulting embryos were reared, screened for the *SYNGAP1* gene mutations, and were used in the subsequent behavioral assays. To study the light-induced hyperactivity and epilepsy, a visual-motor response assay was carried out using *syngap1* and wild-type (WT) larvae from 4, 5 and 6 days post fertilization (*dpf*). The activity of each zebrafish larva was recorded in terms of their center point movement using the Noldus- DanioVision^{TM} high throughput tracking software. Larvae were exposed to 30 minutes of alternating light-dark cycles for a duration of 4 hours. Cumulative duration of movement for each larva was recorded and analyzed over time.

Results: Our preliminary data suggest that there are significantly higher levels of activity associated with the *syngap1ab* mutants compared to the WT larvae, during both light and dark periods. These observations are comparable with the intractable seizures associated with *SYNGAP1* variants in humans. Moreover, larvae with *syngap1ab* $^{-,-/+,-}$ genetic composition had the highest activity levels compared to the *syngap1ab*$^{-,-/-,-}$ and *syngap1ab* $^{+,+/+,+}$ (WT) combinations recapitulating the similar phenotype in human *syngap1* $^{+,-}$ mutations.

Conclusions: Given our preliminary data, *syngap1* zebrafish models of ASD can potentially be used to address the behavioral phenotypes and understand the underlying molecular mechanisms linked to ASD. Identifying these machinery will be useful in the future to develop therapeutic strategies.

5 **107.005** Interneuron-Specific Knockout of Semaphorin 3F Results in Increased Inflammation, Oxidative Stress and Autism-like Behavior.

R. Jagadapillai[1]*, Z. Li*[2]*, E. Gozal*[3] *and G. Barnes*[4]*, (1)Departments of Pediatrics, PRI, University of Louisville, Louisville, KY, (2)Neurology, Vanderbilt University, Nashville, TN, (3)Pediatrics, PRI, University of Louisville, Louisville, KY, (4)University of Louisville School of Medicine, Louisville, KY*

Background:
The neuropathology of all neural circuits in ASD is dependent on changes in functional connectivity via the excitation/inhibition (E/I) ratio that impact routine neurotransmission, synaptic plasticity, and network function. We were the first to publish an extensive investigation of an animal model of autism and epilepsy (Barnes et al., 2009). The semaphorin/neuropilin gene family, an ASD associated set of genes, are guidance cues that control processes and cell motility in a wide variety of tissues. In the developing brain, these cues control interneuron migration/cell numbers, regulate neurite outgrowth (axon/dendrite), and control both GABA/excitatory synaptogenesis. Several groups, including our own, have noted behavioral phenotypes consistent with autism in both the semaphorin 3F (Sema 3F) and neuropilin 2 (NRP2) knockout mice. Similar to NRP2 KO mice, the interneuron specific but not excitatory neuron specific knockout of Sema 3F had decreased Parv+ and NPY+ interneurons and increased epileptogenesis with decreased social behaviors and increased repetitive behaviors compared to wild type littermates.

Objectives: We aimed to determine whether semaphorin 3F KO mice also presented with brain inflammation and oxidative stress that could be associated with ASD-like behavior.

Methods: DLX5/6 Cre Sema 3F Knockout mice and controls were tested for social novelty using the three chamber social interaction test. Markers of neuroinflammation (Iba1 for microiglia, and iNOS) and of oxidative stress (DHE for superoxide, 4-HNE for lipid peroxidation and 3-nitrotyrosine for protein nitrosylation) were assessed by immunostaining in three areas of DLX5/6 Cre Sema 3F Knockout mice and control brains.

Results: The significant increase in immunoreactivity of Iba1, a microglial marker, and of oxidative stress markers (DHE, 4HNE, iNOS, and 3-nitrotyrosine) in hippocampus, cortex and amygdala brain regions suggest increased inflammation and oxidation products within both the glia and neurons of the interneuron- specific Sema 3F KO mouse.

Conclusions: Thus, although this is a single ASD associated gene KO mouse, these data strongly suggest that genetic mouse models of autism with markers of inflammation will be an excellent tool to investigate the role of genomics, environmental factors influencing the immune system, clinical endophenotypes, and metabolic conditions. Most importantly, these models and others can define molecular mechanisms influencing the interactions among organ systems contributing to ASD brain dysfunction.

6 **107.006** Maternal Infection By Group B Streptococcus Induces Sex-Specific Maternofetal Inflammatory Signaling Leading to Postnatal ASD-like Behaviors in Males

M. J. Allard[1]*, A. Giraud*[2]*, M. Segura*[3] *and G. Sebire*[1,4]*, (1)Pediatrics, McGill University, Montreal, QC, Canada, (2)Pediatrics and Neonatal Intensive Care Unit, Saint-Etienne University Hospital, Saint-Etienne, France, (3)Pathology and Microbiology, Universite de Montreal, St-Hyacinthe, QC, Canada, (4)Pediatrics, Universite de Sherbrooke, Sherbrooke, QC, Canada*

Background: Placental infection and/or inflammation (chorioamnionitis) is a common complication associated with adverse outcomes including premature birth and brain injuries leading to neurodevelopmental disabilities such as autism spectrum disorder (ASD). Chorioamnionitis is a polymicrobial infection most often due to ascending genital pathogens. Group B *Streptococcus* (GBS) is a gram-positive bacterium colonizing the urogenital tract of 20-30% of pregnant women. GBS is isolated in 15% of chorioamnionitis, *i.e.* twice as often as the gram-negative bacterium *Escherichia coli* (Tita & Andrews, *Clin Perinatol*, 2010). Chorioamnionitis is characterized by the release of neurotoxic inflammatory mediators affecting placental synthesis of neurotrophic factors, and potentially disrupting neuroglial fiber tracts in the developing brain. Dysregulation of specific proinflammatory cytokines, including interleukin (IL)-1β, tumor necrosis factor (TNF)-α and IL-6, in maternofetal tissues have been associated with higher risks of having a child with ASD. We previously developed a rat model of end-gestational GBS infection that induces histological chorioamnionitis, characterized by an increased density of neutrophil cells in placentas associated with male *versus* female fetuses. Following natural birth, male – but not female – offspring *in utero*-exposed to GBS presented ASD-like behavioral impairments (Allard et al., *Autism Research*, 2016). We hypothesized that a differential activation of proinflammatory mediators and cells according to the fetal sex is responsible for sex-specific neurobehavioral outcomes in GBS-exposed offspring.

Objectives: Mapping out the expression profiles of cytokines and innate immune cells within GBS-infected placentas, and comparing this immune profile between male and female tissues.

Methods: Lewis dams were injected intraperitoneally on gestational day 19 with β-hemolytic serotype Ia GBS (10^8 CFU) or saline (control; CTL). Caesarean-sections were performed at 24 h, 48 h and 72 h post-injection to collect maternofetal tissues (placentas, maternal and fetal blood, fetal brains), and to investigate sex-specific maternofetal immune activation and prenatal brain injuries (GBS: n = 18, CTL: n = 14). Proinflammatory cytokines IL-1β, TNF-α and IL-6 were studied by ELISA and immunohistochemistry.

Results: At 24 h, no difference in titers of IL-1β, TNF-α and IL-6 in maternal sera was detected between experimental conditions. At 48 h, increased titers of IL-1β, but not TNF-α and IL-6, were detected in GBS-exposed maternal sera and GBS-exposed male placentas compared to control tissues. At 72 h, increased titers of IL-1β, TNF-α and IL-6 were detected maternal sera, male placentas, and male fetuses' sera *versus* CTL tissues. At 72 h, increased levels of IL-1β, TNF-α and IL-6 were detected in GBS-exposed male *versus* GBS-exposed female placentas. The correlation between maternofetal inflammatory responses and fetal forebrain injuries will be characterized by ongoing studies.

Conclusions: These results suggest that IL-1β might be implicated in the induction of the male-specific forebrain injuries, and subsequent ASD-like behaviors observed in this rat model. Innovative insights into the mechanistic underpinning the pathophysiology of pathogen-induced placental injuries are needed to develop appropriate novel therapeutic interventions.

7

107.007 Microbial Signatures Associated with Gastrointestinal Function in a SERT Ala56 Knock-in Mouse Model

R. A. Luna[1]*, A. Venkatachalam*[1]*, N. Israelyan*[2]*, J. Runge*[1]*, M. Balderas*[1]*, R. Blakely*[3]*, J. Veenstra-Vander Weele*[4] *and K. G. Margolis*[5]*, (1)Baylor College of Medicine, Houston, TX, (2)Columbia University, New York, NY, (3)Vanderbilt University, Nashville, TN, (4)Psychiatry, New York State Psychiatric Institute / Columbia University, New York, NY, (5)Pediatrics, Columbia University Medical Center, New York, NY*

Background: The gut-microbiome-brain (GMB) axis plays a pivotal role in the manifestation of gastrointestinal (GI) and behavioral symptoms. The crosstalk between the enteric and central nervous systems is heavily influenced by the serotonin transporter (SERT), and specific enteric microbiota have been shown to modulate enteric serotonin (5-HT) production. The SERT Ala56 knock-in mouse model displays gastrointestinal (GI), brain, and behavioral phenotypes similar to those observed in autism spectrum disorder (ASD), and administration of a 5-HT$_4$ agonist, prucalopride has reversed the GI manifestations.
Objectives: 1) Characterize the enteric microbiome in a SERT Ala56 knock-in mouse model. 2) Determine whether treatment with prucalopride corrects gut dysbiosis. 3) Identify key organisms that are associated with changes in GI function.

Methods: Dams were given either prucalopride or vehicle (normal saline) throughout pregnancy and breastfeeding (E1-P21). Drug administration was stopped after 3 weeks to rule out acute drug effects. Five fecal pellets were collected from 9 male progeny per group (WT, SERTAla56+/-prucalopride) at 6-7 weeks of age. Bacterial DNA was extracted from fecal pellets, and next-generation sequencing targeting the V4 region of the 16S rRNA gene was performed on the Illumina MiSeq. With a minimum of 15,000 reads per sample, sequences were quality filtered, clustered into operational taxonomic units (OTUs), and taxonomic assignments were made. GI motility studies were done to measure in vivo total GI transit and colonic motility and in vitro colonic peristalsis. Integrative analysis of GI function and the microbiome was performed to identify factors influenced by microbial species.

Results: The microbial profile of the SERT Ala56 knock-in mice compared to wild type (WT) mice included increases in *Prevotella sp.* and *Lactobacillus sp.* and decreases in *Bacteroides sp.* and *Odoribacter sp*. Prucalopride treatment of SERT Ala56 mice during neurodevelopment, which prevented abnormalities in ENS anatomy and GI function, also caused microbial shifts that closely resembled WT mice. Integrative analysis also revealed a specific OTU, potentially identified as *Clostridium clariflavum*, that was found in increased abundance in mice that had the greatest improvements in total GI motility and the frequency of peristalsis.

Conclusions: Identification of a distinct microbial signature in the SERT Ala56 knock-in model, with parallel changes in GI improvements following prucalopride treatment, further solidifies an interaction between motility and the microbiome. This reversible mouse model effectively illustrates the interconnectivity of GI function and the enteric microbiome, with 5-HT playing a critical role. Future studies will include evaluation of behavior and CNS function.

8

107.008 Modifications in Cytoskeletal and Astrocytic Proteins Content in Prefrontal Cortex, Hippocampus and Cerebellum of the Murine Model of Autism C58/J Strain

I. Barón-Mendoza[1] *and A. González-Arenas*[2]*, (1)Instituto de Investigaciones Biomédicas, National Autonomous University of Mexico, Ciudad de México, Mexico, (2)National Autonomous University of Mexico, Ciudad de México, Mexico*

Background:
Autism Spectrum Disorder (ASD) is presented with a global prevalence of 1/160. ASD have been recognized as a complex brain disorder with high heritability. Two common characteristics are presented in this disorder: impairment of social interaction and communication, and restricted and repetitive behaviours.

Alterations in neuritogenesis, elongation of axons and dendrites, and greater spine densities in ASD patients, particularly found in brain structures associated to memory, learning and motor processes as prefrontal cortex, hippocampus and cerebellum, besides a reported synaptic gene dysfunction, suggest connectional changes and disturbances in plasticity in the autistic brain. The cytoskeleton has a pivotal role in regulating the structure and dynamics of dendrites, spines and axon outgrowth. Also it is essential for synaptic connections stabilization and remodelling. Hence, some modifications of cytoskeletal and astrocyte components could be involved at molecular level in the mentioned alterations.

Objectives:

The objective of this research was to analyse changes in the content of cytoskeletal proteins β-actin and actin-binding-proteins cofilin and synaptopodin; α-tubulin and microtubules-associated proteins MAP2A and Tau, and astrocyte secreted protein thrombospondin-1 (TSP-1) in prefrontal cortex, hippocampus and cerebellum of an autistic animal model corresponding to the C58/J mice strain.

Methods: Prefrontal cortex, hippocampus and cerebellum from C58/J and C57 BL/6 (wild type) mice were dissected. Samples were processed for Western Blot technique.

Results: α-tubulin content showed no change in prefrontal cortex, neither hippocampus nor cerebellum between both strains. However microtubule-associated proteins as MAP2A and Tau presented clear differences. We observed six Tau isoforms with molecular weights between 20-100 kDa in prefrontal cortex, hippocampus and cerebellum of wild type mice strain (C57BL/6). Four Tau isoforms completely disappear in autistic brain areas, 80 and 60 kDa isoforms were detected in both strains. The 80 kDa Tau isoform content in prefrontal cortex, hippocampus and cerebellum of autistic mice (C58/J) was not different compared to the WT strain (C57 BL/6), but the 60 kDa isoform and its phosphorylated form showed a decrease in the autistic prefrontal cortex and hippocampus compared to the WT regions. Furthermore the MAP2A protein content was lower only in prefrontal cortex of autistic mice compared to WT strain. The content of β-actin was uniform in the studied brain areas between WT and autistic mice. Instead, the content of phosphorylated actin-binding protein cofilin showed a decrease in the autistic prefrontal cortex and an increase in autistic cerebellum. Besides, synaptopodin content, another actin-binding protein enriched in dendritic spines neck, was diminished only in hippocampus of autistic mice. Finally, the protein content of astrocyte-secreted protein thrombospondin-1 showed a decrease in prefrontal cortex and hippocampus of autistic mice, although the GFAP protein content was not different between both strains.

Conclusions:

Our work showed important brain structure-dependent changes in protein content of 60 kDa Tau/phospho-Tau isoform, MAP2A, phosphorylated-cofilin and synaptopodin, as well as differences in the astrocyte-secreted protein thrombospondin-1 content in prefrontal cortex, hippocampus and cerebellum of autistic animals (C58/J) compared to wild type mice (C57 BL/6). These differences in autistic mice brain could be associated with disturbances in neuronal cytoskeleton dynamics.

9 **107.009** Obesity and Weight Gain during Pregnancy Associate Independently with Behavior of Infant Rhesus Monkeys (Macaca mulatta)

C. K. Walker[1]*, C. A. VandeVoort*[2,3]*, C. S. Li*[4]*, C. L. Chaffin*[5] *and J. P. Capitanio*[6,7]*, (1)University of California, Sacramento, CA, (2)Reproductive Medicine, UC Davis California National Primate Research Center, Davis, CA, (3)Obstetrics & Gynecology, University of California, Davis, Sacramento, CA, (4)Division of Biostatistics, Department of Public Health Sciences, University of California, Davis, CA, (5)Obstetrics, Gynecology and Reproductive Sciences, University of Maryland School of Medicine, Baltimore, MD, (6)Neuroscience and Behavior, California National Primate Research Center, Davis, CA, (7)Psychology, University of California, Davis, Davis, CA*

Background: Growing evidence identifies maternal adiposity as a potentially-modifiable risk factor for adverse neurobehavioral development including autism spectrum disorder (ASD) and attention deficit / hyperactivity syndrome (ADHD).

Objectives: We explored relationships between maternal obesity, gestational weight gain (GWG) and neurobehavioral impairment in the indoor colony of rhesus (*Macaca mulatta*) monkeys at the California National Primate Research Center (CNPRC).

Methods: This retrospective cohort analysis examined whether maternal prepregnancy obesity and gestational weight gain were associated with behavioral outcomes in 172 rhesus macaque infants at the California National Primate Research Center. The rhesus macaque model is highly relevant to the study of gestational obesity, fetal programming and neurobehavioral outcomes with strong generalizability to humans. Dams conceived indoors, had uncomplicated pregnancies, delivered vaginally and reared infants indoors. Measures of maternal adiposity included prepregnancy Body Condition Score (BCS), a subjective semi-quantitative anatomic assessment that reliably identifies obese monkeys, and GWG measured as steepness of weight change over the interval from the last weight prior to pregnancy to the first weight after birth of the infant. Infants underwent standardized bio-behavioral analysis (BBA) at 90-120 days of age between March 2001 and May 2015. Outcomes were a series of measurements recorded in a standardized 25-hour program designed to characterize behavioral and physiological responsiveness.

Results:: Our exploration of rhesus macaque maternal adiposity measures revealed a pattern of greater behavioral disturbance during the BBA testing for infants of dams that had higher prepregnancy adiposity and / or that gained excess weight. Importantly, these effects were not evident immediately upon relocation to the testing area when all animals responded similarly to the separation and relocation. Rather, the pattern for the infants of obese mothers reflected poor adaptability, as indicated by a number of results from the later assessments, during which infants exhibited enhanced holding-cage Emotionality, substantial disturbance during the human intruder test, and completion of fewer problems and less interest in novel stimuli during the test for visual recognition memory compared with control infants. They also had significantly lower cortisol levels in response to dexamethasone suppression, indicating that the cortisol feedback loop in these animals was more sensitive to negative regulation by glucocorticoids.

Conclusions: These results amplify growing public health concerns implicating maternal adiposity in impaired fetal neurobehavioral programming. Further, this study highlights the translational potential of the nonhuman primate model for the study of developmental programming in humans. Children with ASD and ADHD often exhibit similar variation in temperament traits, including decreased adaptability, increased activity level and unusual approach behaviors. The nonhuman primate cohorts identified in this study would be excellent models for elucidation of fetal programming mechanisms that link maternal obesity and high GWG with adverse offspring behaviors often identified in individuals with ASD and / or ADHD.

10 **107.010** Pogz Mutation Leads to Abnormal Behavior and Transcription Dysregulation in the Brain

R. Suliman *and S. Shifman, The Hebrew University of Jerusalem, Jerusalem, Israel*

Background:

De-novo loss-of-function mutations in POGZ (Pogo Transposable Element with ZNF domain) were identified in multiple individuals with developmental delay, half of them with a diagnosis of autism spectrum disorder (ASD). POGZ consistently interacts with the three isotypes of HP1 and therefore may play a key role in transcription regulation. As of today, the molecular, cellular and neuronal mechanisms through which POGZ is associated with ASD remain incompletely understood.

Objectives:

Our overall aim was to delineate the function of POGZ in the normal brain and in ASD. In particular, we inquired how rare genetic insults in this gene influence networks of genes leading to ASD.

Methods:

Our approach to study the function of POGZ was based on Pogz-deficient mice. We used a conventional knockout mice with a whole body heterozygous mutation in Pogz gene (Pogz KO$^{+/-}$), and conditional knockout mice that harbor a homozygous Pogz knockout restricted to the brain (Pogz cKO$^{-/-}$). To characterize the anatomical and behavioural phenotypes we used several staining methods and a battery of behavioural assays relevant to ASD. To explore how POGZ modulates gene expression in the brain and identify its transcriptional targets we used RNA-Seq and dual-luciferase reporter assay.

Results:

Pogz deficient mice showed a significant growth delay relative to their WT littermates. Behaviourally, these mice exhibited reduced anxiety, deficits in learning and memory and impaired sociability. Similar to what was reported in humans, the KO mice were “overly friendly”. To identify defects in neural development that may explain the behavioral phenotypes, we first studied brain anatomy, including the structure of the cortex, but found that Pogz-deficient mice displayed no detectable defects. However, adult neurogenesis was significantly decreased in the hippocampus because of reduced neuronal survival. Gene expression profiling of the hippocampus identified a large number of dysregulated genes. The majority of differentially expressed genes with fold change above 1.5 or above 2 were upregulated (67%, P = 0.026; 93%, P = 0.00098, respectively) and enriched for genes involved in axon guidance, and regulation of locomotion. Since POGZ was found to be an integral part of the HP1 protein complexes, and given the gene expression results, we hypothesized that POGZ plays a key role in transcription repression. Indeed, dual-luciferase reporter assay showed that POGZ acts as a negative regulator of transcription through its interaction with HP1 proteins.

Conclusions:

Our study shows that Pogz deficiency in mice is sufficient to cause ASD-related behaviours, similar to those found in human individuals with *de-novo* mutations in POGZ. The behavioral abnormalities and growth delay may result from lower survival of newly born neurons and transcriptional dysregulation in mature neurons caused by POGZ deficiency.

11 **107.011** Resveratrol Prevents Molecular Aspects in Sensory Areas of Rats Prenatally Exposed to Valproic Acid

M. F. Dutra[1,2,3]*, J. Santos-Terra*[2,3,4]*, I. Deckmann*[2,3,4]*, G. B. Schwingel*[2,3,4]*, G. Della Flora Nunes*[2,3,5]*, M. M. Hirsch*[2,3,4]*, G. Bauer-Negrini*[2,3,4]*, C. Hedin-Pereira*[6]*, V. Bambini-Junior*[2,3,7]*, R. Riesgo*[2,3,8] *and C. Gottfried*[2,3,4]*, (1)Federal University of Rio Grande do Sul, Porto legre, Brazil, (2)Translational Research Group in Autism Spectrum Disorder (GETTEA), Porto alegre, Brazil, (3)National Institute of Science and Technology on Neuroimmunomodulation-INCT- NIM, Porto alegre, Brazil, (4)Department of Biochemistry, Federal University of Rio Grande do Sul, Porto alegre, Brazil, (5)SUNY at Buffalo, Buffalo, NY, (6)Institute of Biophysics Carlos Chagas Filho, Rio de Janeiro, Brazil, (7)School of Pharmacology and Biomedical Sciences, University of Central Lancashire, Preston, United Kingdom, (8)Clinical Hospital of Porto Alegre, Porto alegre, Brazil*

Background: Autism Spectrum Disorder (ASD) characterized by impairments in communication and social interaction in addition to repetitive or stereotyped behaviors. Another extremely important aspect for ASD are the sensory alterations present in more than 90% of the individuals with ASD like hyper-responsiveness to non-harmful stimuli (visual, tactile and auditory) and hypo-responsiveness to harmful stimuli, which implies a great loss in life quality. Although etiology is unknown, both genetic and environmental risk factors have been associated with the development of ASD, including the use of valproic acid (VPA) during pregnancy. Based on these observations, an animal model of autism by prenatal exposure to VPA was developed and validated by the reproducibility of behavioral, molecular and morphological changes observed in ASD individuals. It also includes alterations in redox, immune and inflammatory systems. We previously showed that a prenatal subchronic treatment of pregnant rats with the antioxidant and anti-inflammatory compound resveratrol (RSV), was able to preven important sensorial deficits induced by VPA in male offspring rats.

Objectives: The aim of the study was to perform a quantitative and organizational analysis of the effects of RSV and VPA on parvalbumin-positive GABAergic interneurons in sensory processing related regions – Primary Somatosensory Area and Amygdala Region.

Methods: Mating was undertaken overnight and confirmed in the following morning by the presence of spermatozoa in vaginal smears. Females received a single intraperitoneal injection of 600 mg/kg VPA or physiological saline on Embryonic day 12.5 (E12.5). For the RSV treatment females received daily subcutaneous injections of 3.6 mg/kg of RSV solution or the correspondent volume of DMSO from E6.5-E18.5. Experimental groups: Control, RSV, VPA and RSV+VPA. At 30 days-old, male rats were perfused with PF 4%, followed by brain dissection. The tissue was sliced in cryostat at -20ºC. Specific regions of *interest were* defined *using* Paxinos atlas. Immunofluorescence labelling: DAPI, Anti-NeuN and Anti-Parvalbumin (PV). The images were obtained by confocal microscopy and processed in ImageJ software with Cell Counter plug-in. Statistical analysis realized in GraphPad Prism 5 software, using one-way ANOVA test followed by Bonferroni's poshoc and considering $p<0.05$ as significant.

Results: In Primary Somatosensory Area, VPA group exhibitedlaminar disorganization, associated to changes in PV^+-neurons positioning, increasing in layer IV-V and decreasing in layer II-III. The prenatal administration of RSV not only promoted cortical reorganization at laminar and columnar level, but also prevented all alterations in layer II-III and IV-V induced by VPA. Moreover, considering total layers, no changes were observed in the amounts and density of PV^+-neurons, suggesting a possible alteration in the migration of these interneurons between the cortical layers. In Amygdala Region, only the density of PV+-neurons were significant reduced in VPA group and RSV was able to prevent this alteration.

Conclusions: These data demonstrates for the first time not only alterations at a cellular level with expressive consequences in the excitatory/inhibitory balance, but also the neuroprotective effect of RSV. Further studies will focus on the mechanisms involved in the RSV-preventive effects.

12 **107.012** Role for Striatal Glutaminergic Signaling in Decreased Risk Assessment in Autism Mouse Models

E. Elliott[1]*, S. Shifman*[2]*, E. Reuveni*[3]*,* ***O. Oron***[3] *and S. Shohat*[2]*, (1)Bar Ilan University, safed, Israel, (2)The Hebrew University of Jerusalem, Jerusalem, Israel, (3)Bar Ilan University, Safed, Israel*

Background:

The genetic etiology of Autism Spectrum Disorder (ASD) is composed of hundreds of genes, and it is expected that these genes affect common molecular mechanisms responsible for ASD-related behavior. In addition to the core autism phenotypes, individuals diagnosed with ASD often display anxiety and impulsivity However, the molecular drivers of these behaviors are unknown.

Objectives:

Using multiple genetic mouse models of ASD, we aimed to determine the relationship between anxiety and impulsivity, and to determine the molecular mechanisms responsible for these behaviors.

Methods:

We performed locomotion, anxiety-related and risk-assessment (RA) behavioral and molecular experimentation on four mouse models of ASD: Shank3 KO, CNTNAP2 KO, Chr16p11.2del, and BTBR mice. We performed Open Field (OF), Dark Light (DL), and Elevated Plus Maze (EPM). We extracted RNA from the striatum of all four mouse models, and their controls, and performed whole throughput RNA sequencing (RNA-seq) on all samples. We then performed Weighted Gene Coexpression Network Analysis (WGCNA) on the RNA-seq data, and correlated co-expressed genes to the behavior of the knockout animals. We further analyzed the WGCNA data to locate hubs of gene products that could be used as potential therapeutic targets. Finally, we performed *in-vivo* pharmacological intervention to target these hubs, and affect behavior in the mic models.

Results:

In behavioral experiments, the CNTNAP2 KO, Shank3 KO and Chr16del models displayed reduced anxiety-like behavior, which correlates with reduced risk-assessing behavior in the EPM and DL test. In the OF, all four mouse models expressed locomotion deficits. The WGCNA analysis of the striatal transcriptome revealed one distinct module of co-expressed genes that had a significant correlation with the risk-assessment behavior both in the EPM and DL, and subsequent PPI analysis of this genetic module revealed a cluster of hubs dominated by Glur4 and Glur5 glutamate receptors. Western blot analysis performed on the synaptosomes of the Shank3 KO mouse model's striatum revealed a significantly reduction of Glur4. We therefore acutely injected the AMPA and Kainate antagonist NBQX into the striatum of C57 and Shank3 KO animals via cannulas. The C57 mice expressed reduced Anxiety-like and risk assessment behavior both in the EPM and DL, while no changes were observed in the OF. Interestingly, the Shank3 KO mice treated with NBQX showed additional decrease in anxiety-like and RA behavior in the EPM, and reduced RA behavior in the DL test and no changes in the OF. These results validate our bioinformatic analysis.

Conclusions:

Our study has determined that there is significantly decreased risk assessment in multiple autism mouse models. Furthermore, the molecular and pharmacological data implicate striatal glutaminergic-signalling as a potential molecular driver of decreased risk assessment. These results suggest a mechanism driving increased impulsivity and decreased awareness of risk in individuals diagnosed with ASD.

13 **107.013** Role of a Circadian-Relevant Gene, NR1D1, in the Brain Development: Possible Involvement in the Pathophysiology of Autism Spectrum Disorders

K. I. Nagata[1], *M. Mizuno*[2], *M. Goto*[3], *H. Tabata*[2] *and T. Yamagata*[3], *(1)Institute for Developmental Research, Aichi Human Service Center, Kasugai, Japan, (2)Institute for Developmental Research, Aichi Human Service Center, Kasugai, Kasugai, Japan, (3)Jichi Medical University, Shimotsuke, Japan*

Background: In our previous study, we screened autism spectrum disorder (ASD) patients with and without sleep disorders for mutations in the coding regions of circadian-relevant genes, and detected mutations in several clock genes including *NR1D1*. Here, we further screened ASD patients for *NR1D1* mutations and identified three novel mutations including a *de novo* heterozygous c.1499G>A (p.R500H).
Objectives: We analyzed the role of Nr1d1 in the development of mouse cerebral cortex.

Methods: We examined the pathophysiological significance of Nr1d1 by the acute knockdown or mutant expression in mouse brain with *in utero* electroporation.

Results: Acute knockdown of mouse Nr1d1 with *in utero* electroporation caused abnormal positioning of cortical neurons during corticogenesis. This aberrant phenotype was rescued by wild type Nr1d1 but not by the c.1499G>A mutant. Time-lapse imaging revealed characteristic abnormal migration phenotypes of Nr1d1-deficient cortical neurons. When Nr1d1 was knocked down, axon extension and dendritic arbor formation of cortical neurons were also suppressed while proliferation of neuronal progenitors and stem cells at the ventricular zone was not affected. Taken together, Nr1d1 was found to play a pivotal role in corticogenesis via regulation of excitatory neuron migration and synaptic network formation.

Conclusions: The results suggest that functional defects in NR1D1 may relate to ASD etiology and pathophysiology.

14 **107.014** The Effects of Maternal High Fat Diet on BTBR and B6 Offspring on Reversal Learning in the Water T-Maze.

K. K. Chadman[1] *and S. Ye*[2], *(1)New York State Institute for Basic Research, Staten Island, NY, (2)Center for Developmental Neuroscience, CUNY College of Staten Island, Staten Island, NY*

Background:

The etiology for most cases of autism spectrum disorder (ASD) is unknown at this time. There is strong evidence for the genetic role in ASD but environmental factors also have a modifying role. One potential environmental factor is the maternal diet during fetal development. Obesity before and during prenatal development increases the vulnerability of affective disorders including schizophrenia and ASD. Prenatal maternal obesity has been shown to be a risk factor for ASD and other developmental disabilities (Krakowiak et al. *Pediatrics* 2012;129;e1121).

Objectives:

The objective of these experiments was to determine if a maternal high fat diet affected reversal learning in C57BL/6J and BTBR T+ ^{tf} Itpr/J (BTBR) offspring.

Methods:

Female C57BL/6J and BTBR mice were placed on either a high fat diet (60 kcal% fat D12492, Research Diets Inc, NJ) or a control diet (45 kcal% fat D12451, Research Diets Inc, NJ) for 2 weeks and then mated. The dams and pups remained on the diet through weaning and then were placed on regular mouse chow. One male and female pup per litter were tested as adults in the water T-maze and reversal test. Training trials for acquisition began with 10 trials per day for 3-days and were followed by reversal training (where the escape platform was moved to the opposite arm) for 2 days of 10 trials. The first arm entered was noted for each trial.

Results: All of the mice learned at the same rate suggesting that acquisition learning was not affected by the high fat diet or mouse strain. However, there were differences among the groups of mice during reversal learning. The BTBR mice prenatally exposed to the high fat diet learned the reversed arm more slowly compared to the BTBR pups from the dams on the control diet, as shown by the increased number of errors during reversal training. The C57BL/6J offspring were not affected by the maternal diet during reversal training as there were no differences in the number of errors between the high fat diet offspring and the control diet offspring.

Conclusions:

The results from the water T-maze reversal trials indicate that the C57BL/6J offspring demonstrated no changes in learning when exposed to the high fat diet during gestation. The offspring from the mouse model of ASD exposed to the maternal high fat diet showed no impairments in acquiring the water T-maze task, but were impaired in reversal learning. This suggests that the mouse model of ASD is more susceptible to environmental stressors affecting reversal learning, one of the core symptoms of ASD.

15 **107.015** The Study of the Relationship between the Copy Number Variants of HUWE1 Gene and Autism Spectrum Disorder

***J. Xie**, The ministry of science and education, Chengdu Third People's Hospital, chengdu, China*

Background:

Autism spectrum disorder (ASD) is a kind of generalized neurodevelopmental disorder. Except the environment factors, the genetic causes also have a vital role in ASD.Although numerous ASD genes have been discovered during the last two decades, for many of them the molecular mechanism via which they contribute to the ASD phenotype remains unknown. In our study, we found that the ASD patients have the elevated copy number of *HUWE1* gene suggesting that the increased gene dosage of *HUWE1* was associated with ASD. In addition, the animal model experiment showed that over-expression HUWE1 could increase the expression of Lef1, ccnd1 and c-myc, which suggested that HUWE1 could regulate the development of the nervous system through the Wnt pathway. Taken together, Our study provides the potential of HUWE1 copy number variants in occurrence of ASD via HUWE1-mediated Wnt signaling.

Objectives:

This study focused on whether the copy number variants of *HUWE1* gene is associated with autism spectrum disorder (ASD).

Methods:

We investigated the copy number of *HUWE1* gene of 67 ASD patients and 74 normal controls by RT-PCR. Zebrafish embryos were injected with synthesis RNA of HECT structure domain with 4 gradients (50ng/ul,40 ng/ul,30ng/ul, 20ng/ul). RT-PCR was used to detected the different expression of Lef1, ccnd1 and c-myc of zebrafish embryos in experimental group and control group.

Results:

We detected the 6 (6/67) persons with elevated copy number of *HUWE1* gene in the patients and all the controls with the normal copy number ($X^2 = 6.921$, $P < 0.05$). The result of RNA injected zebrafish embryos was that the development of the nervous system of 123 cases (56%) were affected in the experimental group and 10 cases (12%) had the abnormal development of the nervous system in the control group ($X^2 = 48.128$, $P < 0.01$). The expression of Lef1, ccnd1 and c-myc in RNA injected zebrafish embryos was significantly higher than the control ($p<0.05$).

Conclusions:

The increased of the copy number of *HUWE1* gene may be a pathogenic factor in ASD.The over-expression of HUWE1 could affect the development of the nervous system of zebrafish embryos by increasing the expression of the relative proteins of wnt pathway. The findings strongly support that the copy number variants of *HUWE1* gene has the potential to be a novel detecting target in the etiological diagnosis of ASD.

16 **107.016** Towards Preclinical Validation of Arbaclofen (R-baclofen) Treatment for 16p11.2 Deletion Syndrome

***A. H. Luo Clayton**[1], B. B. Gundersen[1], W. T. O'Brien[2], T. Abel[3], T. Tsukahara[4], S. R. Datta[4], M. D. Schaffler[5], M. Schultz[5], J. C. Crawley[5], S. Martin Lorenzo[6], V. Nalesso[6] and Y. Herault[6], (1)Simons Foundation, New York, NY, (2)University of Pennsylvania, Philadelphia, PA, (3)University of Iowa, Iowa City, IA, (4)Harvard Medical School, Boston, MA, (5)University of California, Sacramento, CA, (6)Institut de Genetique et de Biologie Moleculaire et Cellulaire (CERBM GIE), Illkirch, France*

Background: Human chromosome 16p11.2 microdeletion is one of the most common copy number variants that confers risk for autism spectrum disorder and other related neurodevelopmental disorders. Animal studies suggest that 16p11.2 deletion may share pathophysiology with Fragile X syndrome (Tian et al., 2015). Data from previous clinical trials suggest that the GABA-B receptor agonist, arbaclofen, may improve symptomatology in some individuals with Fragile X syndrome and idiopathic autism, although the trials themselves did not find statistical significance on their primary endpoints. Taken together, these data raise the intriguing possibility that arbaclofen may be beneficial for 16p11.2 deletion syndrome. Indeed, a recent mouse study supports this possibility (Stoppel et al., 2017). However, the justification for pursuing arbaclofen as a rational therapy for 16p11.2 deletion must be supported by robust preclinical evidence. Concerted efforts to validate early scientific findings may be crucial in addressing the recent paucity of success in translational research (Arrowsmith, 2011).

Objectives: To rigorously determine the robustness and reproducibility of arbaclofen's normalizing effects on behavior in 16p11.2 deletion mouse models.

Methods: Four academic labs and one Contract Research Organization are working as a consortium to rigorously assess the behavioral effects of chronic arbaclofen treatment in mouse models of 16p11.2 deletion. Three different mouse models of 16p11.2 deletion on three different background strains and their wildtype controls were treated for at least 12 days with one of three doses of arbaclofen in their drinking water (0.25, 0.5, 1.0 mg/ml). Using harmonized protocols, mice were tested on Open Field activity, Novel Object Recognition, Object Location Memory, Contextual Fear Conditioning and Accelerating Rotarod. Open Field activity was additionally analyzed using 3D imaging and a novel, machine-learning based algorithm that parcellates behavior to sub-second resolution (Wiltschko et al., 2015). Individual performance on these tasks will be correlated with individual home-cage monitoring measures, as well as high-performance liquid chromatography-tandem mass spectroscopy (HPLC-MS/MS) analysis of arbaclofen levels in each brain.

Results: Approximately 180 of the 360 expected animals have been tested behaviorally and for brain penetration levels of arbaclofen. Data collection is ongoing and will be completed in 2018. In the spirit of data transparency, study results will be broadly disseminated regardless of whether they support or refute the initial hypotheses.

Conclusions: Our consortium offers an example of how to develop and execute a rigorous test of preclinical efficacy of a potential pharmacological therapy for a genetic syndrome that predisposes to autism and related disorders.

Poster Session
108 - Communication and Language
11:30 AM - 1:30 PM - Hall Grote Zaal

17 **108.017** A Longitudinal, Multi-Method Analysis of Pragmatic Language in ASD and Related Neurodevelopmental Disorders

***M. Lee**[1], G. E. Martin[2], A. Goodkind[1], N. Maltman[1], L. Bush[3], K. Bicknell[1] and M. Losh[4], (1)Northwestern University, Evanston, IL, (2)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (3)Northwestern Feinberg School of Medicine, Chicago, IL, (4)Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: Pragmatic (i.e., social) language impairments are universally observed in ASD. Qualitatively similar pragmatic language impairments have also been observed in fragile X syndrome (FXS), the most common inherited cause of intellectual disability and the monogenic disorder most frequently associated with ASD. Careful characterization of pragmatic language in both groups has important implications for understanding the role of *FMR1* (the gene that causes FXS) in autism symptomatology, and potential targeted interventions. An important question concerns how pragmatic skills, and underlying abilities, in each group present across different contexts and over development. Using both detailed hand coding and computational linguistic analyses, this longitudinal study aims to comprehensively characterize pragmatic language development across four different language contexts in males with idiopathic ASD (ASD-O), FXS with and without co-morbid ASD (FXS-ASD, FXS-O), Down syndrome (DS) and typical development (TD).
Objectives: 1) Compare pragmatic language profiles and trajectories of pragmatic development in ASD-O and related disorders across multiple language contexts varying in social demand. 2) Assess the utility of computational linguistic tools for identifying ASD-related language impairments.

Methods: This longitudinal study assessed school age males with ASD-O (n=43), FXS-ASD (n=57), FXS-O (n=13), DS (n=22) and younger TD males (n=24) at up to three time points annually. Participants completed a comprehensive battery assessing cognition, structural language, and theory of mind. Pragmatic assessments included 1) parent questionnaire (Children's Communication Checklist-2nd Edition), 2) a standardized measure (CASL-Pragmatic Judgment Subscale), 3) hand-coding of a structured narrative task, and 4) ratings of conversational behaviors during the Autism Diagnostic Observation Schedule using the Pragmatic Rating Scale-School Age (Landa, 2011). Computational linguistic analyses were applied to narrative and conversational samples using vector semantics to measure coherence and reciprocity.

Results: Males with ASD-O showed deficits in pragmatic language across all contexts that were stable across time points (ps < .05). Within the conversational context, males with FXS-ASD also demonstrated a similar quantity and quality of pragmatic language difficulties to males with ASD-O. Notably, both ASD groups showed significantly greater impairment in the conversational context relative to the structured narrative (p = .004). Computational measures differentiated clinical groups during conversation (ps < .03), and were related to ratings of pragmatic competence in both ASD groups (rs > .4). Assessment context drew on different skills across groups, with standardized measures and narrative quality more strongly related to mental age and structural language (rs > .35), whereas conversational difficulties were not significantly correlated with mental age or structural language in the ASD groups (rs < .27).

Conclusions: Groups showed unique profiles of strengths and weaknesses across different language contexts, with the ASD groups showing greatest difficulties in less structured conversation. Computational approaches appear sensitive to language differences observed in ASD, and may guide the development of efficient, quantitative, objective measures of social communication. Observed overlap both in severity and quality of pragmatic violations in males with ASD-O and FXS-ASD across development suggests specific shared pragmatic skills that may relate to variation in the *FMR1* gene.

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108.018 A Mixed Models Approach to Analyzing Large Cohorts of Natural Conversational Data from Individuals with ASD

M. Cola[1]*, E. F. Ferguson*[2]*, L. Bateman*[2]*, S. Uh*[1]*, S. Plate*[1]*, Z. M. Dravis*[1]*, A. Pomykacz*[3]*, K. Bassanello*[1]*, A. Zoltowski*[4]*, J. D. Herrington*[5]*, K. Bartley*[5]*, E. S. Kim*[1]*, A. de Marchena*[6]*, J. Pandey*[1]*, R. T. Schultz*[1] *and J. Parish-Morris*[1]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)The Center for Autism Research/CHOP, Philadelphia, PA, (3)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (4)Vanderbilt University, Nashville, TN, (5)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of the Sciences, Philadelphia, PA*

Background: Natural, unstructured conversation represents a significant challenge for individuals with autism spectrum disorder (ASD), but relatively little is known about how speech and language unfold in an uncontrolled context; less yet is known about the myriad interacting factors that likely influence dynamic conversation in ASD, such as age, sex, and cognitive ability. Until recently, most studies lacked sufficient power to assess all of these contributors in a single cohort. Here, we report on a growing corpus of natural conversations between individuals with and without ASD and naïve confederates. This corpus will ultimately provide the field with a multi-faceted view of conversational interactions in typical development (TD) and in individuals with ASD, and lay the foundation for new metrics to assess social interaction that allow us to track change across ages, sexes, and ability levels.
Objectives: Use mixed effects models to assess the contributions of diagnostic status, age, IQ, and sex to speech/language features produced during naturalistic conversations with naïve confederates.

Methods: Sixty-nine individuals aged 5-59 years with ASD (N=48, 15 female, mean age=14.93y, mean IQ = 96) and TD (N=21, 15 female, mean age=21.89y, mean IQ=107) participated in a naturalistic ~5 minute "get to know you" conversation with one of 13 undergraduate confederates (10 female). Language was transcribed and time-aligned using XTrans (LDC). Average speaking rate, words per minute, word length, response latency, and turn length were calculated. LIWC was used to calculate social category words (Tausczik & Pennebaker, 2010). The contributions of diagnostic status (ASD, TD), chronological age, sex (M, F), and full-scale IQ to speech and language features were assessed using linear mixed effects models, with confederate ID included as a random effect to account for individual variability in naïve interlocutors.

Results: Linear mixed models revealed that participants spoke faster as they got older (t=3.52, p<.001). Older participants produced more words (t=5.39, p<.001), as did individuals with higher IQ estimates (t=3.05, p=.003). Participants with ASD used slightly longer words than TD participants (t=2.12, p=.04). Older participants had longer response latencies (t=2.30, p=.02), produced more overlapping speech (t=2.40, p=.03), and took longer turns (t=4.54, p<.001). Participants with higher IQ estimates also took longer turns (t=3.48, p<.001). Social topics were discussed more often by older participants (t=2.42, p=.02) and by female participants (t=2.40, p=.02).

Conclusions: A multi-faceted understanding of natural conversational interactions in ASD will inform the next generation of highly granular intervention response metrics. We anticipate adding an additional 20 participants to this cohort by May, 2018, as well as including additional speech/language metrics and an analysis of confederate speech.

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108.019 A Systematic Review of Communication Interventions for Minimally Verbal Children with Autism Spectrum Disorder

A. Brignell[1]*, K. V. Chenausky*[2]*, H. Song*[3] *and A. T. Morgan*[4]*, (1)Audiology and Speech Pathology, University of Melbourne, Carlton, Australia, (2)Neurology, Beth Israel Deaconess Medical Center, Boston, MA, (3)Centre of Public Health Sciences, University of Iceland, Reykjavik, Iceland, (4)Murdoch Children's Research Institute and University of Melbourne, Melbourne, Australia*

Background: Language difficulties commonly co-occur with autism spectrum disorders (ASD) and it is estimated 25-30% of children with ASD fail to develop functional language, or are minimally verbal. The ability to communicate effectively is an essential life skill and difficulties communicating can have a range of adverse sequelae including poorer academic achievement, behaviour difficulties and reduced quality of life. Historically, most studies have investigated communication interventions for verbal children with ASD. We cannot assume the same interventions will work for minimally verbal children. To date, there has been no systematic review to determine the most effective intervention for minimally verbal children.

Objectives: To evaluate the effectiveness of communication interventions for children with ASD who are minimally verbal.

Methods: Fourteen databases were searched to identify relevant studies. Inclusion criteria were: children with ASD < 12 years of age who were minimally verbal (less than 30 functional words/unable to use speech alone to communicate); diagnosed using standard diagnostic assessments and/or criteria (e.g. Diagnostic Statistical Manual for Mental Disorders or International Classification of Diseases) and cognitive level > 12 months. Interventions included randomised controlled trials (RCTs) that used communication-focused interventions and aimed to improve spoken communication or non-verbal communication. Primary outcomes were spoken communication (e.g. direct assessments, parent-completed tools, language samples) and non-verbal communication/augmentative communication (e.g. number of key word signs, number of initiations on an augmentative communication device). Risk of bias of included studies was assessed along with the overall quality of the body of evidence.

Results: Of 5233 studies identified, nine were randomised trials that focused on communication interventions for children with ASD who were minimally verbal. Seven of these compared 2 different interventions but only 2 studies with 153 participants compared an intervention to a control group and thereby met inclusion criteria. One study investigated a Picture Exchange Communication System (PECS) intervention administered by school teachers and the other a parent-mediated Focused Playtime Intervention (FPI). Age at baseline ranged from 4 to 11 years. Outcomes were standardised language scores and the PECS study also included frequency of initiations, speech and PECS use. Children enrolled in the PECS intervention were significantly more likely to use verbal initiations and PECS symbols immediately after intervention, however gains were not maintained 10 months later. PECS did not improve frequency of speech or language ability. There was no significant treatment effect for the FPI on expressive language, however, baseline expressive language (<11.3 months age equivalent) moderated a significant medium-large treatment effect. Both studies had high or unclear risk of bias in at least 4/7 risk of bias categories. The overall quality of the evidence was rated poor.

Conclusions: Across all outcomes, data are insufficient to show whether communication interventions (specifically, PECS and FPI) are effective in increasing verbal and non-verbal communication in minimally verbal children with ASD. Future studies that compare two treatments and include a control group will allow us to better understand treatment effects in the context of spontaneous maturation and will allow further comparison of different treatments and investigation of moderators.

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108.020 Active Listening Strategy Differences Associated with Autism during a Referential Communication Task

J. Beriont[1], *M. Conca*[2], *A. de Marchena*[3], *A. Bagdasarov*[4], *Z. M. Dravis*[5], *L. Bateman*[6], *E. F. Ferguson*[6], *B. B. Maddox*[7], *A. A. Pallathra*[8], *N. Minyanou*[5], *A. Pomykacz*[9], *K. Bartley*[10], *E. S. Brodkin*[11], *J. Pandey*[5], *J. Parish-Morris*[5], *R. T. Schultz*[5] *and E. S. Kim*[5], *(1)Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA, (2)Center for Autism Research, Philadelphia, PA, (3)University of the Sciences, Philadelphia, PA, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (6)The Center for Autism Research/CHOP, Philadelphia, PA, (7)University of Pennsylvania, Philadelphia, PA, (8)Department of Psychiatry, Catholic University of America, Washington, DC, (9)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (10)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (11)Department of Psychiatry, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA*

Background: An active listener's comments and questions can guide a speaker to provide more useful information. Active listening behaviors are important pragmatic language skills—a behavioral domain of concern in autism—with specific deficits observed in conversational repair, contingent response, and requesting information, among others (reviewed in Simmons, Paul, & Volkmar, 2014; Tager-Flusberg et al, 2005).

Objectives: The present study compares the types of comments and questions adults with ASD and typically developing controls (TDC) use to actively manage the information provided by interlocutors, while playing a listening role, in a goal-oriented dyadic referential communication paradigm.

Methods: Adults with ASD (n=12) and age-, gender-, and IQ-matched controls with typical development (TDC; n=13) completed a collaborative, dyadic referential communication task designed to elicit spontaneous back-and-forth conversation in a controlled setting. Each participant viewed a computer touchscreen displaying a blank 2x4 grid, as well as eight abstract figures scattered throughout the screen. A confederate sat opposite the participant, viewing the same eight figures in a particular arrangement within the 2x4 grid. Participant-confederate pairs were tasked with communicating so that the participant (primarily in a listening role) could move and arrange his or her figures to match the arrangement on the confederate's (primarily in a speaking role) screen. Dyads collaborated to arrange a single set of eight figures into 5 immediately consecutive, unique target arrangements (trials). Speech was transcribed, and participants' utterances were classified as managing discourse (DM), requesting clarification (RC), a non-DM non-request (NR), or as serving a combination of these. Requests for clarification were further subcategorized into 6 mutually exclusive types. These ranged from highly informative, such as requesting confirmation of the identity of the figure currently under discussion, using novel descriptors (confirmation of new, or CN, e.g., "The one that's like a barbell?"); to extremely vague, such as open-ended requests for elaboration (E, e.g., "Say more?").

Results: Listeners in both groups spoke more during the first (p<.01) than during subsequent trials. Given that minimal amounts of each type of listener utterances occurred after the first trial, further analyses focus only on the first trial. There were main effects of diagnosis (p<.005) and utterance type (p<.001), and a marginal interaction effect between the two (p=.057), driven by more non-requests (p=.036) and discourse management utterances (p=.024) by the ASD than TDC group. Non-request and discourse management frequency correlated directly with ADOS calibrated severity score (CSS; r=.44, r=.60, respectively). Listeners in both groups varied the types of requests for clarification they produced (p<.01), with TDCs requesting confirmation of novel terms more frequently than participants with ASD (p=.050; see figure), a behavior which correlated inversely with ADOS CSS (r=-.47).

Conclusions: Adult listeners in both groups actively listened by producing comments and questions to manage the information they received from an interlocutor, during a dyadic referential communication task. Use of discourse management and non-request utterances was associated with greater ASD severity, while arguably the most actively informative form of feedback to the speaker—introduction of novel or alternative descriptors—was related with lower ASD symptom severity.

21 **108.021** An Investigation into Executive Function Differences between Autistic and Non-Autistic Monolinguals and Multilinguals

S. Crockford[1]*, A. Remington*[2] *and L. Kenny*[3]*, (1)University of Cambridge, Cambridge, United Kingdom, (2)UCL Centre for Research in Autism and Education, London, United Kingdom, (3)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland*

Background: There has been extensive research to show that multilinguals (those who speak more than one language) enjoy cognitive benefits, such as improved executive function, as a result of their fluency in more than one language (Bialystok, 2010). In contrast, autistic individuals have been documented as having poorer executive function abilities than their neurotypical peers (Hill, 2004). However, relatively little is known about how being multilingual may influence these abilities, The large prevalence of multilingual speakers worldwide and the assumption that autism is a universal condition (i.e. Baxter et al, 2015), would suggest that a large number of multilingual autistic individuals are currently being ignored in research. In addition, families are often advised against raising autistic children as multilinguals, although there is no evidence to support the notion that multilingualism is detrimental to autistic individuals (Jegatheesan et al, 2010; Kremer-Sadlik et al, 2005). This study therefore hopes to highlight that multilingualism is present, and not detrimental to those on the autistic spectrum.

Objectives: This study aimed to examine whether there were differences in executive function performance between autistic multilingual adolescents, autistic monolingual adolescents, and their neurotypical multilingual and monolingual peers.

Methods:The study involved 66 participants, aged 12 to 19, who were administered flanker and set-shifting tasks as part of a battery of executive function measures (NIH Examiner battery, Kramer et al, 2014) and a questionnaire regarding their level of multilingualism. The data from the questionnaire allowed for the creation of four groups of participants, monolingual autistics (N = 18), multilingual autistics (N = 8), monolingual neurotypicals (N = 17) and multilingual neurotypicals (N = 23). Groups were cognitively matched based on their performance on a measure of verbal and non verbal intelligence (from the WASI II, Weshler, 2011) Ethical approval was received from the UCL Institute of Education Ethics Committee.

Results: Mean differences analysis on the two tasks of executive function revealed that on the set-shifting measure, multilingual neurotypical peers performed significantly better than monolingual autistic adolescents ($p = 0.009$). However, there we no significant differences between the other groups of participants. On the other executive function measure, a flanker task, no significant differences were found. Finally, two regression models measuring the effect of multilingualism and autism on the two executive function scores showed a small, but significant positive effect for set-shifting ($r^2 = 0.113$, $p = 0.023$) but not for the flanker task ($r^2 = 0.088$, $p = 0.055$), though this was approaching significance.

Conclusions: The findings from this study support the notion the multilingualism is not detrimental to autism. They also extend further to suggest there may be some relationship between multilingualism and mental flexibility for both autistic and non-autistic individuals. Further research into this relationship will highlight the full extent of multilingual cognitive benefits autistic individuals may or may not receive, in comparison with their neurotypical peers. Finally, it is hoped that these findings will help inform the choices parents and professionals make when raising and educating a multilingual autistic child.

22 **108.022** Assuming Ability: Synthesis of Methods Capturing First Person Perspectives of Children and Youth with Disabilities

R. Tesfaye[1]*, A. Yusuf*[2]*, V. Courchesne*[3]*, T. Savion-Lemieux*[4]*, I. Singh*[5]*, K. Shikako-Thomas*[6]*, P. Szatmari*[7] *and M. Elsabbagh*[8]*, (1)Neuroscience, McGill University, Montreal, QC, Canada, (2)Psychiatry, McGill University, Montreal, QC, Canada, (3)McGill University, Montreal, QC, Canada, (4)Research Institute-McGill University Health Centre, Montreal, QC, Canada, (5)Department of Psychiatry, Oxford University, Oxford, United Kingdom, (6)School of Physical and Occupational Therapy, McGill University, Montreal, QC, Canada, (7)Centre for Addiction and Mental Health, Toronto, ON, Canada, (8)McGill University, Montreal, PQ, Canada*

Background: The United Nations Convention for the Rights of the Child states children have the right to express their own views in all matters that affect them. A large majority of research regarding children with autism has not focused on their first person perspectives. The appropriate capture of first person perspectives of youth with disabilities improves research quality and informs practice, while empowering youth participants themselves. Due to the diversity of communication and cognitive abilities in autism, different methods need to be employed to ensure inclusion. However, existing studies provide limited insight into what methods and approaches are best suited to eliciting their voices. Methods already applied with other disability groups may be suitable for youth with autism.

Objectives: Our main objective was to conduct a synthesis of research methodologies previously used to obtain the first person perspective of youth with various disabilities. Another objective was to present the synthesis results to a group of parents who have children with ASD. This stakeholder validation was used to build on the methods identified in literature. Insights from this review will be used to inform a new study entitled *ASD Voices*, which aims to capture the lived experiences of youth as they transition from adolescents to adulthood.

Methods: Searches for our scoping review were conducted on the *PubMed, Academic Search Complete, and Web of Science* databases (Aug 2017) for relevant articles within the past 15 years. Empirical articles meeting the inclusion criteria: 1) communicating the lived experience of youth with disabilities, from a first person perspective 2) at least one child 18 years of age or under; 3) no single case studies, were included. Thematic analysis was used to extract themes from our stakeholder validation comprised of a group of four parents.

Results: 284 articles met the inclusion criteria. We identified six distinct primary methods (questionnaires, interviews, group discussion, narratives, diaries and art) expressed through four communication modalities (language, writing, images, and augmentative and alternative communication(AAC)). The most common method of communication was a verbal semi-structured interview. 63 studies included some youth with communication/language impairments. Six themes, including eleven sub-themes, were identified from our stakeholder validation.

Conclusions: Based on our findings, we present a novel methodological framework to capture the perspectives of youth with various communication and cognitive abilities, while highlighting family, youth and expert contributions. Our synthesis is line with previous research, underlining the underrepresentation of youth with cognitive and communication impairments. The authors conclude that existing methods applied with various disability groups can be adapted for a range of youth with ASD. A stakeholder consultation with parents confirmed barriers that may be encountered during this type of participant engagement and also provided concrete recommendations on how to best conduct first person research with youth with autism. Future research should consider increasing transparency with methodological struggles to inform other studies. Using these findings, we will now tailor methodologies and implement them for feedback with stakeholder youth in our next pilot phase of *ASD Voices*, to test the efficacy of our results.

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108.023 Atypical Influence of Visible Speech in Children with ASD

J. Irwin[1,2]*, T. Avery*[1]*, J. Turcios*[1]*, B. Cook*[3]*, L. Brancazio*[1,2]*, J. McPartland*[4] *and N. Landi*[1,5]*, (1)LEARN Center, Haskins Laboratories, New Haven, CT, (2)Psychology, Southern Connecticut State University, New Haven, CT, (3)Communication Disorders, Southern Connecticut State University, New Haven, CT, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Psychology, University of Connecticut, Storrs, CT*

Background: In face-to-face conversation, when a speaker talks, the outcome of their speech *and* seen (visual). In some recent research, children with an autism spectrum disorder (ASD) have been reported to be less sensitive to the visible consequences of speech, even when gazing at the speaker's face. However, the underlying mechanisms of deficits in audiovisual speech perception are still unknown.

Objectives: We employed a novel visual phonemic restoration paradigm to assess neural signatures (using event related potentials; ERPs) of audiovisual processing in typically developing children and in children with ASD.

Methods: Participants were 30 monolingual American English-speaking children (15 children with ASD= 12 males and 3 females and 15 neurotypical children = 5 males and 10 females; age range 6.40 to 14.20, mean age = 10.28 years, SD = 1.98 years). Two types of stimuli were alternately presented with video of a speaker saying the consonant-vowel syllable /ba/, while EEG was continuously recorded; 1) an auditory consonant-vowel syllable /ba/ or 2) a syllable in which the auditory cues for the consonant was substantially weakened, creating a stimulus which is more like /a/. In this paradigm, a visual /ba/ should cause the auditory /a/ to be perceived as /ba/ (a visual phonemic restoration) and cause an attenuated ERP discrimination response (measured with the mismatch negativity; MMN).

Results: Typically developing (TD) children exhibited an attenuated discrimination response (MMN) for as predicted, demonstrating a visible influence of seen on heard speech, however, children with ASD showed a large discrimination response, suggesting reduced influence of visual speech, this was evidenced as an interaction between group and the size of the MMN effect ($F(1, 29) = 5.862$, $p = 0.022$, $\eta^2 = 0.132$).

Conclusions: Typically developing children exhibited an attenuated response, demonstrating a visible influence of seen on heard speech. In contrast, children with ASD showed a large /ba/, /a/ discrimination response suggesting reduced influence of visual speech. These findings may implicate impaired integration of auditory and visual speech signals in ASD.

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108.024 Categories of Word Comprehension in Toddlers with ASD or Typical Development: An Extension of Beckage, Smith, and Hills (2011)

S. Kover[1]*, D. A. Fein*[2] *and* ***L. R. Naigles***[2]*, (1)University of Washington, Seattle, WA, (2)Psychological Sciences, University of Connecticut, Storrs, CT*

Background:

In concert with social and environmental influences, vocabulary development and outcomes hinge on the contents of a child's lexicon—what has already been learned influences what is learned next (Perry & Samuelson, 2011; Samuelson & Smith, 1999; Stokes, 2010). In particular, semantic relatedness of children's lexicons predicts learning, with delayed learners showing less relatedness among words (Beckage, Smith, & Hills, 2010). In typical development, a lure-of-the-associates model suggests that new words will be semantically related to previously acquired words (Hills et al., 2010). Beckage et al. (2011) proposed that, in contrast to that pattern, delayed learners preferentially acquire "oddballs": words not semantically related to known words. We extend this hypothesis to ASD, in comparison to typically developing (TD) children matched on receptive vocabulary.

Objectives:

We characterize the semantic relatedness of vocabulary items acquired by children with ASD or TD with two questions: (1) Despite similar vocabulary size, do toddlers with ASD or TD acquire words with different category patterns? and (2) Are toddlers with ASD more likely than TD toddlers to understand "oddballs" (i.e., words isolated within categories)?

Methods:

Toddlers with ASD (n=26; M age=32 months) and TD toddlers (n=26; M age=19 months) were matched pairwise on parent-reported receptive vocabulary (MacArthur-Bates Communicative Development Inventories [CDI]-Words&Gestures) within a margin of 10 words: M=111, SD=72/75, respectively. Groups did not differ on number of words understood, p=.991.

Words understood were tallied according to the 18 CDI categories (e.g., Clothing, Furniture) and calculated as proportions of children's receptive vocabularies. Extending Beckage et al., oddballs were identified as isolated words understood within a category in which at least one word was understood: 1-2 words understood were oddballs; more than 2 words within a category were considered associative. For each category, we tested: (1) group differences in counts and proportions of words understood and (2) group differences in proportions of children whose words in a given category were oddballs.

Results:

(1) Relative to TD toddlers, toddlers with ASD understood fewer pronouns, $t(50)=2.21$, p=.031. Using proportions, toddlers with ASD produced more sound effects, but lower proportions of time (e.g., *day*), description (e.g., *big*), and pronoun words, $ts(50)>2.0$, $ps<.050$. See Figure 1.

(2) The proportion of children with oddball words differed between groups for two categories. Fewer children with ASD (2 of 24) than TD (10 of 24) had oddball clothing words, p=.017. More children with ASD (7 of 22) than TD (1 of 23) had oddball description words, p=.022. See Figure 2.

Conclusions:

The findings point to many similarities, but also some differences in the relatedness of words in the lexicons of children with ASD and TD. Further semantic differences may emerge over developmental time: young children with ASD show typical semantic processing (Ellis Weismer et al., 2016; Rescorla, 2013), yet semantics is an area of weakness later in childhood (Ellawadi et al., 2016; Norbury et al., 2010). The current study has implications for theories of lexical acquisition in ASD, including whether words with certain functions (e.g., adjectives), rather than semantic properties, are vulnerable to delay.

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108.025 Childhood Apraxia of Speech in Minimally Verbal Children with ASD

K. V. Chenausky[1,2]*, H. Tager-Flusberg*[3] *and G. Schlaug*[4]*, (1)Neurology, Beth Israel Deaconess Medical Center, Boston, MA, (2)Department of Neurology, Harvard Medical School, Boston, MA, (3)Psychological and Brain Sciences, Boston University, Boston, MA, (4)Beth Israel Deaconess Medical Center, Boston, MA*

Background:

Approximately 25% of children with autism spectrum disorder (ASD) remain minimally verbal (MV) past age 5 (Kasari etal. 2013). Many factors likely combine to limit spoken language acquisition in these children. One of them is hypothesized to be Childhood Apraxia of Speech (CAS; Shriberg et al. 2011a), a disorder of movement planning that results in imprecise, inconsistent, and unintelligible speech (ASHA 2007). CAS is estimated to affect approximately 1-2 children per thousand (Shriberg et al. 1997), but recent evidence suggests that it is over-represented in certain populations (Shriberg et al. 2011b, Fedorenko et al. 2015). Two main challenges confront researchers assessing the speech of children with MV ASD for signs of CAS: (1) These children produce very little speech, and (2) Consensus on the signs defining CAS is evolving (ASHA 2007).

Objectives:

We sought to estimate the prevalence of CAS in a group of 38 children with MV ASD. If CAS occurs at the same rate in children with MV ASD as in the general population, at most 1-2 would be expected to meet criteria for CAS.

Methods:

Video of 38 participants in a study comparing two spoken-language treatments (7 female, aged 3;5-10;8) was examined for signs of CAS. Treatment study inclusion criteria were: diagnosis of ASD, expressive vocabulary ≤20 words, no productive syntax, and the ability to repeat ≥2 phonemes. To address the first challenge, video of the participants after 25 treatment sessions was used. Each child produced the words “baby”, “cookie”, “daddy”, “mommy”, and “puppy” five times each. Signs of CAS were noted on each attempt, using the operational definitions from Iuzzini-Seigel et al. (2015). Children met criteria for CAS if they showed ≥5 signs from the list on any word. To address the second challenge, an exploratory factor analysis was performed to determine whether the factors underlying the observed signs of CAS grouped into three categories (ASHA 2017) or two (Shriberg et al. 2017).

Results:

37 of 38 children met criteria for CAS. Observed variables loaded onto two factors (“segmental” and “prosody”), consistent with the taxonomic domains in Shriberg et al. (2017).

Conclusions:

Preliminary results suggest that CAS is highly over-represented in MV ASD. However, these initial findings must be interpreted with caution because the inclusion criteria for the treatment study may have inadvertently selected for children with CAS, omitting (a) children with ASD who cannot consistently phonate on request, and (b) low-, but not minimally-verbal, children with ASD. Accordingly, we are in the process of replicating the study in a larger group of 78 MV and low-verbal children and teens with ASD (aged 4;4-19;6), using video from administration of the Kaufman Speech Praxis Test (Kaufman, 1994). Figures documenting reliable identification of signs of CAS in both groups by two independent judges, prevalence estimates for the replication group, and the results of a confirmatory factor analysis on the replication group will be presented along with the initial findings. Results will be interpreted in the context of phenotyping studies and treatment design for children with MV ASD.

26 **108.026** Behavioral Predictors of Improved Speech Output in Minimally Verbal Children with Autism

K. V. Chenausky[1], *A. Norton*[1], *H. Tager-Flusberg*[2] *and G. Schlaug*[3], *(1)Neurology, Beth Israel Deaconess Medical Center, Boston, MA, (2)Psychological and Brain Sciences, Boston University, Boston, MA, (3)Beth Israel Deaconess Medical Center, Boston, MA*

Background: Approximately 25% of children with autism spectrum disorder (ASD) remain minimally verbal (MV) past age 5 (Kasari etal. 2013). Less language is associated with challenging behaviors and poorer long-term outcomes (Venter et al. 1992, Howlin et al. 2004), but maladaptive behaviors decrease and long-term outcomes improve when children learn to communicate more successfully (Buschbacher et al. 2003). Thus, efforts to identify the factors predicting improvement in spoken language are increasingly important as we develop more effective treatments for these children.

Objectives: We wished to understand what factors predict the amount of improvement in % Syllables Approximately Correct after 25 sessions of an intonation-based spoken-language therapy in 38 children with MV ASD.

Methods: Participants were 38 children receiving one of two spoken-language treatments (7 female, aged 3;5-10;8). Treatments were Auditory Motor Mapping Training (AMMT), a novel intonation-based intervention; and Speech Repetition Treatment (SRT), a non-intonation-based control intervention. Inclusion criteria were: diagnosis of ASD, expressive vocabulary ≤20 words, no productive syntax, and the ability to repeat ≥2 phonemes. Seven predictor variables were chosen based on the literature: Sex; chronological age; and baseline measures of expressive language, phonetic inventory, autism severity, and nonverbal IQ. First, bivariate correlations were performed to eliminate predictors not significantly correlated with the outcome variable. Then, regression models were fit to assess the effect of the remaining predictors. Both complete case and multiple-imputation analyses were employed because of missing predictor data. Finally, because some children in each group improved, subgroup analyses were performed to investigate whether predictors differed according to treatment group and improvement status.

Results: Over the course of 25 treatment sessions, AMMT participants (n = 27) improved by a mean of 17.8% Syllables Approximately Correct (SD 18.8), while SRT participants (n = 11) improved by a mean of 0.5% Syllables Approximately Correct (SD 12.0). Bivariate correlations eliminated all predictors save autism severity (ADOS score) and phonetic inventory (the number of phonemes a child could correctly repeat). Together, the two variables accounted for 50-60% of the variance in change in % Syllables Approximately Correct. Across groups and analyses, every additional phoneme a child could repeat at Baseline resulted in a 1.4-2% increase in the amount of improvement after 25 therapy sessions. A one-point increase in ADOS score resulted in a 2-3% decrease in the amount of improvement. Complete-case analyses resulted in lower standard errors than multiple-imputation analyses, despite the smaller number of participants (24 complete cases out of 38 participants total). Phonetic inventory significantly predicted improvement only in children who received AMMT.

Conclusions: ADOS score emerged as a significant predictor when SRT participants were included. These results are consistent with previous findings that children with MV ASD benefit more, on average, from intonation-based therapies and suggest that intonation may be more efficient at enabling these children to harness their speech production abilities to learn new phonetic patterns. The fact that age did not significantly predict improvement is optimistic, in that it means that older children may still show some improvement in spoken language.

27 **108.027** Challenges to the Development of Core Vocabulary for Arabic Symbol-Based AAC

M. Habash[1] *and F. Alnemary*[2], *(1)Irada Autism Services Palestine, Gaza, Palestinian Territory, (2)UCLA, Los Angeles, CA*

Background: There has been enormous research towards the determination of core vocabulary for non-verbal and minimally verbal people using augmentative and alternative communication (AAC) systems in English and other Latin languages; however, there is limited literature about this in Arabic. This is partly due to the grammatical and lexical complexity of the Arabic language. This has created issues to attempts to create an Arabic symbol-based AAC.
Objectives: The aim of this study was to develop a core vocabulary list for a symbol-based Arabic AAC suitable for nonverbal children with mild to moderate autism.

Methods: a participatory study focused on the collection of naturally occurring Arabic vocabulary from 80 neurotypical children, aged from 3 to 10 years from 4 Arabic speaking countries. Parents and children are engaged through the use of an online tool developed for reporting. The tools allows submission of words and offers an option to submit recordings of conversations with parents consent.

Results: this is an ongoing study. Results are expected in March 2018

Conclusions: conclusions will be included once study is completed.

28 **108.028** Characterization of Cross-Genre Writing Ability in Children with Autism Spectrum Disorders

__E. Hilvert__[1], D. Davidson[2] and I. Misiunaite[3], (1)Loyola University, Chicago, IL, (2)Psychology, Loyola University Chicago, Chicago, IL, (3)Loyola University Chicago, Chicago, IL

Background: With an increase in the prevalence of technology, effective writing is not only critical for academic success, but it is also essential for obtaining a high-skill, high-wage job and maintaining daily social interactions. Unfortunately, it is estimated that writing may be one of the most significant academic problems for children with Autism Spectrum Disorders (ASD), with as many as 60% of children having a learning disability in writing (Mayes & Calhoun, 2006). Despite evidence from standardized assessments that writing is generally challenging for children with ASD, little is known about how children with ASD write in different genres. In neurotypical (NT) development, children begin to make important inter-genre distinctions around the age of 9. Typically, children master genre structure earlier in narrative writing compared to expository writing, but use more complex syntax and vocabulary earlier in expository essays (Berman, 2008). More research is needed to understand whether children with ASD are also developing these important distinctions between text genres. Additionally, the mechanisms that influence writing development in children with ASD are still unclear.
Objectives: The objectives of this study were (1) to comprehensively characterize the cross-genre (i.e., narrative, expository) writing development of children with ASD; and (2) to better understand how heterogeneity in handwriting, language ability, and cognitive processing contribute to the writing ability of children with ASD.

Methods: Eighteen children with ASD (M_{age}= 11;02) participated in the present study. All children had an IQ > 70 and were native English speakers (see Table 1). Children completed two writing tasks on the computer: one personal narrative and one expository essay. Writing performance was assessed in terms of productivity, lexical diversity, syntactic complexity, use of evaluative devices (i.e., hallmark feature of narratives, including character's internal states, hedges, intensifiers), and genre structure. Measures of handwriting, language, theory of mind (ToM), and executive functioning were also administered.

Results: We found that children with ASD wrote expository essays that were more syntactically complex in terms of the frequency of noun phrases compared to their personal narratives. However, there was also a trend towards children with ASD using better structure and more evaluative devices when writing their personal narratives, but writing longer expository essays. No other differences between the text genres were found (see Table 2). After controlling for variation in non-verbal IQ, we found that ToM ability was related to syntactic and semantic complexity across text genres. Additionally, greater executive functioning ability was related to the use of more complex syntax and better text structure. Surprisingly, chronological age, language ability, and handwriting fluency were not related to writing performance in either genre.

Conclusions: These findings provide evidence that children with ASD make some distinctions in text style when writing in different genres. Additionally, we found that ToM and executive functioning were significant mechanisms for various aspects of writing development in children with ASD. These results have important implications for the development of effective writing curriculum and interventions for children with ASD.

29 **108.029** The Relationship between Person Reference and Mental State Language in Preschoolers with ASD

__M. Barokova__[1] and H. Tager-Flusberg[2], (1)Department of Psychological and Brain Sciences, Boston University, Boston, MA, (2)Psychological and Brain Sciences, Boston University, Boston, MA

Background:
Although past research has provided mixed evidence of the nature and extent of personal pronoun difficulty in autism, children with autism's preference for proper names when referring to themselves and others along with their experience of a deficient sense of self stand out across studies (e.g., Lee at al., 1994; Tager-Flusberg, 1994; Shield et al., 2015).

Increase in personal pronoun use after the second year has long been used as a reflection of the emerging sense of self in typical development (e.g., Lewis & Ramsay, 2004). Furthermore, mental state language use in autism reflects Theory of Mind (Capps et al., 2000), which is also related to sense of self. Yet, no study has specifically examined the relationship between mental state language as an appropriate context to differentiate between self and others and personal pronoun use as a reflection of sense of self in autism.

Objectives:

We aimed to examine how children with autism refer to themselves and others: using fixed (common nouns and names) vs. shifting (personal pronouns) reference terms, and how this changes across time. Furthermore, we wanted to evaluate the relationship between children's person reference and their use of mental state language.

Methods:

Natural language samples from mother-child interactions were collected from children with autism (N = 50) at two (**T1:** *M*=27.13 months), three (**T2:** *M*=39.63), and four (**T3:** *M*=51.68) years of age. Their autism diagnosis was confirmed with the administration of the ADOS at each time point. Other key measures of the children's development included the Mullen, ESCS, and Vineland. We used the Linguistic Inquiry and Word Count software (LIWC, Pennebaker et al., 2007) to analyze the transcripts of the mother-child interactions by extracting rates (% of total number of words) of the children's use of personal pronouns (1st and 2nd person singular) and of mental state terms using an established word list (Bartsch & Wellman, 1995).

Results:

At each age, children used significantly more personal pronouns (*M1*=1.46; *M2*=4.99; *M3*=6.68) than common nouns and names to refer to themselves and others (*M1*=.63; *M2*=1.37; *M3*=1.27; **T1:** *Z*=-2.17, *p*<.05; **T2:** *Z*=-4.64, *p*<.05; **T3:** *Z*=-5.61, *p*<.05) (Figure 1). Children's use of mental state language was significantly correlated with their use of personal pronouns at all time points even after controlling for general language ability (Table 1).

Conclusions:

Contrary to past research, the children with ASD in our study exhibited no preference for common nouns and names over personal pronouns. This surprising finding could be attributed to the use of natural language sampling rather than pronoun elicitation tasks potentially posing different social and cognitive demands. The children's use of mental state language was related to their use of personal pronouns providing support for the notion that talking about mental states might provide the appropriate context for children to differentiate between themselves and others. These findings demonstrate a new approach to the study of selfhood in autism focusing on the characteristics of speech.

30 **108.030** Choosing a Definition of "Minimally Verbal": Characteristics of Minimally Verbal Children with ASD in the Autism Genetic Resource Exchange

C. DiStefano[1]*, Z. T. Tucker*[2] *and S. Jeste*[3]*, (1)University of California Los Angeles, Los Angeles, CA, (2)UCLA, Los Angeles, CA, (3)University of California, Los Angeles, Los Angeles, CA*

Background:

Approximately 30% of children with autism spectrum disorder (ASD) remain minimally verbal (MV) despite intervention, using only single words or fixed phrases in familiar contexts (Tager-Flusberg & Kasari, 2013). There is inconsistency in the measures used to make a research determination of MV status. A previous study using the Simons Simplex Collection (SSC) found that the MV sample composition varied depending on the measures chosen and found substantial variability in cognitive skills in all MV groups (Hus et al., 2016). Given that SCC excludes children with a nonverbal (NV) mental-age below 18 months, many MV children were likely excluded from that sample. The current study builds on the contributions of Hus et al. (2016) by examining characteristics of MV children in the Autism Genetic Resource Exchange (AGRE) dataset. The AGRE dataset provides a representative MV sample, as it has no mental-age cutoff.

Objectives:

(1) Evaluate rates of MV in the AGRE dataset based on different assessment definitions. (2) Compare MV sample characteristics based on different definitions.

Methods:

Participants included individuals 5-18 years old in the AGRE database with scores for all relevant assessments (N=1478; Male N=1153). We testing the following definitions of MV: Autism Diagnostic Interview – Revised (ADI-R) "single/no words"; Autism Diagnostic Observation Schedule (ADOS) Module-1 (further split into "some words"/"few words"); and Vineland Adaptive Behavior Scale (VABS) expressive language (EL) age below 24 months or below 18 months.

Results:

See table 1 for detailed results. The ADOS Module-1 definition resulted in the largest proportion of participants classified as MV (27%). Including only children who scored "few words" reduced the proportion to 20%, similar to the proportion identified using ADI-R score and VABS EL below 24 months. VABS EL below 18 months resulted in the smallest proportion of participants identified as MV (13%). 72% of participants who received ADOS Module-1 were identified as MV based on ADI-R; this increased to 87% when restricted to participants who received an ADOS rating of "few words". Participants with VABS EL below 18 months had the lowest cognitive and adaptive behavior scores. All groups showed substantial variability in cognitive scores with notably higher non-verbal IQ scores compared to verbal.

Conclusions:

Three of the definitions (ADI-R "single/no words", ADOS "few words", VABS EL below 24 months) had high overlap and consistent sample characteristics. Including all ADOS Module-1 participants yielded a larger MV group, indicating that some participants used less language during the ADOS administration than in their daily activities as reported by parents. Reducing the VABS cutoff to 18 months resulted in a much smaller MV group with notably lower cognitive scores, indicating that this group likely represents a subgroup of the MV population with greater overall intellectual impairment. All MV groups showed variability in cognitive scores, with many participants achieving non-verbal IQ scores in the normal range. This study highlights the importance of selecting a MV definition based on the study goals, as well as carefully assessing participants and reporting sample composition, as there is substantial variability within the MV group regardless of definition used.

31 **108.031** Cognitive Orientation and Linguistic Diversity in the Narratives and Retellings of Children with ASD Vs. Controls

J. Boorse[1]*, L. Bateman*[2]*, E. F. Ferguson*[2]*, M. Cola*[3]*, S. Uh*[3]*, S. Plate*[3]*, Z. M. Dravis*[3]*, A. Pomykacz*[4]*, K. Bassanello*[3]*, A. Zoltowski*[5]*, J. D. Herrington*[6]*, K. Bartley*[6]*, E. S. Kim*[3]*, A. de Marchena*[7]*, J. Pandey*[3]*, R. T. Schultz*[3] *and J. Parish-Morris*[3]*, (1)University of Pennsylvania, Philadelphia, PA, (2)The Center for Autism Research/CHOP, Philadelphia, PA, (3)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (4)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (5)Vanderbilt University, Nashville, TN, (6)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (7)University of the Sciences, Philadelphia, PA*

Background: Narrative storytelling can be challenging for individuals with autism spectrum disorder (ASD) because it is essentially a social-communicative task. To successfully tell a story from pictures, one must be able to take the perspective of characters and communicate their appearances, actions, motives and emotions to another person. Prior research shows that individuals with ASD use fewer mental state terms than typical controls or children with Down syndrome (Tager-Flusberg, 1992), and tell less cohesive stories than children without ASD (King et al., 2014). In addition, many children with ASD have verbal working memory deficits (Williams, Goldstein, & Minshew, 2006), making it easier to describe a story from pictures than to retell the same story from memory.

Objectives: Use a computational approach to assess cartoon story narrations in participants with ASD and matched typical controls (TD), and compare retellings by group.

Methods: Thirty-three school-aged children with ASD (N=17, 3 girls) or typical development (N=16, 9 girls) participated in the present study. Groups did not differ significantly on age (11y) or IQ (105; 2 missing from the ASD group) but there were more girls in the TD group (imbalance will be corrected by May, 2018). Audio recordings of the Cartoon task of the Autism Diagnostic Observation Schedule-2nd Edition (Fig.1) were orthographically transcribed. Four variables were assessed: duration of narratives, proportion of nouns produced relative to total words (concrete orientation), proportion of words about cognitive processes (cognitive orientation), and Shannon entropy (a measure of linguistic diversity; low diversity captures predictable speech that may be repetitive or otherwise restricted in range).

Results: Linear mixed effects models with participant ID as a random effect revealed that children in both groups produced equally long initial narratives (TD M=39s, ASD M=35s, *t*=-.79, *p*=.44). The ASD group demonstrated greater concrete orientation, as evidenced by proportionately more nouns (*t*=2.61, *p*=.01), and diminished cognitive orientation, as evidenced by fewer words about the inner processes of characters, than the TD group (*t*=-2.18, *p*=.07; Fig.1). In addition, participants with ASD produced narratives that were less linguistically diverse than participants in the TD group (*t*=-1.66, *p*=.107; Fig.2). In the retelling (without a picture), children with ASD produced narratives that were significantly shorter than their own first telling (-29%; M=25s; *t*=-3.40, *p*=.004), while children in the TD group produced retellings that only trended toward being shorter (-15%; M=33s; *t*=-1.78, *p*=.10). Retellings in both groups indicated similar concrete orientation (*p*s=n.s.). However, the ASD group continued to demonstrate diminished cognitive orientation (*t*=-2.33, *p*=.03) and reduced linguistic diversity (*t*=-2.15, *p*=.04; Fig.2) as compared to the TD group.

Conclusions: Our results replicate and extend prior research showing that children with ASD produce and remember narratives differently than typically developing children. In a short cartoon narrative and retelling, we found consistent indicators of diminished cognitive orientation and linguistic diversity in the ASD group, as well as evidence of working memory deficits. The next steps in this research are to double our sample size (transcription underway) and explore whether cognitive orientation during narratives relates to ASD symptomology.

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108.032 Comprehension of Interrogative Sentences in Autism Spectrum Disorder

E. Vila Borrellas[1]*, J. Rosselló Ximenes*[1] *and W. Hinzen*[2,3,4]*, (1)General Linguistics, University of Barcelona, Barcelona, Spain, (2)Department of Translation and Language Sciences, Universitat Pompeu Fabra, Barcelona, Spain, (3)FIDMAG Germanes Hospitalaries. Research Foundation Benito Menni Hospital, Sant Boi de Llobregat, Spain, (4)Catalan Institute for Advanced Studies and Research (ICREA), Barcelona, Spain*

Background: Individuals with Autism Spectrum Disorder (ASD) have difficulties to initiate and follow a conversation and respect turn-taking. Despite the importance of asking and answering questions for social interaction, how ASD individuals comprehend the language structures involved in them has been understudied. Prosody on the other hand has a role in shaping questions to the point that there are languages such as Spanish where *yes/no* questions differ from declaratives only prosodically. As for wh questions, ASD children understand them much later than typically developing (TD) children (Goodwin et al., 2012), They are also more difficult to answer than *yes/no* ones (Oi, 2010; Oi and Tanaka, 2011). The difficulty in answering *wh* questions in ASD should be clarified since the assessment of the understanding of false-belief (Sally-Anne task) and other explicit Theory of Mind (ToM) experiments is usually made through *wh* questions.

Objectives: Study the comprehension of different types of questions in ASD and establish the role of visual support and ToM on it.

Methods: In this study, we examined the comprehension of *wh* and *yes/no* questions through visual and non-visual tasks, with and without false-belief content. We selected 16 high-functioning ASD children from 7 to 12 years old (mean = 10.03 years old). All of them were Spanish-Catalan bilingual with Spanish dominance. They were individually matched by verbal mental age with a group of children in the same age range (mean= 9.79 years old).

Results: No significant differences were found between the TD and the ASD group. The ASD and the TD have greater difficulties to answer *wh* rather than *yes/no* questions. In addition, both groups performed better in Non-ToM than ToM tasks and in those with visual support.

Conclusions: High-functioning ASD children did not show significant difficulties to understand interrogative sentences compared to their neurotypical peers. ASD and TD showed a greater level of understanding *yes/no* rather than *wh* questions. Moreover, both groups show that visual support helps to a better question comprehension. Questions involved in ToM tasks are not only more demanding to comprehend for ASD but also for typically developing children.

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108.033 Comprehension of Word Order in the General Population of Mandarin-Exposed Preschool Children with Autism Spectrum Disorders: Evidence from Intermodal Preferential Looking

Y. E. Su[1] *and L. R. Naigles*[2]*, (1)Childa Language Lab, School of Foreign Languages, Central South University, Changsha, Hunan, China, (2)Psychological Sciences, University of Connecticut, Storrs, CT*

Background:
Recent comprehension studies have revealed grammatical strengths in children with autism spectrum disorders (ASD), often when they achieve similar vocabulary levels as those of successfully comprehending (but younger) typically developing (TD) children. For example, 3-year-old English speakers with ASD were able to process basic Subject-Verb-Object (SVO) word order similarly to vocabulary-matched 25-month-old TD children (Swensen et al., 2007); 4-5-year-old high-functioning Mandarin-speaking children with autism also used SVO word order in sentence comprehension (Zhou et al., 2017). However, no studies have investigated whether the general population of Mandarin-exposed preschool children with ASD demonstrates similar grammatical strengths.

Objectives:

Using Intermodal Preferential Looking (Naigles & Tovar, 2012), this study assessed the processing of SVO word order in a general group of Mandarin-exposed preschool children with ASD.

Methods:

Participants included 39 Mandarin-exposed children with ASD (MA=61.28 months (SD=14.84); *M*(vocabulary)=382.29 words (SD=238.73) and 29 TD children (MA=35.07 months (SD=.92); *M*(vocabulary)=713.47 words (SD=90.89). The TD children were recruited to be significantly younger (p<.001) with the goal of matching the ASD group in vocabulary; however, TD vocabularies were significantly larger than ASD (p<.001). Children listened to simple reversible SVO sentences paired with two visual scenes, only one of which matched the sentence, e.g., distinguishing between 'the bird pushing the horse' and 'the horse pushing the bird'.

Results:

Three different measures of looking behavior while viewing the videos indicated that both groups demonstrated comprehension of SVO order (all tests 1-tailed). **With the percent looking to match measure**, group effects emerged when the test trials were divided into first-half vs. second-half [F(1,66) = 5.42, p < .05]. Children looked significantly longer to the match during the test relative to control trials for the 1st half (TD) or 2nd half (ASD) of the test trials (ps < .05). **With the latency of first look measure**, the effect of scene was significant, F(1, 66) = 9.70, p < .01. Both the TD and the ASD groups looked faster to the match than the nonmatch. **With the number of switches measure**, there were significant effects of trial, F (1, 66) = 40.64, p < .001, and group, F (1,66) = 4.99, p < .05. The number of switches of attention decreased significantly between the control and test trials for both groups (ps < .001).

Conclusions:

Mandarin-exposed preschool children with ASD demonstrated similar sensitivity to SVO word order as younger TD children, even though the expressive vocabulary levels of the ASD group were dramatically delayed. Thus regardless of their verbal language skills, grammatical knowledge may be available in the general population of children with ASD. Similar to the comprehension pattern with wh-questions in English-speakers with ASD (Goodwin et al., 2015), the 2nd half of the trials was a more reliable indicator of children with ASD's comprehension. This may suggest that Mandarin-exposed children with ASD need to hear full rather than fragmentary SVO structures (i.e., without omitted nouns) to master SVO word order, i.e., certain types of input information may be more facilitative than others in the acquisition process of children with ASD.

34 **108.034** Cross-Modal Generalization of Vocabulary in Children with Autism Spectrum Disorder

P. L. Su[1] *and S. Camarata*[2]*, (1)Hearing and Speech Sciences, Vanderbilt University, Nashville, TN, (2)Hearing & Speech Sciences; Psychiatry & Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN*

Background: Vocabulary is a foundation for many aspects of language and is an important predictor of reading comprehension and later academic success (Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003). Though previous research suggests that children with autism demonstrate deficits in vocabulary in both the receptive and expressive modalities very early in their development (Ellis Weismer, Lord, & Esler, 2010; Luyster & Lord, 2009), the nature of vocabulary deficits involved in this process remains unclear. Researchers have suggested that compared to typically-developing children, children with ASD may acquire partial knowledge of a learned language form and encounter more difficulties generalizing across settings and modalities(Wynn & Smith, 2003). This study aims to investigate receptive and expressive word acquisition and cross-modality generalization in children with ASD.

Objectives: 1) To examine potential differences in word acquisition across receptive and expressive modality in children with ASD; 2) To examine whether children with ASD demonstrate expressive to receptive or receptive to expressive cross-modal generalization of word learning following a combined storybook and play vocabulary intervention.

Methods: A single-subject, multiple-probe design (Wolery, Gast & Hammond, 2010) was implemented to compare vocabulary learned within receptive or expressive vocabulary intervention conditions. Twelve children with ASD between 36 and 90 months were recruited and taught unfamiliar vocabulary in a combined storybook and play intervention (see Table 1 for participants' cognitive, language, and vocabulary ability). For each child, by random assignment, half of the target words were trained expressively and the other half were trained receptively. Probe sessions occurred both before, during, and after each phase of intervention to compare target words learned in the receptive and expressive modality and to probe the extent of cross-modal generalization.

Results: Children learned target words in both receptive and expressive conditions, as evidenced by an average of 80% accuracy across three trials at the end of each intervention. In receptive modality, participants learned target vocabulary to criterion in an average of 10 sessions. In expressive modality, participants learned target vocabulary in 12 sessions on average. Visual analysis of the immediate post-intervention probe condition showed that participants showed considerably greater success generalizing from expressive to receptive modalities. In cross-modal probes, participants identified 79% of the words taught expressively and 46% of the words taught receptively (see Figure 1 & 2 for sample data of successful and unsuccessful cross-modal generalization).

Conclusions: Unlike typically-developing children who are able to generalize vocabulary learned across both receptive and expressive modalities, children with autism in this study were more likely to cross-modal generalize from the expressive to the receptive modality than the opposite direction. Findings from this study provide clinical implication about teaching vocabulary in this population. Specifically, findings showed that vocabulary forms taught receptively will not reliably generalize to the expressive modality. Children with autism may benefit from an intervention focusing primarily on expressive vocabulary which may lead to growth in both the expressive and receptive modalities.

35 **108.035** Cross-Population Comparison of Expressive Language Profiles in Mandarin-Exposed Children with ASD, MR, and LD

Q. Xie[1] *and Y. E. Su*[2]*, (1)School of Foreign Languages, Central South University, Changsha, Hunan, China, (2)Childa Language Lab, School of Foreign Languages, Central South University, Changsha, Hunan, China*

Background:

Cross-population comparison of language development is beneficial to reveal the similarities and differences between children with autism spectrum disorders (ASD) and those with other language impairments. Studies in western children with ASD have yielded evidence for their core linguistic abilities in lexical and grammatical development, in contrast to the more impaired pragmatic abilities (Ellis Weismer et al., 2011; Geurts & Embrechts, 2008; Tager-Flusberg et al., 1990). Cross-population studies in children with ASD speaking typologically different languages (as a comparison with other language delayed groups) are needed to unveil the unique and universal language profiles in children with ASD across countries.

Objectives:

To compare expressive language profiles including lexical, grammatical and pragmatic skills among children with ASD, children with mental retardation and children with language disorder, via the Putonghua Communicative Development Inventory: Words and Sentences (PCDI-Toddler

Form).

Methods:

Parents of 114 preschool children with language impairments participated in this study, including 41 children with ASD (the ASD group), 41 children with mental retardation (the MR group), and 32 children with language disorder (the LD group). These three groups of children were matched on age (ASD: 47.80±13.82 months, MR: 48.95±16.81 months, LD: 41.84±13.45 months, F（2,110） = 2.28, p>.05) as well as the total vocabulary production score via the PCDI lexical checklist (ASD: 225.20±233.78, MR: 221.71±270.21, LD:279.13±313.14, F(2,111) =.49, p>.05). However, the ASD group had significantly higher scores on the Autism Behavior Checklist than the other two groups (ASD:83.07±21.67, MR:39.00±16.21, LD:32.45±13.95, F（2,100） =72.322, p<.001). Children's lexical, grammatical and pragmatic levels were compared through the completed PCDI-Toddler Form.

Results:

(1) While matched on the total vocabulary production level, these three groups were comparable in the five lexical subcategories: nouns, verbs, pronouns, quantifiers and question words (Fs(2,111)=.27-2.15, *ps*>.05). (2) In the grammatical aspect, three groups of children did not differ on most items of "words and sentences", "combining" (Xs^2=.30-5.22, *ps*>.05), MLU and grammatical complexity (Fs(2,111)=.10 and .59, *ps*>.05). But further pairwise Chi-square test revealed that the ASD group used fewer perfective/experiential aspect markers "le" or "guo" than the LD group (17.1% vs. 37.5%, X^2=3.90， *p*<.05). (3) Three groups were equivalent on most of the pragmatic items in the subscale of "how to use words "(Xs^2=1.04-5.90, *ps*>.05). Pairwise chi-square tests revealed that though the MR and LD groups did not differ in their pragmatic skills, the ASD group displayed a relatively weaker command on "describing past events/people" (17.1%) than the MR group (37.5%) and the LD group (37.5%), X^2=4.27 and 3.90, *ps* <.05.

Conclusions:

In general, Mandarin-exposed children with ASD exhibited similar levels of lexical and grammatical abilities as the MR group and the LD group. Consistent with Ellis Weimer et al. (2011), this is further evidence for the dimensional account that different populations of children with language delays demonstrated core linguistic abilities. However, Mandarin-exposed children with ASD's deficits in the use of perfective/experiential marker and the description of past events/people may reflect their special difficulties in expressing past events, both grammatically and pragmatically (Eigsti, et al., 2007; Jyotishi et al., 2017).

36 **108.036** Current Profiles and Early Predictors of Reading Skills in School-Age Children with Autism Spectrum Disorders

ABSTRACT WITHDRAWN

Background:

The number of studies exploring reading skills of children with autism spectrum disorders (ASD) has grown in recent years. A lot of this research has focused on the mismatch between stronger word reading (decoding) and weaker reading comprehension observed in some children with ASD, with the term "hyperlexia" sometimes being used to describe an extreme version of this profile. However, other studies have noted a very considerable heterogeneity in reading capacity between children with ASD.

Objectives:

To study reading profiles and early predictors of reading in a cohort of school-age children. At age 2.5 years the cohort underwent an autism assessment following identification in a population-based screening. At age 8 years, we used a subgrouping procedure based on individual children's scores on standardized tests of word reading and reading comprehension to determine the prevalence of different reading profiles. The identified subgroups were then compared both concurrently and retrospectively on a range of linguistic, cognitive and social skills data.

Methods:

A total of 53 Swedish speaking school-age children with ASD were followed up using a broad test battery tapping aspects of reading, print knowledge, oral language comprehension, oral language production, nonverbal IQ and severity of autistic presentation. Oral phonological processing was also assessed since this is considered a key correlate of word reading development.

Intake-data at age 2.5y included ADOS, adaptive social and communicative functioning and oral language comprehension and production.

Results:

Approximately half of the sample (n = 25) performed generally poor in reading, meaning that they scored below the normal range on both word reading and reading comprehension tests. In contrast, a sizable minority (n =18) were skilled readers performing above cut off. A final subgroup (n = 10) presented with the hyperlexic profile of normal-to-strong word reading, but poor reading comprehension. The generally poor subgroup was found to score poorly on most assessments, as well as showing a more severe autistic presentation than skilled readers. Group differences between skilled and hyperlexic readers were more selective: whereas the subgroups did not differ on autistic severity, phonological processing, print knowledge or nonverbal IQ, the hyperlexic subgroup scored poorly on tests of oral language comprehension.

When intake data were considered, no differences were seen between the subgroups in social skills or autistic severity. Importantly, however, already at this age it was possible to identify oral language comprehension difficulties in the subgroups that five years latter presented as generally poor or hyperlexic readers.

Conclusions:

The results of this unique population-based study of children with ASD confirm a high degree of heterogeneity in reading skills in ASD. Yet, the patterns appeared to be predictable and align well with established findings in general reading research: that word reading is backed up by phonological skills, whereas reading comprehension builds on a foundation of language comprehension.

37 **108.037** Development of the Critical Communication Skills Assessment

S. Bissell[1] *and J. McCleery*[2]*, (1)University of Birmingham, Birmingham, United Kingdom of Great Britain and Northern Ireland, (2)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background:

The first step in the Picture Exchange Communication System (PECS) training program (Bondy & Frost, 1994; Frost & Bondy, 2002) is to assess ability to follow nine critical communication skills according to checklist criteria. The nine critical communication skills are: 1) requesting reinforcers, 2) requesting help, 3) requesting a break, 4) accepting items, 5) rejecting items, 6) responding to wait, 7) responding to directions, 8) following a visual schedule and 9) transitioning between activities. Skills 1-5 relate to expressive communication and skills 6-9 relate to receptive communication.

Objectives:

The aim of this study was to pilot and validate an assessment protocol of the nine critical communication skills for use in intellectual disability (ID) and autism spectrum disorder (ASD) populations.

Methods:

The Critical Communication Skills (CCS) assessment was developed based on a model employed in a school for children with ASD. The refined CCS assessment protocol is composed of 38 items that allow for both spontaneous and prompted demonstration of the nine critical communication skills. Ten of the items are also administered by the parent/caregiver to determine whether communicative ability varies according to social demands. Each item is scored on a 0-2 scale, with 0 indicating a communication error or incorrect response and 2 indicating a correct response. The assessment is administered in a naturalistic environment utilising the child's own toys and activities as reinforcers and preferred items. Excluding time needed to brief the parent/caregiver on administration strategy, the CCS assessment takes approximately 30-40 minutes to administer.

To determine inter-rater reliability and concurrent validity, scores were compared between two raters, and expressive and receptive communication scores obtained on the CCS assessment were compared to expressive and receptive language raw scores on the Vineland Adaptive Behavior Scales (VABS-2; Sparrow, Cicchetti, & Bala, 2005).

Results:

The CCS assessment was piloted with 20 children aged 2-15 years (*M* age = 7.65; *SD* = 4.32), with a confirmed diagnosis of a genetic syndrome. Most children in the study (*n* = 15) were diagnosed with Kleefstra syndrome, a disorder characterised by language delay and ASD symptomatology.

Inter-rater reliability ranged from good to excellent across items (weighted Cohen's κ = 0.63-1.00; *M* = .85), and a strong correlation was found between the CCS and VABS-2 for expressive communication ($r_{s\,=}$ .666, *p* = .001), but not for receptive communication ($r_{s\,=}$ .358, *p* = .060).

Conclusions:

The CCS assessment is a valuable tool to measure critical communication abilities in ID and ASD populations, particularly expressive communication skills. This measure is now being used to examine the relationship between communication abilities, difficult behaviours, ASD symptomatology, age and level of ability in a cohort of young children with tuberous sclerosis complex. However, the CCS assessment also shows promise as a measure of critical expressive communication skills pre- and post- intervention in randomised controlled trials, and its use within both academic and clinical contexts will be discussed.

38 **108.038** Discriminating Autism Spectrum Disorder and Specific Language Impairment on Acuity of Musical Imagery

***P. F. Heaton**, Psychology, Goldsmiths College, University of London, London, United Kingdom*

Background: Deficits in auditory short-term memory have been linked with impairments in music perception in children with Specific Language Impairment (SLI). Autism Spectrum Disorder (ASD), when co-morbid with language impairment (ALI), is also characterized by auditory short-term memory impairments, although music perception has yet to be systematically investigated in this group.

Objectives: The objective of this research is to investigate the relationship between music perception and auditory short-term memory in individuals with ASD and co-morbid language impairments.

Methods: Children and adolescents with SLI (n=14), ALI (n=14) and typically developing (TD) controls (n=14), matched for chronological age (M = 14.06, S.D = 0.97) and musical experience, completed tests of pitch and temporal acuity within Voluntary Musical Imagery and short-term auditory memory, using the digit span test.

Results: Results revealed significantly lower digit span scores in the SLI and ALI groups than in TD controls, although this was only associated with poor performance on the visual musical imagery task for the SLI group. The ALI participants performed as well as TD controls on the tempo conditions of the musical task and better than TD controls on the pitch condition. For both ALI and TD groups, performance on the musical imagery task was positively associated with levels of musical experience.

Conclusions: This research demonstrates that despite language impairments, individuals with ASD show strengths in music perception skills.

39 **108.039** Do Play Contexts Impact Language Production in Preschool Children with Autism Spectrum Disorder?

***A. Binns**[1], D. Casenhiser[2], S. Shanker[3,4] and J. Oram Cardy[5], (1)Western University of Ontario, London, ON, Canada, (2)Audiology & Speech Pathology, University of Tennessee Health Science Center, Knoxville, TN, (3)The MEHRIT Centre, Peteborough, ON, Canada, (4)York University, Toronto, ON, Canada, (5)Western University, London, ON, Canada*

Background: Children's language environments affect their language production during early stages of language development, and beyond. Language contexts also impact language assessment (i.e., language sampling) and influence how clinicians approach intervention. One essential environmental factor to consider for young children is the play context or toys available in the environment. Research on typically developing toddlers revealed symbolic play contexts that involved interaction with blocks and cars promoted more frequent and complex language than play contexts with gross motor toys. However, when the symbolic toys context was altered to include dolls and house toys, children used more labels than in the gross motor context but the frequency and complexity of language was not significantly altered, Additionally, preschool children spoke more frequently and used more diverse language during free-play with a parent than when engaged in a structured task (i.e., puzzle completion). Currently there is little research examining the impact of play contexts on the language production of preschool children with Autism Spectrum Disorder (ASD). Given the social communication deficits and sensory challenges children with ASD often encounter, it is possible that the most beneficial play contexts for yielding a language sample in children with ASD would not be the same as for typically developing children.

Objectives: To explore the impact of three different play contexts (symbolic, tactile, and gross motor) on the communication of preschool children with ASD.

Methods: Forty-nine children with ASD aged 25-57 months were videotaped during natural play interactions with a parent. Five minutes each of play with three sets of toys (symbolic, tactile, gross motor) were used to examine children's communication. Data used in this study were part of a larger RCT, however, only pre-treatment, parent-child play interactions were examined here. Videos were transcribed in CHILDES CHAT format and the main function of each child utterance was coded for language function (Casenhiser et. al, 2015). CLAN analyses of the transcripts extracted the frequency of each function code, total number of utterances, mean length of utterance (MLU), total word types, total word tokens, type-token ration (TTR), and number of verbs/utterance.

Results: There were no significant differences across the three contexts in most aspects of children's language productions, including their use of comments, protesting, questions, verbs/utterance, or diversity of language functions. However, children produced significantly fewer word types ($p<0.5$) and fewer utterances in the tactile play context than the other two contexts ($p<0.001$). In addition, children produced more affirming utterances during symbolic and tactile than gross motor play ($p<0.5$), and more directing utterances during gross motor play than during symbolic or tactile play ($p<0.5$).

Conclusions: Play contexts seem to impact some aspects of language production differently and not others, in preschool children with ASD. Children with ASD appear to use language differently than their typically developing peers across different play contexts, and might benefit from using a variety of play contexts (e.g. symbolic and gross motor) during language assessment or intervention.

40 **108.040** Early Predictors of Later Language Abilities in High-Risk Infant Siblings of Children with Autism

V. Yuk[1,2], *S. E. Bryson*[3], *I. M. Smith*[5] *and J. A. Brian*[6], *(1)The Hospital for Sick Children, Toronto, ON, Canada, (2)University of Toronto, Toronto, ON, Canada, (3)Dalhousie University, Halifax, NS, Canada, (4)University of Alberta, Edmonton, AB, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: Younger siblings of children with autism spectrum disorder (ASD) are at increased risk of developing ASD themselves; those who do not have ASD often show related language and communication delays. Impairments in language are often preceded by deficits in nonverbal communication, such as gesture use and pretend play, which suggests that they may be pre-linguistic indicators of later language outcomes. Indeed, both gestures and play have been shown to predict later language in young children with and without ASD, but less work has examined this relationship in high-risk siblings, even though they, like children with ASD, exhibit poorer gestures and play compared to low-risk children.

Objectives: To determine whether gestures and play at 18 months predict language proficiency at 36 months in high-risk siblings with and without ASD, and in low-risk controls.

Methods: Our sample included 105 high-risk siblings diagnosed with ASD at age 36 months, 313 high-risk siblings not diagnosed with ASD (non-ASD), and 164 low-risk controls, drawn from the Canadian Infant Sibling study. At 18 months, gestures and play were assessed using the ADOS-Generic (ADOS-G), Module 1, and at 36 months, language abilities were measured using the Mullen Scales of Early Learning (MSEL). A multi-group structural equation modeling (SEM) approach was used, as it allowed us to capture shared variance between similar variables. Our model involved three latent variables representing our constructs of interest: "gestures", which comprised "Pointing" and "Gestures" from the ADOS-G; "play", which included "Functional Play with Objects" and "Imagination/Creativity" from the ADOS-G; and "later language", which included Receptive and Expressive Language scales of the MSEL. Estimated parameters included the regression of later language on gestures and play, and the correlation between the latter two.

Results: SEM revealed that the relationship between gestures, play, and later language differed between groups. In controls, gestures ($\beta=-0.342$, $p=0.005$), but not play ($\beta=-0.110$, $p=0.305$) predicted later language, and gestures were not correlated with play ($r=0.162$, $p=0.269$). For non-ASD high-risk siblings, gestures ($\beta=-0.486$, $p=0.001$), but not play ($\beta=-0.041$, $p=0.758$), predicted later language, but the two were significantly correlated ($r=0.573$, $p<0.001$). In the ASD group, neither gestures ($\beta=-1.937$, $p=0.151$) nor play ($\beta=1.309$, $p=0.331$) predicted later language, but this apparent lack of significance could be explained by high collinearity ($r=0.952$, $p<0.001$). In fact, when gestures and play are combined into one latent variable, it significantly predicts later language ($\beta=-1.104$, $p<0.001$).

Conclusions: This study provides evidence that gestures significantly predict later language in high-risk siblings not diagnosed with ASD. Play did not predict language outcome in our sample, although other aspects of play not captured here may yield different results. Our findings complement previous work by demonstrating that not only do specific measures of gestures predict later language, but so does the underlying construct representing gesture use. This study emphasizes the importance of attending to early indicators of language, especially gestures, in high-risk siblings, as they may help identify children who could benefit from early language interventions.

41 **108.041** Emotional and Social Development in Vocalizations in Korean-Speaking Toddlers with Autism Spectrum Disorder and Those with Developmental Delay

S. W. Cho[1], ***K. S. Lee***[2] *and H. J. Yoo*[3], *(1)Sogang University, Seoul, Korea, The Republic of, (2)Rehabilitation, Hanshin University, Seoul, Korea, Republic of (South), (3)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, The Republic of*

Background:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that may impair social interaction and communication. Many infants with ASD lack vocalization during the first year of life, and may have impaired communication during future development. Vocal behaviors play a key role in developing language and speech from six to twelve months after birth, infants develop critical vocal behaviors including canonical babbling and variegated babbling as they fully develop nonverbal communication skills using gestures and vocalizations

Objectives:

This study examines the development of socializing and emotional expressions through vocalizations and joint attention behaviors in Koreanspeaking children with Autism Spectrum Disorder (ASD) compared with those with developmental delay (DD).

Methods:

Video samples were collected from 28 toddlers with ASD and 18 age-matched toddlers with DD and vocalizations were each coded in detail for the purpose of this retrospective research. In addition to some statistical analysis, Computerized Language Analysis (CLAN) was done for obtaining the final results.

Results:

Although they produced a higher number of vocalizations than the DD group, the ASD group did not engage in emotional or social interactions with their caretakers as the DD group did. The children with ASD used more atypical vocalizations and socially unengaged vocalizations than the children with DD did. Joint attention using vocalizations in the ASD group, in particular, was largely dyadic, with triadic types occurring at a significantly lower frequency than those in the DD group.

Conclusions:

Results from this study indicate the importance of assessing early vocalizations in toddlers with ASD, suggesting that some common symptoms of ASD, such as lack of typical, emotional and social functions in early vocalizations, could be used to develop screening and intervention programs related to ASD.

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108.042 Engaging the Play Partner in Pretence: Verbal and Non-Verbal Signalling between Children with ASD and Their Parents

L. Stirling[1]*, S. Douglas*[1]*, C. Dissanayake*[2] *and S. Conte*[1]*, (1)School of Languages & Linguistics, The University of Melbourne, Parkville, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background:

It is well accepted that pretend play is critical for children's development, and also that sophisticated communicative abilities are essential for collaborative pretend play to proceed successfully, as the players must negotiate the transformed meanings that constitute the pretence. This involves each play partner gaining the other's acceptance of the potential intended pretend play elements they wish to include. Research on the degree to which children with ASD are able to engage in shared or negotiated pretence in interactive contexts in the form of collaborative social pretend play is ongoing, but has generally not focused on the conversational interaction which accompanies the play. This project compares social pretend play sessions between adult/child pairs from an ASD and typically developing (TD) group, focusing on verbal and non-verbal communicative strategies used by both adult and child to engage the play partner in the developing pretend scenario.

Objectives:

This study is part of an on-going project which investigates the ways in which high-functioning children with ASD interact and communicate with their play partners during pretend play. We propose that studying engagement in pretence from a discourse analytic perspective may allow us to build more adequate theories around pretence deficits in ASD, and we hypothesise that communicative interactions involved in collaborative pretend play between children with ASD and their play partners will be found to be atypical in the sequential organisation of their verbal and/or non-verbal signalling.

Methods:

Video data from 20 high-functioning children with ASD and 20 TD children, age range approximately 4-8 years old and matched on Verbal Mental Age, had been collected for a previous research project. We used a detailed discourse analytic approach to re-examine a 10-minute free play session from these data. In particular, the sessions were coded for the number of attempts to engage the play partner verbally or non-verbally in the play – "solicitations" – and for whether these attempts were successfully taken up by the partner in order to progress the play.

Results:

Results from a pilot study of 10 children in this corpus show only small differences in the types of signalling produced by the children. However we found that adults in the ASD dyads produced approximately 50% more "solicitations" than adults in the TD dyads and that these were less likely to be taken up by the children. Adults used more non-verbal signalling with ASD children and their attempts to engage ASD children were more likely to succeed when they aligned with the child's plot developments and when they involved non-verbal signalling rather than purely verbal communication. Analysis of the full data set is on-going.

Conclusions:

An earlier study of this data set using behavioural coding of the play had showed no significant differences in symbolic pretend play behaviour between the groups except for small frequency differences in object substitution. However a discourse analytic approach allows us to identify some differences, which have implications for potential intervention. This study illustrates a complex interaction between differences in children's contributions and differences in parental style.

43

108.043 Examining How Varying Levels of Verbal and Visual-Spatial Skills Relate to Emotional and Cognitive Aspects of Music Perception

E. M. Quintin[1]*, S. Sivathasan*[1] *and H. Dahary*[2]*, (1)Educational & Counselling Psychology, McGill University, Montreal, QC, Canada, (2)McGill University, Montreal, QC, Canada*

Background: There is growing evidence that music perception is a strength for people with autism spectrum disorder (ASD; Boso et al., 2009; Heaton, 2008). Music represents a unique domain in which to assess both cognitive and emotional processing, and it has been shown that people with ASD recognize music-evoked emotions (Quintin et al., 2011; Stephenson, Quintin, et al., 2015), as well as show enhanced pitch discrimination (Bonnel et al., 2003, 2010), musical memory (Stanutz et al., 2014), and melodic perception (Heaton, 2003). Previous research has also demonstrated that level of intellectual functioning is related to perception of musical structure (Quintin et al., 2012) and music-evoked emotion (Quintin et al., 2011), however direct comparisons between cognitive and emotional processing of music, including individuals with varying levels of intellectual functioning, have yet to be established.

Objectives: The aim of this research is to assess the impact of variations in intellectual functioning within the autism spectrum on perception of cognitive and emotional aspects of music perception.

Methods: Twenty-three adolescents with ASD ages 12-16 years old with varying levels of cognitive functioning (Wechsler Intelligence Scale for Children [WISC-V]: Verbal Comprehension [VCI] range: 50-111; Visual-Spatial [VSI] range: 61-144) completed two musical emotion recognition tasks in which they identified happy, sad, and fearful emotions in long excerpts (mean duration of 37 seconds) and short excerpts (mean duration of 4 seconds). Participants also completed a musical working memory and rhythm perception task.

Results: Participants were grouped into low and high VCI and VSI groups using median splits of the index scores (VCI = 80; VSI = 95). Overall, across emotion recognition tasks, results showed that performance accuracy (*M* = 92%) was not influenced by participants' level of intellectual functioning (VCI and VSI). However, participants in the low VCI group rated music-evoked excerpts as more intense than those in the high VCI group. Participants in the low VCI group were also slower at identifying emotions in the long excerpts compared to those in the high VCI group, but there were no differences between groups in response time for the short excerpts. Additionally, VCI marginally predicted performance accuracy only on the musical working memory task (*M* = 81%) but not the rhythms perception task (*M* = 64%), which were significantly influenced by participants' level of visual-spatial skills.

Conclusions: Overall, results suggest that adolescents with ASD are able to recognize music-evoked emotions, irrespective of level of intellectual functioning, though their ratings of intensity and response times may be impacted by their level of verbal cognitive skills. Furthermore, individuals with varying levels of verbal comprehension were able to process cognitive aspects of music perception (i.e., musical working memory and rhythm perception), however accuracy was more greatly influenced by visual-spatial skills. Findings lend support toward the use of targeted, strengths-based music interventions adapted to varying cognitive skills within the spectrum.

44 **108.044** Examining Unique Predictors of Language Growth in Infants at High and Low Risk for Autism Spectrum Disorder

C. C. Dick[1], *S. R. Edmunds*[2], *T. DesChamps*[1], *L. V. Ibanez*[3], *E. A. Karp*[1] *and W. L. Stone*[1], *(1)Psychology, University of Washington, Seattle, WA, (2)University of Washington, Seattle, WA, (3)UW READi Lab, Seattle, WA*

Background: Language ability is a powerful predictor of outcome for individuals with ASD (Anderson et al., 2013; Venter et al., 1992), highlighting the importance of understanding how early language emerges. Previous studies exploring predictors of language development in ASD often examined one predictor in isolation, preventing the identification of predictors that contribute most to language outcome. To address this, recent work examined several predictors within a single model, identifying three that uniquely account for language growth in preschool-aged children with ASD: intentional communication (IC), response to joint attention (RJA), and parent verbal responsiveness (PVR; Yoder et al., 2015). The current study evaluates these value-added predictors of language growth in infants at high risk (HR) and low risk (LR) for ASD to capture the developmental period in which language is rapidly developing.
Objectives: (1) To examine expressive language (EL) and receptive language (RL) growth trajectories for HR and LR infants. (2) To examine the unique contribution of predictors (IC, RJA, and PVR) on EL and RL growth trajectories.

Methods: Data were collected at 12, 15 and 18 months as part of a prospective, longitudinal, multi-site study of HR (n=45) and LR (n=32) infant siblings. IC and RJA were measured using the Early Social Communication Scales (Mundy et al., 2003). PVR was coded from videos of parent-child free play (data coding ongoing). EL and RL were measured using the MacArthur-Bates Communicative Development Inventory (MCDI; Fenson et al., 2007). Hierarchical linear modeling was used to examine the contributions of risk group and hypothesized predictors at 12-months on EL and RL growth between 12-18 months.

Results: Preliminary analyses tested growth in EL and RL over time for HR and LR infants with time modeled as infant age. For EL, growth was best modeled by fixed-intercept, random quadratic time, b=1.09, p<.001. There was a significant quadratic time by group interaction, b=-.83, p=.027, suggesting that LR infants' growth in EL accelerated more quickly than that of HR infants. For RL, the best fitting growth model included a random intercept and random linear slope, b=14.49, p<.001. Although RL increased on average across age, LR infants showed consistently higher RL compared to HR infants across time as indicated by a main effect of risk group, b=-29.67, p=.005, and a lack of linear time by group interaction. IC and RJA were not predictive of level or change in EL or RL. Upon completion of PVR video coding, analyses will examine PVR in relation to these trajectories.

Conclusions: Risk group differentially predicted trajectories for both EL and RL. Preliminary analyses indicate that some hypothesized 12-month behavioral predictors (i.e., IC and RJA) did not account for these differences in growth, potentially because joint attention, an important aspect of both constructs, may still be emerging at 12 months (Ibanez et al., 2013; Mundy et al., 2007). Further analyses will examine the contribution of PVR, and whether changes in IC and RJA as they emerge predict language growth.

45 **108.045** Factors Affecting Gestural Development in Children with Autism

H. Ying[1], *M. K. Y. Wong*[2], *W. Y. Lam*[2], *C. H. E. Cheng*[2] *and W. C. So*[3], *(1)The Chinese University of Hong Kong, HONG KONG, China, (2)The Chinese University of Hong Kong, Hong Kong, Hong Kong, (3)Educational Psychology, The Chinese University of Hong Kong, Hong Kong, Hong Kong*

Background:
Gestures are spontaneous hand movements produced during communication. They convey ideas and thoughts. Previous studies have reported a delay in gestural development in children with autism, in comparison to their typically developing peers (e.g., Luyster et al., 2007; So, et al., 2015b).

Objectives:

Little is known about the individual variations in gestural use among children with autism and underlying factors affecting gestural use. Understanding these issues can provide us insights into the spectrum of gestural communication skills, and more importantly, help us to design tailor-made intervention programs for individual children with autism.

Methods:

Twenty-nine Cantonese-speaking children aged 4 to 7 years participated in this study. All of them were diagnosed with ASD or autistic disorder. We assessed their severity of autistic symptoms (by the Social Communication Questionnaire, SCQ) and visual memory skills (by Beery Visual Perception sub-test, VM) since they were found to be correlated to gestural use (So, et al., 2016; So, Wong, & Lam, 2016). Higher scores in SCQ represent more sever communication and social skill symptoms while higher scores in VM represent better visual memory. Gestural communication skills were assessed in the recognition task, followed by the production task. Twenty pantomime gestures (e.g., DRIVE) and markers (e.g., GREETING) commonly used in daily life were tested in the assessments (So et al., 2016). In the gestural recognition task, children were asked to point to the corresponding meaning of these gestures demonstrated by a human model. In the gestural production task, children were asked to produce these gestures, one at a time, when prompted by the human experimenter (e.g., “What is the gesture for eating?”). Gestural production was evaluated by four parameters (use of hands, hand-shapes, placement, direction of movement). Any inaccuracy in one of the parameters would lead to erroneous production of that gesture.

Results:

There were individual variations in gestural recognition and production. Two separate multilevel logistic regression analyses were conducted for gestural recognition and production task performance, with participants and gesture items as the random effects and chronological age and scores of SCQ and VM were the fixed effects in each analysis. We found that SCQ negatively predicted gestural production, and VM positively predicted gestural recognition and production. The effect of age was not statistically significant in both analyses. Results indicated that children with better visual memory recognized and produced gestures better than those with poorer visual memory (Figure 1 right panels), suggesting that visual memory is substantially involved in gestural learning. Those with mild autistic symptoms gestured more accurately than those with more severe symptoms (Figure 1 left panels). This is probably because children with more severe autistic symptoms may not be able to use nonverbal means, including gestures, to communicate with others.

Conclusions:

Our findings suggested that we should take autistic symptoms and visual memory into consideration when designing gestural intervention programs that can cater different needs of children with autism. For example, more training sessions should be provided for those with poorer visual memory and more severe autistic symptoms.

46 **108.046** Gender Differences in Narrative Language in 10-Year-Olds with Autism Spectrum Disorder

O. Conlon[1]*, J. Volden*[1]*, I. M. Smith*[2]*, P. Szatmari*[3]*, P. Mirenda*[4]*, T. Vaillancourt*[5]*, C. Waddell*[6]*, L. Zwaigenbaum*[1]*, S. Georgiades*[7]*, T. Bennett*[8]*, E. Duku*[7]*, M. Elsabbagh*[9] *and W. J. Ungar*[10]*, (1)University of Alberta, Edmonton, AB, Canada, (2)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (3)Centre for Addiction and Mental Health, Toronto, ON, Canada, (4)University of British Columbia, Vancouver, BC, Canada, (5)University of Ottawa, Ottawa, ON, Canada, (6)Simon Fraser University, Vancouver, BC, Canada, (7)McMaster University, Hamilton, ON, Canada, (8)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (9)McGill University, Montreal, PQ, Canada, (10)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada*

Background: Autism spectrum disorder (ASD), characterized by deficits in social communication (SC), is found in 4:1 M:F ratio. This ratio has sparked questions about whether girls present a more subtle symptom profile. Because competence in SC requires synchronous application of social, cognitive and linguistic skill, it is particularly vulnerable to subtle differences in functioning making appropriately sensitive assessment tools imperative. Narrative analysis provides one way to examine SC. Conlon et al. (2015) examined narrative performance of 8-year-old boys and girls with ASD, matched on age, NVIQ (WISC4 Perceptual Reasoning Index, boys M=94.00: girls M=94.08) and language. Girls produced narratives containing more of the salient story elements (Ideas SS) than boys on the Expression Reception and Recall of Narrative Instrument (ERRNI) (Bishop, 2004). Follow-up detailed transcript analysis revealed that girls made fewer pragmatic errors and enhanced their stories (e.g., added emotional terms) more than boys.

Objectives: The current study examines the narratives of the same participants at age 10, to determine if gender differences persist.

Methods: Participants were 12 10-year old boys and 12 girls who had participated in Conlon et al. (2015). The ERRNI was administered. Current NVIQ and core language scores were not available, but Vineland Adaptive Behavior Scales-2, Communication SS were stable from age 8 to age 10 (ANOVA IV: Age, DV: VABS Comm SS, Boys F(1,10) = 0.637, p = 0.451, Girls: F(1,10) = 0.001, p = 0.977), as were ERRNI MLUw scores, a rough index of syntax (ANOVA IV: Age, DV: MLU, Boys: F(1,10) = 0.135, p = 0.725, Girls: F(1,10) = 2.50, p = 0.145). A coder, blinded to gender, analyzed the narrative transcripts for syntactic complexity, story macrostructure, pragmatic difficulties and semantic enhancement (e.g., mental state words) using a system modelled on Norbury, et.al. (2014). Preliminary results from four boys and four girls are presented.

Results: ANOVAs (IV: gender, DVs: ERRNI subscale SS) revealed significant gender differences on the Ideas SS, [F(1,22) =5.32 p=0.03, *d*=0.71], such that girls (M=85.29, SD=13.87) included more salient story elements than boys (M=75.41, SD=12.57). Significant differences were also found on the detailed transcript analysis; girls (M=0.28, SD=0.22) made fewer pragmatic errors (boys M=0.76, SD=0.21; F(1,6) = 9.72, p=0.02, *d*=2.23), semantically enhanced their narratives more (girls M=0.39, SD=0.07; boys M=0.09, SD=0.07; F(1,6) = 35.53, p=0.001, *d*=4.29), and used more complex syntax (girls M=0.33, SD=0.15; boys M=0.08, SD=0.04; F(1,6) = 10.72, p = 0.02, *d*=2.28). Girls also (M=0.33, SD=0.20) made fewer errors in sentence formulation (boys; M=0.73, SD=0.18; F(1,6) = 8.70, p=0.03, *d*=2.10).

Conclusions: ERRNI Ideas scores were significantly better in girls than boys, replicating the findings of Conlon et al (2015). Preliminary findings from detailed analysis on a subset (4 boys, 4 girls) indicate persistent gender differences in pragmatic errors and semantic enhancements, as previously found, and additional difficulties in syntax and sentence formulation in boys. Overall, the ERRNI captures broad but subtle SC differences between boys and girls with ASD. Detailed transcript analysis may help in understanding differences in SC in boys and girls with ASD.

47 **108.047** Indexing Social Focus in the Natural Conversations of Individuals with and without ASD

S. Uh[1]*, L. Bateman*[2]*, E. F. Ferguson*[2]*, M. Cola*[1]*, S. Plate*[1]*, Z. M. Dravis*[1]*, A. Pomykacz*[3]*, K. Bassanello*[1]*, A. Zoltowski*[4]*, J. D. Herrington*[5]*, K. Bartley*[5]*, E. S. Kim*[1]*, A. de Marchena*[6]*, J. Pandey*[1]*, R. T. Schultz*[1] *and J. Parish-Morris*[1]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)The Center for Autism Research/CHOP, Philadelphia, PA, (3)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (4)Vanderbilt University, Nashville, TN, (5)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of the Sciences, Philadelphia, PA*

Background: Language is a window into people’s inner worlds. Analyzing words produced during the course of a natural conversation can shed light on a person’s thoughts, feelings, personality traits, and interests (Tausczik & Pennebaker, 2010). In this study, we tested the extent to which social focus is evident in language, by exploring personal pronoun use in individuals with social communication challenges (autism spectrum disorder; ASD) and matched individuals that are typically developing (TD). We hypothesized that individuals with less social focus would use fewer personal pronouns during natural conversation with a naïve confederate, and individuals with more social focus would use more personal pronouns. Our natural conversation task was designed to be an ecologically valid analogue for everyday experiences of meeting new people and establishing relationships; an essential challenge for individuals with ASD and a frequent target for intervention.

Objectives: Use natural language to index social focus: Compare rates of all pronouns, personal pronouns, "I", "you", and "we" produced by individuals with ASD and typically developing control participants. Determine whether linguistic markers of social focus are validated by expert clinical ratings of social communication impairment: Correlate rates of personal pronoun use with autism symptoms in the ASD group.

Methods: Fifty-six participants aged 5-36 with ASD (N=38, 12 female) or typical development (N=18, 12 female) engaged in a ~5 minute unstructured "get to know you" conversation with one of 13 randomly assigned undergraduate confederates (10 female). Participants in the ASD and TD groups did not differ significantly on age (mean=14y) or IQ (106, all IQs>75), but did differ on sex ratio (*p*=.02). This limitation (uneven sex ratios by group) will be addressed before May, 2018 through increased sample sizes. Linear mixed effects regression models included diagnosis as a fixed effect and confederate ID as a random effect to account for individual differences among confederates.

Results: The ASD and TD groups did not differ on overall pronoun use (including words like "it" and "that"), but the ASD group produced significantly lower rates of personal pronouns than the TD group (*t*=2.29, *p*=.03, Fig.1). The ASD group produced less "we" than the TD group (*t*=2.11, *p*=.04), but groups did not differ significantly on rates of "I" or "you". In participants with ASD and ADOS evaluations (N=37), personal pronoun use correlated significantly with ADOS social affect calibrated severity scores (*r*=-.36, *p*=.03, Fig.2), but not with repetitive behaviors/restricted interests subscores (*r*=-.15, *p*=.38).

Conclusions: We found that short, naturalistic conversations with a naïve interlocutor provide an index of social focus that correlates with expert clinical ratings of social impairment. Specifically, we found that personal pronoun use is diminished in individuals with ASD relative to typical controls, and individuals with more autism symptoms produce fewer personal pronouns than individuals with fewer autism symptoms. This result holds promise as a potential metric for tracking social intervention effectiveness, via natural conversations that reveal the extent of an individual's social focus from week-to-week or even day-to-day.

48 **108.048** Integrative Nonverbal Communication in Children with ASD during Conversation and Free PLAY

***S. Tal**, I. Gordon, S. Fridenson-Hayo and O. Golan, Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel*

Background:

Nonverbal communication (NVC) has long been recognized as a core deficit in Autism Spectrum Disorder (ASD). NVC is multi-channel by nature, and conveys meaning via a finely-tuned, integrative presentation of facial expressions, gaze, vocal expressions, and gestures. NVC is context-bound by nature, and influenced by the social situation in terms of activity type and identity of the interaction partner. Integrative NVC deficit is currently a mandatory diagnostic criterion for ASD in the DSM-5. However, integrative NVC has rarely been empirically studied, and existing studies have not evaluated more than two NVC channel combinations. In addition, most studies focused on infants and toddlers, with little attention given to NVC in school-aged children.

Objectives:

To compare integrative NVC in children with ASD to that of Typically Developing (TD) school-aged children, during two contexts: positive conversation and joint free play. It was predicted that, compared to children with TD, children with ASD will exhibit reduced integrative NVC abilities, and would rely more on intense single channel NVC expressions.

Methods:

Thirty-nine children (1 girl) with ASD (clinically diagnosed, and verified using ADOS2), aged 5-10 years, with no intellectual impairment, and 31 typically developing (TD) controls (1 girl), matched on gender and cognitive abilities, were video-recorded with their mothers during a free-play, and during a conversation. Videos were micro-coded for display of single channel NVC behaviors: facial expressions (low vs. high intensity expressions), vocal expressions (low vs. high intensity expressions), gesturing (gesture production vs. no production) and gaze (directed to/away from mother's face). Integrative NVC variables were computed, and represented co-occurring NVC single channel behaviors. Parental reports regarding children's autism symptomatology were collected with the SRS-2.

Results:

During conversation, compared to their TD peers, children with ASD showed reduced integrative use of NVC, and intensified vocal and facial expressions. Reduced NVC on a single channel during conversation was only found for gesturing. Gesturing during conversation was also negatively correlated with SRS-2 social-communication scores, over and above group.

During joint free-play, compared to their TD peers, children with ASD showed more intensified vocal expressions and directed more gaze to their mothers' faces. These single channel group differences were found only when integrative NVC was examined, which suggests that children with ASD also exhibit integrative NVC deficits within a joint free play interaction with their mothers.

Conclusions:

The findings provide evidence for an integrative NVC deficit among children with ASD. In our elementary school-aged sample, Integrative NVC was found to be more indicative of NVC deficits of children with ASD, than single-channel NVC behaviors. Contextual differences were interpreted in terms of compensatory attempts during conversation (resulting in intensified facial and vocal expressions), and developmental delay during free-play (demonstrated through extensive gaze to mother's face) of children with ASD. These findings validate the NVC deficits of individuals with ASD, which have mostly been described clinically. Findings highlight the importance of NVC integration, and the role of various contexts when diagnosing children with ASD, and when designing appropriate interventions.

49 **108.049** Investigating Pragmatic Communication Abilities in Minimally Verbal Children and Adolescents with Autism Spectrum Disorder

***C. G. La Valle**[1], D. Plesa-Skwerer[2] and H. Tager-Flusberg[2], (1)Department of Psychological and Brain Sciences, Boston University, Boston, MA, (2)Psychological and Brain Sciences, Boston University, Boston, MA*

Background: Individuals with ASD demonstrate difficulties with pragmatic communication or an incongruence between situational demands and the communication employed (Tager-Flusberg et al., 2005; Volden et al., 2009). The pragmatic communication abilities of minimally verbal (MV) individuals with ASD and how these abilities change with age, has not been studied in-depth, although these individuals comprise 30% of the ASD population (Tager-Flusberg & Kasari, 2013). This research is relevant for assisting in the design of developmentally appropriate interventions to improve social communication in MV individuals with ASD.

Objectives: To compare the pragmatic communication abilities of MV children and adolescents with ASD.

Methods: Thirteen MV children with ASD (MV-C; 10 males; age range:6-11 years) and 13 MV adolescents with ASD (MV-A; 12 males; age range:12-18 years) were administered the ADOS (*n*=24 Module 1; *n*=2 Module 2). Transcripts of the ADOS sessions were coded for pragmatic functions building on a coding scheme developed by Tager-Flusberg & Anderson, 1991. Intelligible utterances were coded for contingency and function and adjusted for session length. Contingency was assessed in terms of adjacency (follows or doesn't follow prior adult utterance) and topic relevancy (contextually appropriate or inappropriate) and the utterances were coded for function. Function was assessed in terms of requests, agreement, disagreement, "yes" and "no" responses, scripted recitation (e.g., repeating fragments from various media) and perseverative speech (repetition of a word/phrase when inappropriate). Structural language was assessed in terms of rate/minute of intelligible utterances, different words used, and mean length of utterance in words (MLUw).

Results: MV-C had a lower rate of adjacent ($t(24)=2.537$, $p<.05$) and contingent utterances ($t(24)=2.669$, $p<.05$) compared to MV-A, but the groups didn't differ in nonadjacent utterances ($p>.05$), indicating that MV-A are responding in a more "topically related" way that builds upon the previous utterance elicited by the adult, compared to MV-C. When assessing function, MV-C had fewer requests ($t(24)=2.677$, $p<.05$), responses indicating agreement ($t(24)=2.649$, $p<.05$), disagreement ($t(24)=2.633$, $p<.05$), and "yes" and "no" responses ($t(24)=3.066$, $p<.05$) compared to MV-A, but they did not differ in scripted recitation or perseverative speech (*ps* >.05), suggesting that MV-A are utilizing a wider range of responses to maintain engagement with the examiner compared to MV-C. When assessing structural language, MV-C had fewer intelligible utterances ($t(24)=2.876$, $p<.05$) compared to MV-A; however the groups didn't differ in their rate/minute of different words used or MLUw (*ps* >.05; see Figure 1). Although, the groups didn't differ in the use of structural language, significant differences emerged when evaluating pragmatic communication.

Conclusions: Findings highlight developmental differences between MV-C and MV-A in their ability to engage in social exchanges, including conversations, as suggested by increasing contingency and a wider range of pragmatic functions demonstrated during the interactive ADOS sessions. Findings underscore the potential for improvement in pragmatic communication even among MV individuals with ASD, which should be a primary focus of language intervention. Clinical implications of the study findings suggest the utilization of speech and language therapy to support communicative development.

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108.050 Is Cross-Situational Word Learning Impaired in Children with Autism Spectrum Disorder?

C. Hartley[1]*, L. A. Bird*[2] *and P. Monaghan*[1]*, (1)Lancaster University, Lancaster, United Kingdom, (2)Lancaster University, Lancaster, United Kingdom of Great Britain and Northern Ireland*

Background:

Word learning is of crucial importance to language acquisition. The challenge of mapping sound-to-meaning is often characterised by referential ambiguity; there might be multiple potential referents for a newly-heard word. In the absence of ostensive cues, typically developing (TD) children can infer the meanings of new words from cross-situational statistics alone. By contrast, many children with autism spectrum disorder (ASD) experience impaired language acquisition and word learning. Here we explore whether children with delayed linguistic development have specific difficulty tracking word-referent co-occurrences.

Objectives:

The objective of this study was to examine the ability of children with ASD (and concomitant language delay) to identify, retain, and generalise the meanings of unfamiliar words from cross-situational statistics.

Methods:

Participants were 15 children with ASD (*M* age: 8.78 years) and 20 TD children (*M* age: 6 years) with similar receptive vocabulary age equivalents (ASD *M*: 5.7 years; TD *M*: 6.5 years). Populations differed on non-verbal IQ (TD *M*: 101.7; ASD *M*: 83.73; $t = 3.99$, $p < .001$). Using a touch-screen tablet, participants were presented with pairs of unfamiliar objects and were instructed to identify the referent of a novel word. These exposures were intentionally ambiguous (i.e. there was no cue to which object was the correct referent), but cross-trial statistics enabled children to disambiguate correct word-object pairings. Participants learned six new word-object relationships over 48 trials, divided into two blocks. After a 5-miute delay, children completed 24 test trials assessing label retention and generalisation to differently-coloured exemplars.

Results:

Performance on learning and test trials was analysed via generalised linear mixed effects models. Learning was significantly more accurate in Block 2 (ASD: 71.7%; TD: 74%) than Block 1 (ASD: 64.4%; TD: 68.5%; $Z=2.93$, $p=.003$), and populations did not differ. Both populations demonstrated similar accuracy on retention (ASD: 64.4%; TD: 65%) and generalisation test trials (ASD: 64.5%; TD: 67.5%) that significantly exceeded chance (all *ps* < .001). For children with ASD, both learning and test trial accuracy were predicted by receptive vocabulary ($Z = 3.78$-4.5, $p < .001$) and chronological age ($Z = 3.09$-3.4, $p = .002$-$.001$). For TD children, both learning and test trial accuracy were predicted by non-verbal IQ ($Z = 2.01$-3.12, $p = .04$-$.002$) and chronological age ($Z = 2.32$-2.35, $p = .02$).

Conclusions:

In comparison to TD controls matched on receptive vocabulary, the accuracy of cross-situational word learning in linguistically-delayed children with ASD is unimpaired. Both groups were able to identify, retain, and generalise novel word meanings from statistical associations alone. Thus, delayed language development in ASD may not be attributable to specific difficulties tracking word-referent co-occurrences. However, ASD may impact the mechanisms that scaffold this ability. Performance was predicted by receptive vocabulary in children with ASD and non-verbal IQ in TD children, suggesting that cross-situational word learning may be influenced by language-specific mechanisms in the former population and domain-general mechanisms in the latter. We recommend that follow-up analyses examine potential differences in reaction times and explore whether test trial accuracy can be enhanced by attentional cues during learning.

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108.051 Is Repetitive Speech a Marker of Development or Impairment?: Correlates of Unconventional Language Use

M. Maeda[1]*, C. Lord*[2] *and R. J. Luyster*[1]*, (1)Communication Sciences and Disorders, Emerson College, Boston, MA, (2)University of California Los Angeles, Los Angeles, CA*

Background: Children with ASD often use unconventional language, including echolalia, neologisms, idiosyncratic phrasing, and pedantic/formal speech. However, there is a tension in clinical realms: is unconventional language best characterized as functional language or as problematic, repetitive behavior? Speech-language therapy generally emphasizes the communicative value of unconventional language, treating it as a developmental achievement (Charlop, 1983; Tarplee and Barrow, 1999). In contrast, behavioral approaches tend to focus on reducing unconventional language, interpreting it as a problem behavior (Lanovaz & Sladeczek, 2012; Neely, Gerow, Rispoli, Lang, & Pullen, 2016). Despite this marked divide, there is a relative dearth of empirical evidence associating unconventional language with language, cognitive, adaptive, or behavioral characteristics.

Objectives: The objective was to address whether unconventional language is associated with higher or lower scores across measures of language, cognition, adaptive functioning and repetitive behaviors.

Methods: Children were selected from a larger sample (Anderson, Liang, & Lord, 2014; Lord et al., 2006). Sixteen children with high levels of unconventional language at ages 2 and/or 3 (based on the Autism Diagnostic Observation Schedule, ADOS) were identified. Each child was individually matched on gender/nonverbal ratio IQ to a child with no evidence of unconventional language on the ADOS. This resulted in an overall sample of 32 children: 16 with high levels of unconventional language (HiUL), and 16 with low levels of unconventional language (LoUL).

Results: The HiUL group had higher ratio verbal IQ than the LoUL group, $t(30)=4.13$, $p<.001$. Similarly, HiUL had higher standard scores for the Vineland Communication [$t(30)=4.05$, $p<.001$)] and Socialization domains [$t(30)=2.49$, $p<.05$], though no group differences were noted in Vineland Daily Living Skills or Adaptive Behavior Composite. On the ADOS, HiUL had *lower* social affect algorithm scores – indicating lesser impairment – than LoUL [$t(30)=2.42$, $p<.05$]. There was no significant difference in the restricted and repetitive behavior algorithm scores. On the Repetitive Behavior Scale-Revised (RBS-R), the HiUL group had a *lower* mean score (M=21.80, SD=15.89) than the LoUL group (M=11.67, SD=8.74), though the difference was not significant.

However, we note a potential bias in the ADOS, whereby children could be scored as having low levels of unconventional language because of minimal expressive language overall. Therefore, a second round of matches was generated (HiUL: n=6; LoUL: n=6), including only children who showed established single word speech on the ADOS. Table 1 indicates a consistent pattern of results: HiUL showed higher average skills. Mann Whitney tests were significant ($p<.05$) for the Vineland Communication and Socialization domain scores and Adaptive Behavior Composite.

Conclusions: These findings indicates that -- compared to LoUL peers -- children with high levels of unconventional language in their toddler/preschool years have higher communication skills and lower levels of social impairment. This has important clinical implications: these preliminary findings support the position that unconventional language is associated with developmental progress and should not be discouraged in therapeutic settings. Additional analyses will address associations between early unconventional language and adolescent outcomes.

52 **108.052** Is the Sky Blue?: Question Asking in Children with ASD

A. Netburn[1], J. Georgeson[1], S. Arunachalam[2] and ***R. J. Luyster**[1]*, *(1)Communication Sciences and Disorders, Emerson College, Boston, MA, (2)Boston University, Boston, MA*

Background: As they grow, children use language in a number of different ways. A substantial amount of research in typically developing children delineates the importance of *question-asking* for linguistic, cognitive and social development. In autism spectrum disorder (ASD), language development is often impaired or delayed. Although there are a few intervention studies detailing procedures to teach, or train children with autism to correctly use questions, there is a dearth of research exploring everyday question-asking in children with autism. Better understanding naturalistic question-asking in children with ASD would provide clues about opportunities for everyday learning across language, cognitive and social domains.

Objectives: The aim of this research is to investigate the frequency, content, and development of question-asking in young children with ASD.

Methods: This study contains preliminary data from a two-part online survey. Part I included demographics and questions about daily activities. Participants were then instructed to spend time observing their child's language. Approximately one day later, they were sent an email with a link to Part II, which focused on question-asking. Recruitment is ongoing, but to date, reports have been collected from caregivers with children under 6 years of age; 55 caregivers had a child with ASD (8 female), and 22 had a child with typical development (TD, 5 female). Children were categorized by their caregivers according to expressive language level, including (a) those who spoke at the single word level (9 ASD; 4 TD), (b) those who spoke in 2-3 word phrases (28 ASD; 11 TD), and (c) those who spoke in sentences of 4 or more words (18 ASD; 7 TD).

Results: Comparisons across diagnostic groups were conducted according to caregiver-reported language level. Because of the small cell sizes for the TD sample, non-parametric tests were used. Preliminary analyses suggest that the proportion of utterances that are questions did not differ across diagnostic groups (within expressive language levels; see Figure 1a). However, for children using phrase-level speech, the children with ASD used significantly fewer questions per day than the TD ($p=.001$; see Figure 1b and c), and a similar pattern was observed for the children using sentence level speech (though it was not significant, $p=.05$; see Figure 1b and e).

Qualitative review of the data suggests some other important points. First: many more children with ASD (even those who are speaking in phrases or sentences) are reported by their caregivers to ask fewer than 10 questions per day (see Figure 1c and e). Moreover, caregivers of children with ASD report less frequent usage of *what, where, when, why* and *how* questions than caregivers of TD children, whereas groups are remarkably similar in their rates of *yes/no* questions (see Figure 1d and f).

Conclusions: These results suggest that typically developing children and children with ASD approach the developmental process of question-asking considerably differently. By asking fewer questions overall and by favoring dichotomous *yes/no* forms over more open-ended *what, where, when, why* and *how* questions, children with ASD may create fewer and less rich opportunities to learn from their world.

53 **108.053** Joint Attention Skills Concurrently Predict Receptive Vocabulary in Minimally and Low Verbal Youth with ASD

***M. G. Pecukonis**, D. Plesa-Skwerer and H. Tager-Flusberg, Psychological and Brain Sciences, Boston University, Boston, MA*

Background: While 30% of individuals with ASD are classified as minimally or low verbal, little is known about the correlates of language ability in this population (Tager-Flusberg & Kasari, 2013). It has been argued that joint attention (JA) skills, which are often impaired in ASD (Mundy, Sigman,

Ungerer, & Sherman, 1986), are a precursor to language development (Tager-Flusberg, Paul, & Lord, 2005). However, several studies that have found a relation between language and JA skills in ASD have not differentiated between responding and initiating JA (e.g., Bean & Egisti, 2012). Furthermore, many of these studies have been conducted with young and/or verbally fluent samples (e.g., Dawson et al., 2004). Thus, there is a need to explore the relation between specific types of JA skills and language in older, minimally and low verbal youth with ASD.
Objectives: To investigate the relation between joint attention (JA) skills and concurrent receptive vocabulary in minimally and low verbal youth with ASD.

Methods: 59 minimally and low verbal youth with ASD (41M, 18F), ages 5.33 to 20.92 years, participated in this study (Table 1). Raw scores from the Initiating Joint Attention (IJA), Responding Joint Attention (RJA), Pointing, and Showing items of the Autism Diagnostic Observation Schedule-2 (ADOS-2; Lord et al., 2012) or the Adapted ADOS (A-ADOS; Hus & Lord, in preparation) were collected. Youth also completed the Peabody Picture Vocabulary Test-4 (PPVT-4; Dunn & Dunn, 2007), a standardized measure of receptive vocabulary. Non-verbal IQ (NVIQ) was measured using the Leiter International Performance Scale-3 (Roid, Miller, Pomplun, & Koch, 2013).

Results: Age was not significantly correlated with JA or PPVT-4 scores (*p*s > .1). NVIQ however was significantly correlated with RJA and PPVT-4 scores (r_s=-.273, *p*=.037; r_s=.364, *p*=.005, respectively). When controlling for age, NVIQ, and gender, RJA, Pointing, and Showing scores were significantly correlated with PPVT-4 scores (r_s=-.278, *p*=.038; r_s=-.315, *p*=.018; r_s=-.337, *p*=.01, respectively), while IJA scores were not significantly correlated with PPVT-4 scores (r_s=-.212, *p*=.116) (Figure 1).

Conclusions: The findings demonstrate that better RJA, Pointing, and Showing, but not IJA, skills are related to higher receptive vocabulary in minimally and low verbal youth with ASD. The results may be explained by the scoring guidelines for these ADOS items. The RJA item includes response to both gaze and gesture (i.e. pointing and showing), while the IJA item includes initiation of gaze only. Importantly, the Pointing and Showing items include initiation of these gestures. Therefore, deficits in JA skills, particularly the response to and initiation of explicit pointing and showing gestures, may explain why some youth with ASD fail to acquire receptive language. Gaze may have less of an influence on acquisition of receptive language in these older youth with ASD. Future studies should examine the relation between language and objective measures of gesture versus gaze skill. The findings also highlight the importance of targeting non-verbal communication skills, particularly explicit gesture behaviors, in interventions to improve language outcomes throughout development.

54 **108.054** Language Discrepancy and Aggressive Behaviors in Individuals with Autism Spectrum Disorder

H. V. Medeiros[1], *E. Hanson*[2] *and P. Hickey*[1,3], *(1)Developmental Medicine, Boston Children's Hospital, Boston, MA, (2)Boston Children's Hospital/Harvard Medical School, Boston, MA, (3)Psychology, Tufts University, Boston, MA*

Background: Individuals with Autism Spectrum Disorder often display deficits in language, with receptive skills frequently more developed than expressive **(**Tager-Flusberg & Kjelgaard, 2001). Aggression is also prevalent, with 1 in 4 individuals exhibiting these behaviors (Hill et al., 2014). Previous studies identified a relationship between language and aggression (Estrem, 2010) but have not examined the impact of a discrepancy in receptive and expressive skills on aggression.
Objectives: The current study used language and aggression scores to see if data replicated previous studies. This study first assessed for discrepancy between receptive and expressive language ability, and then assessed the correlation between the amount of discrepancy, direction of discrepancy, and possible relation to physical aggression levels.

Methods: Data on individuals with ASD (n = 713) aged 1.9 to 22.7 years was used from the Simons Simplex Collection and the Boston Autism Consortium. Diagnosis was verified using The Autism Diagnostic Observation Schedule and Autism Diagnostic Interview-Revised (ADI-R). The Vineland Adaptive Behavior Scales were used to measure receptive and expressive language skills. Aggression was measured by ADI-R items 81, 82, and 83: “aggression towards caregivers/family” and “towards non-caregivers/non-family” and “self-injurious behavior” on a 0-3 scale (0=not present). The ADI-R was used to evaluate participant’s age of onset of aggressive symptoms and the current presence or absence of aggression. We calculated a mean value for behaviors by averaging the current aggression scores (CAS).

Results: Results suggest that a majority of our cohort (65%) exhibited language delay and (70%) aggressive behaviors. 84% of the sample had discrepancies between their receptive and expressive language skills, with 8.5% being a statistically significant discrepancy and 6.5 % having significantly higher receptive language (HRL). There was a significant relationship between CAS and HRL (p=.011), with larger discrepancy related to higher (more severe) aggression. There was also a significant relationship between HRL and aggression towards caregivers/family (p=.034) as well as aggression towards self (p=.036). Results were not significant for non-caregiver/non-family members (p=.259).

Conclusions: Preliminary results suggest a significant relationship between HRL and CAS within the family, as well as for self-injurious behavior, whereas there was not a significant relationship between HRL and CAS for non-family members. The current study highlights the importance of examining receptive and expressive skills as separate variables within the context of current aggressive behaviors. Future directions include analyzing the sample of children who displayed higher expressive than receptive language skills within the context of aggression (2% displayed statistically significant higher expressive language skills).

55 **108.055** Linguistic Markers in the Narratives of Children on the Autism Spectrum

K. F. Schroeder[1,2], *M. García*[1,2], *J. Rosselló Ximenes*[1,2] *and W. Hinzen*[2,3], *(1)General Linguistics, University of Barcelona, Barcelona, Spain, (2)Grammar and Cognition Lab, Barcelona, Spain, (3)Catalan Institute for Advanced Studies and Research (ICREA), Barcelona, Spain*

Background: Narratives are ecological means to elicit speech in clinical populations- both to assess formal aspects of language as well as how language construes a shared reality of agents and events. While narrative skills are assessed in diagnostic measures such as the Autism Diagnostic Observational Schedule (ADOS), the language which builds these narratives rarely receives analysis. Previous literature on narratives in autism spectrum conditions (ASC) have shown that referential anomalies distinguish children with ASC from clinical groups like ADHD or typically-developing peers [1, 2] and may relate to ASC symptom severity [3]. However, this previous work has not looked at reference fully systematically.
Objectives: In the present study, we catalogue referential constructions and errors though a linguistic lens and explore the relation between qualitative deficits in narratives and specific grammatical profiles.
Methods: Fifteen children with high-functioning ASC (mean age: 8.6, range: 7-12 years) and fifteen typically-developing controls who were

individually matched on verbal-IQ and chronological age participated in the storybook narration task of the ADOS. Narratives were transcribed and annotated for various grammatical constructions across nominal, verbal, and clausal domains. Narratives were further rated for story completeness and errors were catalogued.

Results: Our results showed that our ASC population didn't differ from controls on errors (all $p \geq .325$). However, we found significant differences in the way in which the narratives were built- primarily with regard to a reduction of anaphoric devices ($p = .003$) and relative clauses ($p = .011$) in the ASC group. The proportional reduction of anaphora correlated to lower overall story completeness and quality across groups (r=.514; p =.004).

Conclusions: These results show that even at the high-functioning end of the spectrum and controlling for verbal IQ, linguistic markers based on fine-grained grammatical measures can detect ASC against typically developing controls.

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56 **108.056** Listening in Your Shoes: Can Children with Autism Take the Perspective of Others When Interpreting Language?

K. Abbot-Smith[1], *D. M. Williams*[2] *and D. Matthews*[3], *(1)University of Kent, Canterbury, United Kingdom of Great Britain and Northern Ireland, (2)University of Kent, Canterbury, United Kingdom, (3)School of Psychology, University of Sheffield, Sheffield, United Kingdom*

Background: Individuals with Autism Spectrum Disorder (ASD) frequently fail to interpret the intent of a speaker's utterance, apparently because they have difficulty determining the crucial aspects of common ground, which they share with the speaker. Only two studies (both with adults with ASD) have previously investigated this experimentally (Begeer et al., 2010; Sanstieban et al., 2015). Both manipulated level one visual common ground (whether the speaker can see a particular object). Both found that the participants with ASD were unimpaired relative to typical controls. However, visual perspective-taking may not align in development with social perspective-taking, which is understanding the interlocutor-specific experiences shared with the conversation partner.

Objectives: To determine whether social versus visual perspective-taking have differential effects on the ability of children with ASD to interpret requests.

Methods: We compared 24 eight- to eleven-year-olds with ASD with 23 typically-developing eight- to eleven-year-olds. Groups were matched on non-verbal IQ, receptive language, chronological age and gender. Children interpreted requests (e.g. 'Can I have that ball?') in contexts which would be ambiguous (i.e. because the child can see two balls) if perspective-taking was not utilized. There were three within-subjects conditions: Social perspective-taking, Level 1 Visual Perspective-taking (VPL1) and Level 2 Visual Perspective-taking. There were three trials per condition. For each the requester wore dark sunglasses and did not point. In the VPL1 condition one of the two objects was hidden from the viewpoint of the requester (E1). The correct choice was the object that the requester could see. In the Social Condition, the child was told that E2 had bought toys that E1 had not yet seen. E2 passed one of these (e.g. a pink ball) over to E1, who played with / discussed this with the child. Then E1 left the room and E2 showed the child another object of the same type (e.g. a yellow ball) and played with /discussed this with the child. When E1 returned to the room, both the child and E1 could see two balls as E1 excitedly verbalized the request. The correct choice was the object that was new for E1 (here: yellow ball).

Results: Overall the group with ASD performed significantly worse than the typically-developing control ($p = .032$, $\eta_p^2 = .073$). Their performance was not found to relate to affect recognition. There was also a main effect for condition ($p = .033$, $\eta_p^2 = .097$). Children with ASD found the Social Condition significantly harder than the VPL1 Condition (p <.01). Nonetheless, Social and VPL1 conditions were strongly inter-correlated for children with ASD ($r = .73$, $p < .001$), even when non-verbal IQ, receptive language and age were partialled out ($r = .73$, $p < .001$).

Conclusions: Children with ASD find it more difficult to use social than to use VPL1 to interpret language. VPL1 may be a more basic form of social perspective-taking (Harris, 1992) since the two are related. A large proportion of intellectually high-functioning children with ASD may have difficulty interpreting language if instructions or discourse require social perspective-taking

57 **108.057** Property Extension in ASD: Categorically but Not Perceptually Restricted

V. Tecoulesco *and L. R. Naigles, Psychological Sciences, University of Connecticut, Storrs, CT*

Background: Difficulties with how words are represented, organized, and accessed have been observed in individuals with Autism Spectrum Disorder (ASD). Category formation and generalization abilities are also often atypical in ASD, with school age children and adolescents frequently performing inconsistently on categorical induction tasks. For example, they often restrict properties assigned to specific instances of a named category, to the taught instance itself rather than extending to new instances of that named category (Kelley et al., 2006). What is still unclear is whether their category restrictions apply to all new instances vs. just instances that differ visually/perceptually from what was taught.

Objectives: The current study compares TD children and children with ASD during their early school years on their extension of stated properties to new instances when these instances were (a) identical except for the pose, (b) from the same category but different perceptually, and (c) perceptually similar but from a different category.

Methods: Typically developing (TD) children (N=29, MA =5.55 years (0.33), 5 girls) and children with ASD (N=16, MA= 6.35 years (0.59), 2 girls) participated. The children's Test for Auditory Comprehension of Language (TACL-3) vocabulary raw scores were similar (M(TD)=36.66(4.78), M(ASD)=32.31(5.47) although the TD group was more advanced (t(43)=2.81,p = 0.008). Pictures of eight natural kinds, both animate and inanimate, were presented. Children were asked to predict whether a known property of one member of a named category would be applicable to another member of the same category. For example: "This white rabbit eats grass. Does this brown rabbit/white squirrel/white-rabbit-in-different-pose/cat also eat grass?" The four test pictures included a target (same natural kind but different color or form), perceptually similar but not the same category, same natural kind with slight modifications in pose, and a distractor.

Results: Most TD children and children with ASD successfully extended the attribute to the slightly modified item of the same natural kind at above chance levels (TD=93%; ASD=88%); however, the TD group performed more consistently than the ASD group (M(TD)=7.24(1.15); M(ASD)=5.88(1.59); t(43)=3.32, p=0.002). With the critical target item, the TD group endorsed the category extension significantly more often than the ASD group: M(TD)=4.72(1.51), M(ASD)=3.56(1.86) (t(43) =2.27 p=0.028). Many in the TD group performed above chance unlike most in the ASD group (TD=59%, ASD=25%). These group differences held when TACL vocabulary scores were entered as a covariate (Fs >4.76, ps<0.035). Finally, for the physically similar but not of the same natural kind stimuli, there were no observed differences between the groups t(43)=-1.773, p=0.09, who both endorsed the physical similarity foil at levels significantly below chance.

Conclusions: Both the TD and ASD groups successfully extended the property to instances that only varied in pose from the taught instance; hence, property extension is not completely restricted in children with ASD. However, when property extension involved perceptual differences within a named category, the children with ASD performed at chance, unlike the TD children. Thus, extension on the basis of categories seems to be a major challenge for children with ASD.

58 **108.058** Relating Neural Response Consistency to Complex Speech Sounds and Concurrent Language Ability in School Age Children

V. Tecoulesco[1]*, K. Stevens*[2]*, D. A. Fein*[1]*, E. Skoe*[3] *and L. R. Naigles*[1]*, (1)Psychological Sciences, University of Connecticut, Storrs, CT, (2)University of Connecticut, Storrs, CT, (3)Speech Language Hearing Sciences, University of Connecticut, Storrs, CT*

Background: Investigations into the neurological basis of atypical language development in autism spectrum disorders (ASD) have largely focused on cortical indices. Atypical language-relevant neural networks, however, may also arise from unreliable sensory representations. Auditory brainstem responses (ABR), auditory evoked potentials that reflect neural activity in the auditory nerve and brainstem, have been linked to reading ability in the general population and in dyslexia (Banai et al.,2009). In addition, abnormal neural conduction time, as revealed by prolonged ABR latencies, has been found in the ASD central auditory system. ABR responses recorded in childhood have recently been linked to more advanced language development displayed several years earlier, in late toddlerhood.
Objectives: The purpose of the current study is to investigate the extent to which instabilities in early stages of central auditory processing can account for differences in language development in ASD by examining the relationship between neural response consistency to complex speech sounds and current language ability.

Methods: Typically developing (TD) children (N=8, MA=11.25 years (1.9), 2 girls) and children with ASD (N=8, MA=12.5 years (3.59), 1 girl) participated. All testing was performed in the children's homes using a portable EEG system, including a screening for normal hearing thresholds, and ABR recordings to a "da" stimulus (10.9/sec, 6000 trials) presented at 80 dB SPL. Consistency was determined by correlating the first 3000 responses with the last 3000 responses. Current language ability was measured using four subtests of the Clinical Evaluation of Language Fundamentals 5 (CELF-5); Word Classes, Formulated Sentences, Repeated Sentences, and Following Directions. Nonverbal cognition was measured using the Differential Ability Scales (DAS).

Results: No significant group differences were found for ABR consistency. The TD group scored significantly higher than the ASD group on all four CELF 5 subtest standard scores (*Fs* > 12.67, *ps* < .003) raw scores (*Fs* > 5.23, *ps* < 0.038) and age equivalents (Fs > 5.79, ps < 0.03). These group differences held (ps < 0.006, ps < 0.04, ps < 0.049) when digit span from the DAS was entered as a covariate. Significant correlations were found for ABR response consistency and three CELF-5 subtest standard scores (Word Classes, Formulated Sentences, and Repeated Sentences), for the ASD group only (*rs* > 0.797, *ps* < 0.018). Formulated Sentences raw scores and age equivalents also correlated significantly with ABR responses (*rs* > 0.757, *ps* < 0.03).

Conclusions:

In children with ASD, /da/ ABR consistency has a significant relationship to concurrent language, such that greater neural fidelity in representing auditory input is associated with more advanced language abilities. Both knowledge of how words relate to each other as well as the ability to remember and formulate grammatically correct sentences are positively correlated with how consistently sensory input was being processed early in the auditory pathway, suggesting that some origins of language delays and impairments in ASD may lie in inconsistent auditory processing. The absence of similar relationships in the TD group could be an artifact of the limited variability of both language measures and ABR responses in this group.

59 **108.059** Linking Auditory Processing and Lexical Representation Via Phonological Discrimination

V. Tecoulesco[1]*, E. Skoe*[2] *and L. R. Naigles*[1]*, (1)Psychological Sciences, University of Connecticut, Storrs, CT, (2)Speech Language Hearing Sciences, University of Connecticut, Storrs, CT*

Background: Auditory Brainstem Responses (ABRs) are auditory evoked potentials recorded on the scalp that reveal the earliest stages of auditory processing. Prolonged conduction time to click-evoked ABRs as well as differences to speech-evoked ABRs have been found in children with autism spectrum disorders (ASD). The Auditory Stability Hypothesis of Language Development, proposes that inconsistent neural processing of sound negatively impacts the ability to form a stable representation of the auditory world, thus disturbing higher-level functions, such as language, that depend on that sensory signal. Unstable neural responses to sound may be characteristic of reading-impaired populations, and recent evidence suggest that other language-impaired individuals, including those with ASD, may likewise have unstable neural responses to sound, suggesting that stability of auditory processing may support language development in both typical and atypical populations.
Objectives: The purpose of this project is to study the connections between auditory processing and language learning using a phonological discrimination task, which by hypothesis links early auditory processing and macro-level language competency. The overarching goal is to understand the role of consistency of sound processing in early word learning by looking at its effect on phonological discrimination.

Methods: Sixteen children participated in the study, eight typically developing (TD) (two girls) with a mean age of 11.25 (1.9) years and eight diagnosed with ASD (one girl) with a mean age of 12.5 (3.59) years. All participants were first screened for normal hearing thresholds. ABRs were recorded in response to a "da" stimulus (10.9/sec, 6000 trials) presented at 80 dB SPL. To assess phonological discrimination, pairs of bisyllabic CVC-CVC (consonant-vowel-consonant) novel words that differed by only one phonemic unit (biskar vs. bisdar) or were identical (selzim vs. selzim) were presented, and the child was asked if they were the same or different. Current language ability was measured using four subtests of the

Clinical Evaluation of Language Fundamentals 5 (CELF-5); Word Classes, Formulated Sentences, Repeated Sentences, and Following Directions.

Results: The TD group performed significantly more accurately on phonological discrimination than the ASD group (*t*(14)= 2.84, *p*= 0.023). Neural response consistency was positively correlated with phonological discrimination ability in the ASD group (*r*=0.825, *p*= 0.014) but not in the TD group (*r*= 0.213, ns). Bivariate correlations including both groups found that children with better phonological discrimination also had higher standard scores on all CELF 5 subtests (*rs*> 0.747, *ps* < 0.001). The relationship between neural response consistency and language ability (Formulated Sentences and Word Classes) was mediated by phonological discrimination, as indicated by a Sobel test (*z's*>2.28, *ps* <0.02).

Conclusions: Phonological discrimination appears to mediate the relationship between neural response consistency to speech sounds and current language ability. Neural consistency may engender firmer phonological representations that encourage word-learning as well as more advanced language development. As group differences were not observed between TD and ASD this may indicate that similar processes are at work in both typical and atypical populations. Greater heterogeneity within the ASD sample may account for more pronounced relationships between phonological discrimination and neural responses.

60 **108.060** Measuring the Broad Autism Phenotype in Parents of Children with Autism

K. Nayar[1], *N. Maltman*[2], *S. P. Patel*[2], *L. Bush*[3], *S. Crawford*[4], *G. E. Martin*[5] *and M. Losh*[6], *(1)Feinberg School of Medicine, Department of Psychiatry and Behavioral Sciences, Northwestern University, Evanston, IL, (2)Northwestern University, Evanston, IL, (3)Northwestern Feinberg School of Medicine, Chicago, IL, (4)Communication Sciences and Disorders, Northwestern University, Chicago, IL, (5)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (6)Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: The broad autism phenotype (BAP) refers to a constellation of subclinical personality and language features in unaffected relatives of individuals with autism spectrum disorder (ASD), thought to index genetic liability to ASD, and therefore informative for understanding ASD etiology. Whereas gold standard diagnostic tools exist for evaluating ASD, methods for characterizing the BAP are less consistent, including direct assessment measures that have the benefit of objective independent ratings based on concrete behavioral examples, as well as questionnaires that rely on self- or informant-reports and are therefore more efficient but susceptible to rater bias. Indeed discrepancies between self- and informant-reports have been observed, pointing to a strong need to evaluate different measures of the BAP to determine the most accurate methods for characterizing this important construct.

Objectives: This study compared rates of the BAP using gold standard direct assessment measures, and questionnaire data in mothers and fathers of individuals with ASD. We examined interrelationships among measures, and within-family correlations of clinical-behavioral features across measures that could provide insights into those measures most sensitive to biologically meaningful clinical features.

Methods: One hundred eighty four parents of individuals with ASD were assessed for personality and language features of the BAP using three different methods: 1) the Modified Personality Assessment Scale Revised (MPAS-R; Tyrer, 1988), a direct assessment interview, 2) the Broad Autism Phenotype Questionnaire (BAPQ; Hurley et al., 2007), and 3) the Pragmatic Rating Scale (PRS; Landa, 1992), which was used to assess pragmatic language during semi-naturalistic conversations. BAP status was established based on established cut-offs (Hurley et al., 2007; Losh et al., 2008). Within family associations in clinical-behavioral symptoms were examined with child variables from the ADOS, ADI-R, and the Pragmatic Rating Scale-School Age (PRS-SA).

Results: The self and informant ratings of the direct assessment MPAS-R classified 48% and 49% of the sample as BAP+, respectively. The self and informant ratings of the BAPQ classified 15% and 19% of the sample as BAP+, respectively. The BAPQ captured only 25% (self) and 20% (informant) of those classified by the MPAS as BAP+. The PRS classified 22% of the sample as BAP+ on the pragmatic language trait only. The BAPQ classified only 23% (self) and 20% (informant) of these individuals as “positive” for the pragmatic language feature of the BAP. Parent-child correlations revealed negative associations between the BAP (as measured by direct assessment on the MPAS-R) and child ADI-R social and verbal communication scores (*ps*<.05). Similarly, the pragmatic language domain on the BAPQ was negatively associated with child’s overall ASD symptom severity (*p*<.03).

Conclusions: Findings suggest that questionnaires may markedly under-classify the BAP, relative to objective, direct assessment measures of personality and pragmatic language. Parent-child correlations were also most robustly observed with direct assessment measurement of the BAP. Theoretical and methodological considerations for future studies of quantitative traits in ASD and in family members will be discussed.

61 **108.061** Mechanisms of Voice Control in Autism Spectrum Disorder: A Family Study

S. P. Patel[1], *J. H. Kim*[2], *C. R. Larson*[2] *and M. Losh*[1], *(1)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (2)Northwestern University, Evanston, IL*

Background: Impairments in prosody (e.g., intonation, rate), have been noted since the earliest descriptions of social communication impairments in autism spectrum disorder (ASD; Kanner, 1948). Additionally, subtle differences in prosody have been identified in a subset of parents of individuals with ASD with the broad autism phenotype (BAP; Losh et al., 2012). Existing investigations of prosody in ASD have focused primarily on perceptual judgments and global acoustic measures (e.g., fundamental frequency), which are beneficial in characterizing prosodic profiles within this population; however, these studies have failed to investigate the feedforward and feedback control mechanisms, which support planning, production, self-monitoring, and self-correction of speech (Guenther, Tourville, & Bohland, 2015), that may underlie prosodic atypicalities in ASD.

Objectives: This study investigated potential breakdowns in sensorimotor monitoring and correction of prosody in individuals with ASD and their parents.

Methods: A pitch-altered voice auditory feedback paradigm in which participants vocalized and received real-time auditory feedback of their voice was implemented (Burnett et al., 1998). Participants included individuals with ASD (n=20), their parents (n=20), and respective controls (n=20 proband controls; n=23 parent controls). In the first task (“vowel”), participants vocalized “ah” for five seconds, while five randomly-timed pitch alterations occurred. Simultaneously, event-related potentials (ERPs) to pitch alterations were recorded using a 32-electrode electroencephalography (EEG) system. In the second task (“speech”), participants asked the question “You know Nina?” and one pitch alteration occurred on the third syllable. Vocal responses from both tasks were examined in relation to prosodic abilities assessed by the *Profiling Elements of Speech Prosody-Communication* assessment (Peppé & McCann, 2003).

Results: The ASD group had larger responses to pitch-altered voice auditory feedback in the vowel task compared to controls (*p*=.03). Increased vocal response magnitudes during vowel production in both ASD and their controls, were associated with poorer expressive prosodic abilities (*p*s < .05). The ASD parent group did not differ from parent controls in vocal response magnitude during the vowel task, but preliminary ERP results demonstrated smaller N1 amplitudes in fronto-central electrodes in ASD parents (*p* =.09). Both ASD and ASD parent groups demonstrated reduced vocal responses in the speech task compared to respective control groups (*p*s <.02). Differences in the parent groups were driven by parents with the BAP (*p* < .02).

Conclusions: In the ASD group, larger vocal responses to pitch-altered voice auditory feedback during vowel production but attenuated responses during speech, suggest difficulty incorporating auditory feedback cues into vocal control mechanisms. ASD parents, specifically those with the BAP, also demonstrated attenuated responses during speech, suggesting that response magnitudes to pitch-altered voice auditory feedback during speech may index genetic liability to ASD. ERP results from ASD parents during vowel production may indicate attenuated abilities in detecting mismatches between intended and actual sensory consequences. Correlational analyses provide additional support for the relationship between vocal responses to pitch-altered auditory feedback and prosodic production. Ongoing analyses investigate differences in response magnitude between vowel and speech tasks to determine if individuals with ASD and their parents demonstrate task-dependent responses similar to controls (Chen et al., 2006).

62 **108.062** Multimodal Communicative Patterns in Toddlers with Autism Spectrum Disorders and Toddlers with Other Developmental Disorders: A Deeper Look.

*E. Murillo[1], **L. Boada**[2] and M. Parellada[3], (1)Psicología Básica, UAM. Universidad Autonoma de Madrid, Madrid, Spain, (2)Hospital Universitario Gregorio Marañón. Child and Adolescent Psychiatry. IISGM. CIBERSAM, Madrid, Spain, (3)Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background:

Typically developing children produce multimodal communicative behaviors from the early stages of language development. The coordination of elements such as gestures, vocalizations and use of gaze has an important predictive value in the development of later language skills. For example, the coordinated use of gestures and vocalizations at 12 months is an important predictor of lexical development three months later (Murillo & Belinchón, 2012; Wu and Gros-Louis, 2014).

Many studies have shown that children with Autism Spectrum Disorder (ASD) have difficulties in the use of gestures with a communicative purpose and in the integration of multimodal information. For instance, prospective studies of high-risk children subsequently diagnosed with ASD indicate differences in the use of gestures and vocalizations at one year of age (eg, Parladé and Iverson, 2015). However, there is also some contradictory evidence. Some studies with adults and adolescents with ASD found no differences in the frequency of gestures production neither in its temporal coordination with speech compared to those with typical development. It seems, therefore, that the synchrony of communicative resources constituting multimodal communicative behaviors can be specifically affected in children with ASD at very early stages of development.

Our hypothesis is that children with ASD will produce not only less communicative behaviors, but specifically less multimodal communicative behaviors than children with other language or developmental disorders.

Objectives:

To explore the production of multimodal communicative behaviors as a specific marker of ASD.

Methods:

Participants: 6 children (4 boys, 2 girls) aged between 23 and 40 months assessed at a University Hospital due to social and communicative development concerns. Three of the participants had an ASD diagnosis, and the other three had a language or developmental disorders. Both groups were matched by age.

The ADOS was administered individually by a clinician with the appropriate clinical and research training and reliability for the administration of the instrument and the session was recorded for later analysis. We analyzed 180 minutes of behavior through the module 1 of the ADOS-G using ELAN software by the Max Planck Institute for Psycholinguistics.

We registered and coded all the communicative behaviors (a total of 668) during the ADOS-G administration session. Coding system included different categories for gestures, vocalizations and social use of gaze. The coders were blind to children's ages and diagnosis.

Results:

As expected, children ASD showed a lower frequency of communicative behaviors than children with a non-ASD diagnosis (U=0; z=-1,964; p=0,050). They produced less vocalizations (U=0; z=-1,964; *p*=0,050) **and less multimodal behaviors, combinations of gestures and vocalizations than children in the non-ASD group (U=0; z=-1,964;** *p*=0,050). However, considering the communicative behaviors produced in proportional terms, we did not find difference between groups in the frequency of gestures without vocal accompaniment (U=3; z= -0,655; *p*=0,513).

Conclusions:

Our preliminary data suggest that besides the decreased communicative acts, children with ASD have specific difficulties integrating the communicative elements into multimodal communicative behaviors but not in the frequency of gestures usewhen they are compared to other developmental disabilities.

63 **108.063** The Role of Augmented Language Input on the Expressive Language Growth of Young Children with Autism Spectrum Disorder (ASD)

***K. Sterrett**[1], C. Kasari[2], R. Landa[3] and A. P. Kaiser[4], (1)University of California Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (4)Special Education, Vanderbilt University, Nashville, TN*

Background: The development of language in children with autism spectrum disorder (ASD) is a potent predictor of positive social outcomes (Anderson et al., 2009). Yet despite intensive early intervention approximately 30% of children fail to develop functional language by the time they enter school (NRC, 2001). One promising intervention is the use of speech generating devices (SGD), which have shown treatment effects when used in isolation (Van Der Meer & Rispoli, 2010) or in conjunction with a behavioral treatment (Kasari et al., 2014). There are a number of

hypotheses as to the mechanism by which SGD lead to language growth such as the consistency of the language produced by SGD and the pairing of the language with a visual. There is little empirical evidence supporting these hypotheses (Blischak, Lombardino & Dyson, 2003).
Objectives: To test the moderating effect of the language input produced by SGD versus verbal language input from an adult on the expressive language growth of children with ASD during an intervention trial.

Methods: Thirty-one children were included with a mean age of 6.44 years (SD=1.23). All children received a 24-week behavioral intervention (JASPER+EMT) with an SGD used by the interventionist to model language (see Kasari et al., 2014 for intervention overview). The dependent variables were the number of spontaneous comments, word roots and requests measured using the Natural Language Sample. The independent variables were the proportion of children's responses to adult language (verbal and/or SGD models). A response was defined as the child producing contingent language within five seconds of adult's verbal or SGD language models.

Bi-variate correlations were run between the outcomes, children's response to models, Leiter age equivalency and ADOS severity scores. Next, linear regression models were run for each dependent variable at exit with the proportion of responses to SGD and verbal models at entry entered as independent variables controlling for cognitive ability and entry scores on the dependent variables.

Results: The percentage of responses to language input produced by the SGD was correlated with the number of different word roots ($r=.57$; $p<.01$) and spontaneous requests ($r=.47$; $p<.05$) at entry. None of the outcomes were correlated with the proportion of responses to verbal models.

The regression equations for spontaneous comments and number of different word roots were significant, $F(4, 17) = 5.28$, $p< .01$ and $F(4, 17) = 14.67$, $p< .01$.

Proportion of response to SGD models at entry (but not verbal models) was predictive of the number of spontaneous comments and different word roots at exit after controlling for entry scores and cognitive ability, $t(21) = 2.96$, $p < .01$ and $t(21) = 2.85$, $p = .01$ respectively.

Conclusions: These data suggest that children process augmented language models differently than adult verbal models. It could be that those children with higher receptive language or cognitive abilities are able to benefit from the input from the devices (Sevcik, 2006). A direction for future research will be to test the role of these potential moderators with a larger sample of children.

64 **108.064** Multipurpose Handheld Devices and Communication in Individuals with Autism Spectrum Disorder: A Meta-Analysis

ABSTRACT WITHDRAWN

Background: The development in technology has permitted the use of tablets for communication and social interactions. Tablet-based speech-generating devices (SGDs) have specific features that led to the frequent use of these devices in the AAC field, such as flexibility, availability, social acceptability, cost-efficiency, portability, and high quality. Recent systematic reviews show some common patterns about the effectiveness of utilizing tablet-based SGDs to enhance social-communication skills in individuals with autism spectrum disorder (ASD). However, the majority of systematic reviews used behavior-change indices (e.g., percentage of nonoverlap data–PND), that may provide unreliable results. Further, most meta-analyses did not mention whether tablet-based SGDs are considered an evidence-based practice (EBP).
Objectives: We aim to answer the following research questions: What is the magnitude of effectiveness of tablet-based SGDs by using rigorous nonoverlap method (i.e., nonoverlap all pairs-NAP) combined with with confidence interval (CI)? What is the level of evidence of utilizing tablets as SGDs by individuals with ASD?

Methods: Electronic databases, ancestral, and hand search were conducted to located relative studies. The studies were included based on the following criteria: (a) the study must utilize single-case experimental design (SCED) that demonstrate functional relation; (b) at least one participant with a diagnosis of ASD must be included in the study; (c) the independent variable had to be handheld multipurpose devices with AAC apps; (d) social-communication skills (e.g., requesting, labeling, answering and asking questions) had to be the main dependent variable; and (e) the study had to be published in English in a peer-reviewed journal. The studies were coded based on participants' characteristics, experimental design, setting, intervention, teaching methods, target behavioral outcome(s), quality of the single-subject research based on the quality indicators suggested by Horner et al. (2005), and effect size of treatment(s).

Results: The systematic review identified a total of 29 studies that applied tablet-based SGDs as a single treatment or as a treatment package in 81 individuals with ASD. The average NAP value for the tablet-based SGD was higher (*M* = 0. 90) with narrow estimated intervals (CI95% = 0.84, 0.94) compared to picture communication system (PCS) and manual sign (MS), which indicated more reliable and trustworthy effect size. Based on evaluating the quality of each study, all 29 were considered acceptable quality by the quality indicators established by Horner et al. (2005).

Conclusions: Overall, this review shows that using tablets as dedicated SGDs to teach social-communication skills met all the standards, suggested by Horner et al. (2005), to be considered EBP. Further, tablet-based SGDs display medium effects in improving different social-communication skills in individuals with ASD. The results of the review help guide future research in several directions to close the gap in the literature. Future studies should investigate whether tablet-based SGDs are best suited for infants, toddlers, and adults with ASD with a wide range of autism severity. Finally, future research is recommended to examine the stakeholders' perspectives about the effectiveness and the acceptability of tablet-based SGDs.

65 **108.065** Neurobehavioural Outcomes of a Music Intervention for Autism - a Randomized Controlled Trial

M. Sharda[1]*, C. Tuerk*[1]*, R. Chowdhury*[2]*, K. Jamey*[1]*, N. Foster*[1]*, M. Tan*[3]*, A. Nadig*[4] *and K. L. Hyde*[1]*, (1)International Laboratory of Brain, Music and Sound Research (BRAMS), University of Montreal, Montreal, QC, Canada, (2)Psychology, International Laboratory of Brain, Music and Sound Research (BRAMS), University of Montreal, Montreal, QC, Canada, (3)Abaton Integrative Medicine, Oakville, ON, Canada, (4)School of Communication Sciences and Disorders, McGill University, Montreal, QC, Canada*

Background: Music is an intrinsically rewarding stimulus that can enhance social-communication and sensorimotor abilities by engaging multiple brain networks. Previous studies of music-based interventions for children with autism spectrum disorder (ASD) have suggested positive outcomes (Geretsegger et al, 2015). Preliminary neuroimaging findings have shown that children with ASD have preserved functional connectivity during song-listening (Sharda et al, 2015). However, neurobiological mechanisms underlying specific benefits of music-based therapies for ASD remain unknown. Here, we evaluate the neurobehavioural effects of a music-based intervention compared to a non-music behavioural intervention for school-age children with ASD, using a randomized control trial (RCT).
Objectives: Our specific goal was to evaluate resting-state functional connectivity (RSFC) in children with ASD before and after 12 weeks of a music

or non-music intervention, particularly in fronto-temporal and salience brain networks implicated in social-communication and shown to be altered in ASD.

Methods: Fifty-one children with ASD (43 boys), 6-12 years old, participated in a single-blind, parallel-arm RCT of music therapy (ISRCTN26821793). Participants were randomly assigned to 12 weekly sessions of individual music (MT, n=26) or non-music (NM, n=25) therapy. Sessions in MT involved use of songs and rhythmic cues to improve turn-taking and reciprocal social interactions and communication skills. The NM sessions targeted similar skills but without the use of music. Groups did not differ on age, sex, IQ and socioeconomic status at baseline. Both behavioural (Children's Communication Checklist-2 composite score; CCC-2) and neuroimaging measures (T1; resting-state functional MRI) were obtained pre- and post-intervention. Here, we report preliminary neuroimaging results of 45 (MT=24, NM=21) participants with usable data. Seed-based RSFC maps with 4 apriori seeds were generated using an FSL-based pipeline for each participant. Seeds were anchored in language (left IFG) and salience (right fronto-insula) networks. Motion was corrected following guidelines in Power et al, 2012. Effects of MT vs. NM were evaluated by comparing the RSFC in each seed, pre- and post-intervention, using mixed-effects ANOVA. Results were considered significant when there was a group-by-time interaction at p<.05 (cluster-corrected using random field theory; RFT). RSFC at post-intervention was correlated with change in communication skills to study the link between the brain mechanisms underlying social-communication.

Results: Previously reported behavioural results (Figure1a) showed significant improvements in social-communication after 12 weeks of MT. We also found changes in RSFC pre- to post-intervention, in MT compared to NM, in networks seeded from left IFG (decrease in RSFC) and right fronto-insula (increase in RSFC; p<.001, RFT-corrected, Figure1b,c). Additionally, decreased RSFC in the left IFG network post-intervention was related to increases in CCC-2 score in MT participants who improved post-intervention (p=.04, Figure1d).

Conclusions: Children with ASD who underwent 12 weeks of music therapy had more typical RSFC in fronto-temporal brain regions compared to those who underwent a non-musical intervention. Changes in RSFC were further related to behavioural improvements in standardized measures of social communication suggesting neurobiologically-mediated improvements in social communication as a result of music intervention. These results provide neurobiological support for use of music as a therapeutic tool for children with ASD to improve social-communication.

66 **108.066** Perceptual Markers of Autism during Oral Narrative Production

ABSTRACT WITHDRAWN

Background:

Individuals with Autism Spectrum Disorder (ASD) have variable language abilities, ranging from severely impaired to above average. Verbal individuals with ASD frequently exhibit speech differences, including atypical or lack of prosody. These speech and/or vocal differences often result in difficulty conveying communicative information, such as affect, linguistic, and pragmatic information. It is not clear what the underlying mechanisms are that contribute most to the acoustic form of "speech atypicalities" among speakers with ASD compared to the speech of their Typically Developing (TD) peers. Regardless of the mechanisms (linguistic, motoric, temporal, prosodic) that contribute to the perception of speech "oddness", it is difficult to identify precisely what sounds "different" to the human ear.

Objectives:

The following research questions were addressed: 1) Are there distinct acoustic-perceptual speech and language differences as perceived by human listeners that distinguish children with ASD compared to TD peers?; 2) Do experienced and non-experienced judges acoustically rate oral narratives produced by children with ASD differently than those produced by TD peers?

Methods:

Oral narratives using the ENNI (2007) were collected on 31 children with ASD and 31 TD peers between the ages of 4-11 years matched for age, gender and receptive vocabulary. The 31 participants with ASD were formally diagnosed with ASD and had an IQ above 70. All acoustic samples were digitally recorded in a child-friendly sound-treated room. The "human listeners" included one group of 40 Speech Language Pathology (SLP) graduate students (trained listeners) and 40 randomly selected graduate students from different disciplines (untrained listeners) who were recruited across a university campus. All human listeners (judges) met inclusionary criteria: 1) normal hearing; 2) English as a native language; and 3) level of experience/contact time with individuals with communicative disabilities and/or ASD. The 40 SLP judges were engaged in coursework and clinical experiences working with individuals with communicative differences or disabilities and/or children with ASD. The 40 untrained judges earning degrees in different disciplines had little to no experience working with individuals with communicative disabilities and/or ASD. The judges applied a perceptual rating instrument that included 13 categories comprised of seven linguistic and six speech/acoustic variables. The judges rated each category using a three-point Likert scale.

Results:

There are distinct differences as perceived by human listeners that distinguish children with ASD as sounding "different" compared to TD peers. For the main effect diagnosis (ASD vs. TD), significant between group differences were found for four out of 13 variables: Story sequencing (p=0.008); Articulation (p=0.001); Fluency (p=0.005); and Rate (p=0.016). A trend, but nonsignificant differences at 0.05 were found for Topic organization (p=0.073) and Pitch (p=0.058). For the main effect judge (SLP vs. untrained listeners), significant within group interactions were found for three variables: Emotional language (ToM) (p=0.020); Articulation (p=0.002); and Rate (p=0.037). A trend was also found for Causal language (p=0.094). Inter-rater reliability was respectable at 0.73.

Conclusions:

Experienced and non-experienced judges rated the acoustic/speech aspects of connected speech as the most discriminating features that distinguished the connected speech among children with ASD compared to TD peers.

67 **108.067** Pragmatic Language Differences between Boys and Girls with Autism Spectrum Disorder: A Cross Cultural Comparison.

E. F. Dillon[1]*, R. Landa*[1]*, C. E. Wilson*[2]*, K. J. Greenslade*[3] *and E. Utter*[4]*, (1)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (2)Psychology, University of Dublin, Trinity College, Dublin, Ireland, (3)Communication Sciences and Disorders, University of New Hampshire, Durham, NH, (4)Kennedy Krieger Center, Center for Autism and Related Disorders, Baltimore, MD*

Background: Autism Spectrum Disorder (ASD) is a highly heterogeneous condition that traditionally has been defined by its maleness: both in describing the "extreme maleness" of its characteristics, and in the decidedly male ratio of diagnosis (Fombonne, 2007). However, the assumption of ASD as inherently male may overlook an alternative expression of ASD more common in, or specific to, women and girls. Some research suggests that girls with ASD may demonstrate a social advantage over boys, akin to that observed in typical development (Head, McGillivray, & Stokes, 2014).

Pragmatic, or social language, deficits have been observed across the autism spectrum, and sub-clinically, in family members of those with ASD (Landa et al., 1992). While pragmatic language differences are observed in healthy men and women, sex differences often have not been detected between mothers and fathers of children with ASD (Landa et al., 1992; Klusek, Losh & Martin, 2014). Little is known about potential sex differences in the pragmatic functioning of children with ASD.

Objectives: To explore gender differences in autism symptoms, focusing on pragmatics. To determine whether differences are consistent across cultures.

Methods: Fifty-three children with ASD (30 girls), aged 9-16 years (*M*= 11.86, *SD*= 1.60), were recruited from the United Kingdom and Ireland; 34 (9 girls), aged 8-12 years (*M*= 8.94, *SD*= 1.27) were recruited from the US. Samples were compared on *ADOS* items, and on pragmatic ability from examiner ratings of conversation samples using the *Pragmatic Rating Scale for School-Age* children (*PRS-SA*; Landa, unpublished).

Results: Recruitment and coding are ongoing; additional data will enhance existing sample (N=87) results, reported here. One-way between-subject ANCOVAs, controlling for nonverbal IQ, indicate similar sex differences in total *PRS-SA* scores, across the US and UK/Ireland samples. In the US sample, *PRS-SA* scores were significantly higher for males (M = 18.00, SD= 7.10, p = .01) than females (M = 9.44, SD = 4.30), indicating more pragmatic errors in males. Likewise in the UK/Ireland sample, (F (1, 49) = 3.57, p = .028), girls (M = 11.18, SE= 0.80) displayed significantly fewer pragmatic errors than boys (M = 13.79, SE = 0.84). Interestingly, nonverbal intelligence and pragmatic language errors were negatively related in boys, but not girls (Figure 1). In the UK/Ireland sample, girls (M = 15.33, SE = 1.32) displayed significantly lower *ADOS* total algorithm scores than boys (M = 22.82, SE= 1.55), (F (1, 49) = 12.88, p = .001), signaling fewer or less severe social-communication deficits and/or repetitive behaviors/restricted interests. Additionally, boys scored significantly higher (p < .05) on particular ADOS items (e.g., Excessive Interest, Compulsions, Conversation and Unusual Eye Contact).

Conclusions: Findings suggest similar sex differences on pragmatic errors in both cultures, with pragmatic ability possibly linked to nonverbal intelligence in boys with ASD. Also, sex differences on social-communication and repetitive behaviors/restricted interests are present on UK/Ireland sample *ADOS* scores. Implications for earlier identification and services for girls with ASD are discussed.

68 **108.068** Spatial Language Abilities of High Functioning Individuals with Autism

***A. Bochynska**, V. Vulchanov and M. Vulchanova, Norwegian University of Science and Technology, NTNU Trondheim, Trondheim, Norway*

Background: The cognitive and language profiles of individuals with Autism Spectrum Disorders (ASD) display both deficient and enhanced abilities within particular domains (Tager-Flusberg, Joseph & Folstein, 2001; Vulchanova, Talcott, & Vulchanov, 2014). Peaks can be observed in the areas of e.g. visual discrimination, Block Design and vocabulary size, whereas troughs are found in communication, pragmatics or egocentric transformations. Here we are interested in the peaks and troughs within the spatial domain. Even though spatial cognition has been widely studied in ASD (e.g. Caron et al, 2004; Edgin & Pennington, 2005; Shah & Frith, 1993; see Muth, Honekopp, & Falter, 2014 for meta-analysis on visuospatial skills), very little attention has been given to spatial language, i.e. descriptions of spatial relations between objects. Since the use of spatial language is based upon both linguistic and perceptual representations, it is particularly interesting in the context of autism and uneven cognitive profiles, and can provide new insights into the disorder characteristics as well as the interplay between language and cognition.
Objectives: The main aim of the current study was to investigate the use of spatial language and identify strengths and weaknesses of spatial verbal abilities in high functioning individuals with autism.

Methods: We have adapted a battery of three spatial language tests developed at the University of East Anglia (Markostamou, Coventry, Fox, & McInnes, 2015): Spatial Verbal Memory (immediate and delayed recall of verbal spatial information from egocentric and allocentric perspective), Spatial Naming Test (production of locative, directional and path prepositions), and Verbal Comprehension in Spatial Perspective Taking (spatial language comprehension in different frames of reference: absolute, egocentric, intrinsic and other-person). Twenty-five high functioning individuals with autism (HFA; 7 females) and 25 typically developing controls (TD; 11 females) participated in the study. The groups were matched on age (range: 9-27), Verbal and Perceptual IQ (Wechsler Intelligence Scales, WISC-IV and WAIS-V) and two linguistic components: grammatical comprehension and semantics (Test of Language Development, TOLD-I:4).

Results: In the Spatial Verbal Memory task, HFA individuals recalled significantly less spatial content from the egocentric, but not allocentric story, compared to TD group. In the Spatial Naming Test, HFA group differed significantly from the TD group in the production of proximity terms (by more frequently omitting the proximity terms, e.g. "to the left" instead of "far to the left", giving an alternative term, e.g. "first" instead of "nearest", or making a perspective error, e.g. "far in the front" instead of "far to the left") and source paths terms (by omitting source, e.g. "down" instead of "down off" or by semantic violations, e.g. "out of" instead of "away from"). Finally, in the Spatial Perspective Taking task HFA individuals showed longer response latencies in all, except the intrinsic frame of reference condition.

Conclusions: The results point to a selective fragility (see Landau & Zukowski, 2003) in the spatial language abilities of high functioning individuals with autism and uncover areas of strengths (e.g. intrinsic reference frames) and weaknesses (e.g. egocentric perspective, spatial memory source goals) in the profile.

69 **108.069** Statistical Learning and Autism-Related Social Communication Difficulties

***K. M. Parks**[1], L. Griffith[2], N. B. Noonan[2] and R. A. Stevenson[3], (1)The University of Western Ontario, London, ON, Canada, (2)Psychology, University of Western Ontario, London, ON, Canada, (3)Western University, London, ON, Canada*

Background: One of the defining characteristics of ASD is difficulties with social communication, including difficulties in the comprehension and the production of language. One contributor to learning these language skills is the ability to track statistical regularities and patterns that occur within languages specifically, and within the environment as a whole (statistical learning; SL). Likewise, difficulties with SL make it harder to learn patterns and regularities within the environment. Specifically, SL difficulties in ASD make it challenging to learn the inherent rules that govern language and social cues, and have thus been hypothesized to contribute to the language, speech, and social communication difficulties. Here, we explore this hypothesis by testing how difficulties in SL may help to explain the weak language, speech, and social communication patterns commonly observed in individuals with ASD.

Objectives:

- To test weather the ability to learn implicit statistics of the environment in both the auditory and visual domains relate to autistic traits associated with the broad autism phenotype.
- To examine specifically whether language comprehension and production are related to auditory and visual SL.
- To test whether other autism-related issues in socio-communication (e.g. social awareness, emotion regulation) are related to SL abilities.

Methods: We administered well-established measures of auditory and visual SL paradigms where individuals were presented with steams of syllables (auditory) and shapes (visual) during a learning phase that were embedded with statistical regularities unknown to the participants (N=24, data collection ongoing; mean age=19.50, *SD*=4.51). Following the learning phase, participants were tested on whether they learned these statistical regularities through completing pattern completion tasks. Participants receptive and expressive language skills were then tested using the Clinical Evaluation of Language Fundamentals (CELF-5), and completed clinically-reliable questionnaires examining autistic traits (Broad Autism Phenotype Questionnaire; BAPQ), social communication (Social Responsiveness Scale; SRS), and social competency (Multi-dimensional Scale of Social Competency; MSCS). We hypothesized that low levels of SL abilities would be associated with (a) higher levels of autistic traits, (b) decreased receptive and expressing language abilities, and (c) decreased social competency.

Results: Auditory SL was significantly correlated with receptive ($r_{(23)}$=.28, p<.05) and expressive ($r_{(23)}$=.32, p<.05) language comprehension. Further, visual SL was significantly correlated with multiple aspects of social communication related to ASD symptoms, including social communication ($r_{(23)}$=.45, *p*<.05), social cognition, ($r_{(23)}$=.42, *p*<.05), social awareness ($r_{(23)}$=.42), pragmatic language ability ($r_{(23)}$=.42, *p*<.05), social motivation (*r*(22)=.44, *p*<.05), and emotion regulation ($r_{(22)}$=.43, *p*<.05).

Conclusions: Our results demonstrate that auditory and visual SL are specifically related to a number of issues associated with ASD, including language abilities, social communication and competency, and autistic traits in general. These findings are in line with current theories of language development which suggest that SL tends to facilitate early language ability, and that lower-level SL difficulties in ASD may cascade into, or contribute to, the language and socio-communication issues canonically observed in ASD.

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108.070 Structural Language/Nonverbal Ability Profiles in Children with ASD

S. Silleresi[1]*, P. Prévost*[2,3]*, R. Zebib*[1,3]*, F. Bonnet-Brilhault*[4]*, J. Malvy*[5] *and L. Tuller*[1,2]*, (1)Université François Rabelais de Tours, Tours, France, (2)UMR iBrain 1253, Inserm, University of Tours, Tours, France, (3)UMR Imagine & Brain Inserm 930, Tours, France, (4)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (5)CHRU Tours, Tours, France*

Background:

A diagnosis of ASD includes specification of any co-occurrence with language impairment and/or cognitive disabilities (APA, 2013). Regarding language impairment, studies on verbal children with autism have reported that approximately 50% manifest significant structural language impairment (ALI), while the rest display normal abilities (ALN) (e.g. Leyfer et al., 2008). Regarding cognitive disabilities, current large-scale studies have found that the mean rate in children with ASD is roughly 30% (CDC, 2014). However, few studies have explicitly explored the possible combinations of language (dis)ability and cognitive (dis)ability (Kjelgaard & Tager-Flusberg, 2001; Rapin et al., 2009; Joseph & Tager-Flusberg, 2002). There are two potential methodological stumbling blocks in this enterprise. One concerns how language is tested: language abilities have typically been assessed via receptive vocabulary tasks, which probably overestimate verbal abilities in this population (Mottron, 2004). The other concerns the evaluation of cognitive abilities in children with ASD, which have usually been reported as Full Scale IQ scores (FSIQ). However, a large body of literature has demonstrated that perception-based nonverbal tasks, Raven's Progressive Matrices (RPM) and the WISC-IV Perceptual Reasoning Index, better estimate cognitive level of children with ASD in comparison to FSIQ and other Wechsler indices (Courchesne et al., 2015; Mayes & Calhoun, 2008; Nader et al., 2016).

Objectives:

The aim of the present study was to explore the existence, nature and relative frequency of the profiles obtained by crossing both structural language and nonverbal abilities in children with ASD using more controlled evaluation of both of these properties.

Methods:

Forty verbal children with ASD (30 analyzed), aged 6-12 years (*M*=8.79, *SD*=18.76), were evaluated on formal language abilities via standardized language tasks and tasks targeting specific aspects of morphosyntax and phonology and on cognitive abilities via both RPM and WISC-IV/WPPSI-IV. The only inclusionary criterion was ability to produce utterances of at least three words, while no exclusionary criterion was applied for nonverbal abilities.

Results:

Results showed that both RPM and Wechsler nonverbal indices were strongly correlated with most structural language measures (Table 1). All four possible profiles consistently emerged, with both nonverbal measures: two "homogenous" profiles (ALN with normal NVIQ and ALI with low NVIQ) and two "discrepant" profiles (ALN with low NVIQ and ALI with normal NVIQ) (Fig 1), although their relative frequency was not equivalent. This was particularly striking given that, although no group differences were found between RPM and Wechsler indices (*p*=.742), some children showed a difference of 50 percentile points or more in favor of Wechsler scales (contra Nader et al., 2016).

Conclusions:

Our study provides evidence for the existence of all four structural language/nonverbal profiles in children with ASD. The relative infrequency of low NVIQ profiles among these verbal children, and especially the ALN/low NVIQ profile, may reflect population characteristics, although these children are typically excluded from studies on language in ASD. Understanding structural language/nonverbal ability profiles (and therefore appropriate treatment) can only be achieved through wide investigation across the entire spectrum, and thus not restricted to high-functioning children.

71 **108.071** Switching between Counterfactual Worlds and Reality in ASD: An ERP Study

J. S. Black[1]*, D. M. Williams*[2] *and H. Ferguson*[3]*, (1)School of Psychology, University of Kent, Canterbury, United Kingdom of Great Britain and Northern Ireland, (2)University of Kent, Canterbury, United Kingdom, (3)School of Psychology, University of Kent, Canterbury, United Kingdom*

Background: Research has previously found that children with Autism Spectrum Disorders (ASD) have difficulty reasoning counterfactually, and that this may contribute to deficits in Theory of Mind ability (Grant, Riggs & Boucher, 2004; Peterson & Bowler, 2000). Using an eye-tracking and reading paradigm, we have previously demonstrated that counterfactual understanding is undiminished in adults with ASD. However, these scenarios were limited to a single sentence, which may be too simplistic to fully test the limits of counterfactual comprehension in ASD. It has been suggested that people with ASD experience a local processing bias, and exhibit superior anomaly detection abilities during reading when the anomaly is incongruent with a local than global context (Au-Yeung et al, 2017). Furthermore, ASD is associated with difficulties in cognitive flexibility and attention switching. It is therefore possible that counterfactual information embedded within a longer context, or that requires switching between counterfactual/reality, may be problematic for people with ASD.

Objectives: We examined whether adults with ASD (compared to a sex, age, and IQ matched Typically Developing (TD) group) are able to accommodate counterfactual worlds over longer passages, or switch from counterfactual to real worlds. Ease of integration was indicated by recording event-related brain potentials (ERPs), specifically the N400 response, which is sensitive to anomaly detection during reading.

Methods: Participants read scenarios on a computer screen. The first sentence established the counterfactual context (e.g. "If it had been raining this morning, Susan would have rushed to get to work."), and was presented in full for self-paced reading. A second sentence described a consequence of this counterfactual event, and was presented word by word. Critically, this sentence included a noun that was either consistent or inconsistent with the preceding context, and either included a modal verb to indicate reference to the counterfactual world (e.g. "In the end, Susan would have arrived at work early/late") or switched back to the factual-world (e.g. "In the end, Susan arrived at work late/early"). Factual scenarios were used as a baseline measure of contextual integration (e.g. "Because…"). ERPs were recorded from 32 electrodes, time-locked to the onset of the critical word.

Results: Results showed that participants detected the contextual inconsistency in all context conditions (i.e. showed larger N400 for inconsistent than consistent words). Crucially, this pattern was manifest in both groups, suggesting comparable counterfactual language processing in TD adults and adults with ASD. Nevertheless, some subtle differences in the topography of the N400 effect emerged between groups; the effect was left lateralised in the ASD group but was balanced across hemisphere in the TD group.

Conclusions: Adults with ASD were able to rapidly accommodate a counterfactual context, showing that they successfully maintained access to this non-real world over a longer passage. Adults with ASD were also sensitive to contextual cues, which facilitated rapid switches back to the real world, suggesting that they maintain comparable access to reality as TD adults. These findings argue against general difficulties in global coherence and complex integration in ASD, and against a general impairment in cognitive flexibility.

72 **108.072** The Association between Narrative Language and Social Perception in Children with Autism Spectrum Disorder (ASD) and with Typical Development (TD)

L. Mäkinen[1]*, S. Loukusa*[1]*, S. Kuusikko-Gauffin*[2]*, I. Moilanen*[3]*, H. E. Ebeling*[4] *and S. Kunnari*[2]*, (1)Research Unit of Logopedics, University of Oulu, Oulu, Finland, (2)University of Oulu, Oulu, Finland, (3)Child Psychiatry, University of Oulu and Oulu University Hospital, Oulu, Finland, (4)Child Psychiatry, University of Oulu, Oulu, Finland*

Background:

Narration is essential for effective communication. Efficient narration and storytelling requires linguistic and social-cognitive skills, such as emotion recognition and understanding listener´s and story character´s minds. Children with autism spectrum disorder (ASD) have challenges in all above mentioned areas (Baixauli et al., 2016; Loukusa et al., 2014).

Objectives:

This study explores the associations between narrative language and social perception abilities in children with ASD and their typically developing (TD) peers. Even though narratives have been widely investigated, surprisingly little is known about the connections between narration and social perception. It could be assumed that narration requires social perception skills, since listener's needs in a given context should be acknowledged in order to produce a coherent and informative story.

Methods:

Sixteen high-functioning children with ASD (aged 5;1–10;7 years; mean age 7;7) and 16 children with TD (aged 5;2–10;0 years; mean age 7;5) participated in this study. Children with ASD were carefully diagnosed by child psychiatrists or child neurologists using ICD-10 criteria based on ADI-R, ADOS and other investigations by a multiprofessional team in Oulu University Hospital in Finland. The Edmonton Narrative Norms Instrument (ENNI, story A3), which is a picture-based story generation task, was used for narrative elicitation. Children's stories were analyzed for story grammar (SG), based on ENNI manual (Schneider, Dubé & Hayward, 2005). SG measures the informativeness and the hierarchical organization of the story. In addition, children's social perception abilities were evaluated with NEPSY-II subtests of Affect Recognition and Theory of Mind (ToM) (Korkman, Kirk & Kemp, 2008).

Results:

Children with ASD produced stories that contained less information measured by SG than did TD children. Moreover, compared to TD children, children with ASD had lower scores in both NEPSY-II subtests. In ASD group, we found a moderate positive association between SG and the Affect Recognition and non-significant association between SG and ToM. In TD children, there were no significant associations between SG and NEPSY-II subtests.

Conclusions:

Children with ASD showed difficulties in narration, emotion recognition and in ToM. Emotion recognition and SG seem to be associated in ASD. This is plausible, since, for example, characters' emotional reactions are measured in SG, which support the idea of interplay between emotional understanding and narrative practice in ASD. In this study we did not find association between SG and ToM. Picture-based storytelling, which concentrates mostly on the actions in stories may not be connected with ToM. The role of ToM in picture-based narration should be critically considered in future studies.

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108.073 The Multiple Measure Approach to Diagnostics: Examining the Complexity and Stability of Autism Symptomatology

M. Roberts[1], *Y. S. Stern*[1] *and L. H. Hampton*[2], *(1)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (2)Northwestern University, Evanston, IL*

Background: Despite the US Preventive Services Task Force recommendation to avoid early autism screening if concerns have not been raised by a parent or clinician (Siu & USPSTF, 2016), there is sufficient evidence that early autism screenings are beneficial to not only ensure earlier access to diagnosis for children from diverse backgrounds (Veenstra-VanderWeele & McGuire, 2016), but to also facilitate access to early interventions that can provide long-term benefits (Dawson, 2016). Any one autism screening measure does not result in optimal sensitivity or specificity, but recent studies have demonstrated that by combining screening measures we may be able to add positive predictive value and reduce stress and unnecessary assessments for children who receive false positive screenings (Khowaja, Robins, & Adamson).

Objectives: What is the positive predictive value of two common autism screening measures (STAT, MCHAT) (1) alone? (2) when either results in a positive? And (3) when both result in a positive?

Methods: A total of 158 toddlers were screened for an autism diagnosis after parent referral to a developmental clinic. Participants were 23% female, 30.6 months (sd=4.4) old, and 63% were ultimately diagnosed with autism. The STAT (Stone et al., 2004) and MCHAT (Robins, Fein, & Barton,1999) were administered at referral, and the ADOS was given as part of a full diagnostic evaluation 3 weeks later. Both screening measures were used to assess positive and negative predictive value of adding a second screening measure for autism screenings.

Results: The STAT alone resulted in a positive predictive value of 0.81 (SE=0.04) and a negative predictive value of 0.87 (SE=0.07). The MCHAT alone resulted in a positive predictive value of 0.84 (SE=0.05) and a negative predictive value of 0.52 (SE=0.06). Combing the STAT and MCHAT during screening resulted in significantly better positive predictive value (0.91, SE=0.04) than considering either the STAT or MCHAT (PPV=0.78, SE=0.04; p=0.027). Additionally, considering either the STAT or the MCHAT resulted in a greater Negative predictive value (0.90, SE=0.05) than combining the two measures (0.54, SE=0.06; p=0.000).

Conclusions: Multiple screening measures should be considered to optimize autism diagnostics after referral based on concern. Additional measures may be necessary to increase the positive predictive value of multiple measures in autism screenings while also optimizing negative predictive value. Recommendations for practice and future research will be discussed. By the time these data are presented, we anticipate a sample of 200 participants.

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108.074 Multiple Measures of Language Development in Autism: Understanding Language Ability and Usage across Contexts

L. H. Hampton[1] *and M. Roberts*[2], *(1)Northwestern University, Evanston, IL, (2)Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: Toddlers with autism demonstrate highly variable language abilities (Kjelgaard & Tager-Flusberg, 2001), and as such it has been recommended that each language phase of early development in autism be assessed using multiple sources of information (Tager-Flusberg et al., 2010). Although automated measures of child vocalizations has been found to be stable and valid for predicting future spoken language outcomes (Woynaroski, Oller, Kaysili, & Yoder, 2016), these measures do not provide specific detail as to why a child is communication or whom the communication is directed. Additionally, many measures across development are not predictive of skills 5 years later in children with autism. However, early observations of non-verbal communicative acts are significantly associated with later language, social, and communication outcomes (Charman et al., 2005).

Objectives: Coupled with the current recommendations for assessment of expressive language benchmarks in early development of autism, we consider 4 primary measures of language: child vocalizations, non-verbal communication observed during a semi-structured observation, vocabulary as reported by parents, and pragmatics observed during a naturalistic language sample. (1) How do language measures relate to and diverge from one another in toddlers with autism? (2) What profiles of autism emerge across measures?

Methods: A total of 46 toddlers (mn=33, sd=6 months; 40% minority race; Mullen T-score mean=26.9, sd=8.7) with autism have been assessed for baseline characteristics and language abilities across contexts. Toddlers were recruited in the Chicagoland area and were included as part of a larger randomized control trial based on the following characteristics: a) between 18 and 36 months of age, b) live with their biological mother and she was willing to participate in the study, c) a confirmed diagnosis of autism, d) no other developmental or sensory impairment diagnosis including hearing impairment, uncorrected vision impairment, identified genetic disorder, or seizure disorder, and English as the primary language spoken at home. Children were assessed across multiple contexts. Parents reported the number of different words the child understood and said (MCDI, Fenson et al., 2007). Total child vocalizations was extracted from day-long recordings at home using LENA^{TM} technology (LENA Research Foundation).

Results: All measures of early language and communication were moderately and significantly correlated (r=0.34-0.75; p<0.00), except for the relationships between observed non-verbal communicative behaviors and all other measures of language and communication (r=0.03-0.23, p>0.1). Across participants, 4 profiles of toddlers emerge: high performing toddlers across all measures (8%), low performing toddlers across all measures (24%), toddlers who perform low across measures except demonstrate many different gestures (35%), and toddlers who present with mixed profiles (39%). These profiles illustrate the added benefit of including gestures and vocalizations in language measures.

Conclusions: Due to the discrepancy between non-verbal communication and verbal communication measures, it is critical to consider both forms of communication in early intervention research with this population, especially due to the known relationship between non-verbal communication (above other indicators) and long-term language outcomes in autism (Charman et al., 2005).

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108.075 Biological Measurement in Toddlers with Autism: Auditory Brainstem Responses in Relation to Autism Symptomology

M. K. Jones[1], *Y. S. Stern*[1], *M. Roberts*[1] *and L. H. Hampton*[2], *(1)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (2)Northwestern University, Evanston, IL*

Background: Neurological underpinnings of autism have long been sought out to shed light on heterogenic presentations of autism symptomology. Auditory brainstem responses (ABRs), a measurement of sound processing, have been considered a biological measurement that may aid in understanding the relationship between neurological mechanisms and autism symptomology. Previous research has reported atypical

ABRs in children with autism, characterized by longer wave V latencies. In addition, longer wave V latencies and less consistent ABRs are related to low language levels in children who did not have autism. However, little research has considered the relationship between ABRs and characteristics of autism, such as language levels and sensory processing challenges.

Objectives: The current study aims to characterize the relationship between ABRs and autism symptomology, specifically autism severity, language skills and sensory processing challenges. We extend the understanding of the relationship between ABRs and autism to include toddlers with autism. The study explores (1) the relationship between ABRs and language development in children with autism and (2) addresses whether differences between ABRs are associated with sensory processing challenges in children with autism.

Methods: ABRs were measured for 20 children (6 females) with autism (*M*=33.5 months, *SD*=4.82). Autism diagnoses were verified based on Autism Diagnostic Observation Schedule scores (*M*=20.85, *SD*= 4.55). ABRs were recorded in response to a click and /da/ stimulus. Wave V latencies and response consistency measures served as ABR outcome measures. The Preschool Language Scales-5 (M=65.6, SD=12.92) and Macarthur-Bates Communicative Development Inventories (M=47.55, SD=71.41) were primary measures of language development. Sensory processing profiles were characterized by summing of scores on two questions specific to sensory processing on the ADOS, yielding a group with greater sensory processing challenges (n=11) and a group with lower sensory processing challenges (n=9).

Results: More consistent responses were positively related to number of *Words Understood* and *Words Produced* on the MCDI. However, correlations between ABR measures and ADOS scores as well as measures of language development revealed no significant relationship (see Table 1). Children with greater sensory processing challenges showed numerically longer wave V latencies, when compared to those with lower sensory processing challenges, however no statistically significant relationships were found between these sensory groups for either the click wave V latency (*t*(19)=-1.04, *p*=.315) and /da/ wave V latency (*t*(19)=-1.01, *p*=.331). Additionally, on average children with greater sensory processing challenges showed less consistent responses, however this group difference did not reach significance (*t*(19)=.72, *p*=.480)**.**

Conclusions: The current study furthers the understanding of the relationship between ABRs and autism symptomology by including toddlers with autism. Previously reported atypical ABRs in older children with autism may be a reflection of the neurological impact that autism has on the sound encoding process over time. Atypical ABRs may not yet be apparent in toddlers with autism. Future research should include larger sample sizes as well as more nuanced behavioral measures of sensory processing. Longitudinal approaches should be considered when studying ABRs in children with ASD in order to explore the developmental relationship between ABRs and autism symptomology.

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108.076 Towards a Cumulative Science of Prosody in ASD

R. Fusaroli[1]*, E. Weed*[1]*, A. Lambrechts*[2]*, D. M. Bowler*[3] *and S. B. Gaigg*[4]*, (1)Aarhus University, Aarhus, Denmark, (2)City, University of London, London, United Kingdom of Great Britain and Northern Ireland, (3)Autism Research Group, City, University of London, London, United Kingdom, (4)City, University of London, London, United Kingdom*

Background: Individuals with Autism Spectrum Disorder (ASD) tend to show distinctive, atypical acoustic patterns of speech. These behaviours affect social interactions and social development and represent a promising non-invasive marker for the clinical features of ASD. Fusaroli et al (2016) conducted a meta-analysis quantifying acoustic patterns in the speech of people with ASD across 34 articles. The study indicated fragmentary findings with little overlapping across studies in the investigated clinical and acoustic features, methods and findings.

Objectives: To overcome these challenges, we need to identify the barriers to data-sharing across research groups and highlight the potential of multi-study analysis across corpora (i.e. what is known as mega-analysis in genetic studies).

Methods: We updated the pool of studies under consideration (now 51 studies). We contacted all corresponding authors to inquire about shareability of the data and where possible requested participant level data. We performed a Bayesian multilevel mega-analysis combining participant-level and population-level data (when the former was not available), explicitly modeling age, gender and language of the participants, as well as relations between acoustic features.

Results: 30% of corresponding authors answered and 10% provided at least some of the requested data (some answers still pending). The mega-analysis identified: i) strong effects of age, and genderbeyond what approximate group-level matching accounted for; ii) strong interdependence between acoustic features, which needs to be accounted for, and iii) larger effect sizes than the previous meta-analysis. Interdependence is partly due to the common and inappropriate use of mean and standard deviation to describe long-tailed distributions of (within-subject) acoustic features. In addition, we identify key concerns: confidentiality and ethical concerns; lack of consent from co-authors; temporal and economic costs of retrieving the data.

Conclusions: Mega-analyses allow for more nuanced and powerful analyses than meta-analyses. However, they require more sophisticated statistical techniques and access to more detailed data than currently shared either within scientific articles or directly by their authors. We outline recommendations to reduce concerns in sharing data, avoid statistical confounds between acoustic features and provide examples to run analogous Bayesian mega-analyses.

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108.077 Use of Communicative Gestures in School-Age Children and Adolescents with Nonverbal Autism

D. Slušná[1]*, W. Hinzen*[2]*, J. Rosselló Ximenes*[3]*, B. Salvado*[4] *and A. Rodríguez*[5]*, (1)Universitat Pompeu Fabra-CIBERER, Barcelona, Spain, (2)Catalan Institute for Advanced Studies and Research (ICREA), Barcelona, Spain, (3)General Linguistics, University of Barcelona, Barcelona, Spain, (4)COADI, BARCELONA, SPAIN, (5)COADI, Barcelona, Spain*

Background: Language is estimated not to develop in at least 25% of individuals on the autism spectrum, forming its most severe and understudied end. More studies of nonverbal cognition and communication in this population are urgently needed. A specific research desideratum is to profile nonverbal communicative gestures, some subtypes of which have been shown to be closely linked to language development in both typical and atypical populations.

Objectives: We aimed to shed light on language-gesture relationships by profiling production rates and types of nonverbal communicative gestures in this nonverbal population. Furthermore, we explored the interaction of gestural profiles with different measures of nonverbal cognition and receptive language.

Methods: 19 subjects were recruited from special schools in the Barcelona area. The examiner-child interaction during the ADOS was analysed and coded for gesture use. Standardized measures of nonverbal IQ (as measured by Leiter-R) and nonverbal symbolic cognition (as measured by the

ComFor) were also taken. Language status as a recruitment criterion was confirmed in production and comprehension assessed through diagnostic interviews (ADOS and ADI-R), teacher informants, and standardized language tests (Peabody Picture Vocabulary Test-III, and CELF-5 where possible).

Results: All subjects proved to be testable and had comprehension scores commensurate to production ones. Overall rate of production of communicative gestures was low as well, although in a study run in parallel, mean-rank distributions of gesture rates in typically developing pre-verbal infants between 9 and 22 months were interestingly not significantly different. Qualitative gesture profiling however showed the complete absence of declarative gestures including distal pointing. Even distal imperative pointing was scarce at group level, as were iconic gestures, which were produced with an imperative purpose in a strictly embodied context. The proportion of bimodal communicative acts (gesture + vocalization) was significantly lower than gesture-only acts. 79% of individuals scored ≤70 in nonverbal IQ. The remaining 21% of individuals above the cut-off for intellectual disability (ID) did not show different tendencies in any of the measures taken in comparison with the rest of the sample with ID. Neither language nor gesture scores correlated with levels of nonverbal symbolic cognition, which in turn were significantly correlated with nonverbal IQ.

Conclusions: This study provides evidence that in a population of both productively and receptively non-verbal school-age children and adolescents, nonverbal gestural communication changes fundamentally along with language, though this change is not seen quantitatively in communication rates. In particular, gesture types relating to certain restricted forms of referentiality were not present in this group, which would be predicted from independent evidence of their language-relatedness. Moreover, the same linguistic and gestural profile is seen in both high and low nonverbal IQ scores. These results inform debate on how verbal so-called 'nonverbal' communication is, and the debate on the role of language in autism at large.

78 **108.078** Using Early Words to Communicate Intentions- a Comparison of Toddlers with Autistic Spectrum Disorder and Toddlers with Typical Development

A. Oren[1], *A. Mimouni-Bloch*[2,3], *S. Goldberg*[2] *and E. Dromi*[4], *(1)Constantiner School of Education, Alona Oren, Tel Mond, Israel, (2)Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel, (3)The Pediatric Neurology and Developmental Unit, Loewenstein Rehabilitation Hospital, Raanana, Israel, (4)Constantiner School of Education, Tel Aviv University, Tel Aviv, Israel*

Background:

About 70% of toddlers with Autism Spectrum Disorder (ASD) present delayed emergence of speech, a difficulty attributed to several factors, among them their core deficit in communication. Restrictions in the use of early words for various communicative intentions is among the earliest manifestations of ASD. The majority of toddlers with ASD eventually develop functional speech, hence, a close analysis of the function of early words and how they are used in context is highly desirable.

Objectives:

1. To study how toddlers with ASD use their early words to convey various communicative intentions
2. To compare the contexts in which Typically Developing (TD) toddlers and toddlers with ASD at similar lexical levels produce words.

Methods:

24 mother-toddler dyads participated in the study: In nine dyads, the toddlers had been diagnosed with ASD prior to the study; in fifteen dyads, the toddlers were typically developing. Toddlers in the two groups were matched by lexical levels at study entry. Each mother–toddler dyad was video-recorded three times, during naturalistic interaction. The first recording took place when toddlers reached a productive lexicon of 40-70 different words. Two additional recordings took place in intervals of two months. All verbal productions were classified into four main communicative intentions (Declarative, Requesting, Protesting and Non- Communicative speech). The frequency of each communicative intention was calculated in order to characterize within-group developmental changes (i.e., the developmental rate of each participant), as well as differences between the two groups.

Results:

1. Toddlers with ASD were delayed in the emergence of first words, compared to the TD toddlers (31.5 months and 17 months, respectively). In addition, a greater within-group variability was found in the ASD group.

2. In contrast to our assumption, in both groups, the most common communicative intention was Declarative: throughout the three visits, words were used to describe or comment, rather than to request items or activities. However, a statistically higher percentage of declaratives was found among toddlers with TD ($F(2,21)=7.41$, $p<0.01$). Both groups rarely used their words to protest or to object.

3. In both groups, the majority of productions was directed towards the communicative partner. However, toddlers with ASD used words for non-communicative purposes more often than TD toddlers ($F(2,21)=14.81, p<0.01$).

4. A statistically-significant higher frequency of approach- withdrawal, crying and self- stimulation was noted in the ASD group (i.e. for withdrawal: $F(1,22)=1.14$, $p<0.01$). In the TD group, a statistically significant higher frequency of showing and pointing was recorded ($F(1,22)=4.65$, $p<0.05$; $F(1,22)=8.39$, $p<0.01$, respectively).

Conclusions:

While TD toddlers begin to talk with an already-established knowledge of the main communicative functions of words, toddlers with ASD seem to have only partial understanding, and they improve as they expand their productive lexicon. The relative paucity of verbal requests and protests in both groups might be attributed to the unstructured setting. In the ASD group, non- verbal behaviours may have served as an alternative to requests or protests. These findings bear both theoretical importance and practical implications for early intervention for toddlers with ASD.

Poster Session
109 - International and Cross-Cultural Perspectives
11:30 AM - 1:30 PM - Hall Grote Zaal

79 **109.079** A Mixed Methods Investigation of Korean Americans' Autism Awareness and Attitudes

***H. S. Lee** and C. Kasari, University of California, Los Angeles, Los Angeles, CA*

Background: Korea's ASD prevalence is a staggering 1 in 38, but two-thirds of children with ASD in Korea have never received special education services (Kim et al., 2011). Korean parents avoid registering their children as disabled due to stigma (Kim & Kang, 2003), and view ASD as a hereditary disorder that threatens marriage prospects for relatives (Grinker et al., 2012).
As 76% of Korean Americans are Korean-born immigrants (U.S. Census Bureau, 2004), it is likely that many Korean Americans still hold Korean values and cannot access ASD information in English due to language barriers.

Misconceptions and stigma may discourage Korean American families of children with ASD from obtaining services. ASD knowledge and attitudes in the Korean American community need to be assessed.

Objectives: The goal of this study was to examine the relationships between age at immigration and 1) ASD knowledge and 2) attitudes in the Korean American community.

Methods: A survey was administered to 159 Korean adults at Korean community organizations in Los Angeles, CA. The survey consisted of adapted versions of the Autism Knowledge Survey (Tipton & Blacher, 2014) and open-ended questions assessing autism attitudes (Grinker et al., 2015). The survey was translated into Korean.

Participants' responses on the Autism Knowledge Survey, containing 14 statements about ASD, were scored based on correctness. Open-ended questions included: 1) What words or phrases do you think of when you think of autism? 2) What causes autism? The causes listed by participants were coded into categories. Interrater reliability calculated using Cohen's Kappa, was high (range=.72-.93).

Results: A multiple regression was conducted to investigate the relationship between age at immigration and autism knowledge, controlling for having a family member with ASD, gender, age, education level, and income (see Table1). Earlier age of immigration, having a family member with ASD, and being a female were associated with higher levels of ASD knowledge. The model explained 23.9% of the variance (R^2=.24, F(6, 122)=6.40, p<.001), with age at immigration by itself explaining 13.7%.

Four themes were identified through inductive coding of participants' perceived causes of autism: 1) biological, 2) parenting, 3) postnatal (includes parenting), and 4) unsure. A logistic regression was performed to examine the relationship between age at immigration and the likelihood of listing parenting as a cause, controlling for demographic variables (see Table2). The model was statistically significant ($\chi^2(6)$=16.92, p=.010). It explained 25.3% of the variance and correctly classified 84.7% of cases. Individuals who immigrated to the U.S. at an older age were more likely to list parenting as a cause (odds ratio=1.08, p=.017). Examples from the qualitative responses included "parents' drug addiction", "parents' lack of love", and "reckless behaviors".

Conclusions: Koreans who immigrated later in life tend to have lower levels of ASD knowledge and incorrectly believe that parenting causes ASD. More resources in Korean are needed to raise Korean Americans' ASD awareness. Mass media and educational seminars may be effective ways of disseminating ASD information. Awareness campaigns should consider individuals' acculturation levels and incorporate cultural adaptations in the design and implementation.

80 **109.080** A Randomized Controlled Trial of PEERS in Israel: Behavioral and Questionnaire-Based Outcomes

*[1]. **J. Rabin**, S. Israel Yaacov[1,2], I. Mor Snir[2] and O. Golan[1,2], (1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for Children at Risk, Givat-Shmuel, Israel*

Background: Social communication impairments are a fundamental characteristic of autism spectrum disorder (ASD). Social skills training groups are the most common intervention for individuals with ASD and has been found to be an effective treatment mode. The Program for the Education and Enrichment of Relational Skills (PEERS; Laugeson & Frankel, 2010) is an evidence-based parent-assisted social skills training program for teens with ASD, which has been well validated in North America. PEERS has been adapted for clinical use in Israel, with promising results in adolescents, as well as elementary school aged children.
Objectives: The main aim of the current study was to conduct a randomized control trial (RCT) of the culturally adapted version of PEERS in Israel. Whereas previous evaluations of PEERS have mostly relied on questionnaires, this study employed a live role-play assessment of conversational skills as an ecologically valid outcome measure, in addition to parent, teacher, and self-report questionnaires.

Methods: Forty one participants (2 females) aged 12-18 (M= 14.04, S.D=1.71), who were diagnosed with ASD without an intellectual disability (diagnoses validated using the ADOS-2) were randomly assigned to an immediate treatment (IT, n=20) or to a delayed control treatment (DCT, n=21) group and were evaluated at three time points: pre and post intervention for both groups, and 16 weeks after treatment completion for the IT group. Behavioral assessment was conducted using the *interested* condition of the Contextual Assessment of Social Skills (CASS; Ratto et al., 2011). This semi-structured role-play comprises a three minute conversation with a confederate. Trained, independent, blind judges coded adolescents' conversational skills, including question asking, topic changing, vocal expressiveness, gestures, positive affect, kinesic arousal, social anxiety, quality of involvement, and quality of rapport. In addition, we assessed the intervention outcomes using various parent, teacher and self-report questionnaires: Social Skills Improvement System (Gresham & Elliott, 2008), Social Responsiveness Scale (Constantino & Gruber, 2012), Quality of Play Questionnaire (Laugeson & Frankel, 2010), Test of Adolescent Social Skills Knowledge (Laugeson & Frankel, 2010) and Empathy Quotient (Baron-Cohen & Wheelwright, 2004).

Results: In accordance with previous studies, compared to the DCT, significant intervention effects were found in the IT group. These included improved parent reported social skills and reduced autism symptomatology, and improvements on teacher reported communication skills, teen social knowledge, number of social encounters, and teen reported empathy. The analyses of the behavioral data revealed that following the intervention, compared to the DCT group, IT participants asked more questions and showed an improvement on the overall involvement subscale as well as on the total score of the CASS (see Figure 1). Most of these gains maintained on a 16 week follow up. Improvement on CASS involvement in conversation positively correlated with teens' gains on social skill knowledge and parent reported social and communication skills' improvement.

Conclusions: The current study validates the efficacy of the adapted PEERS program for adolescents' with ASD in Israel. The ecological validity of the impact PEERS has on adolescents' social skills had been corroborated by a behavioral outcome measure.

81 **109.081** Adapting the Who Caregiver Skills Training Programme for Implementation in Ethiopia

***B. T. Gebru**[1], F. G. Bayouh[2], M. Kinfe[2], M. Tesfaye[3], Z. Yenus[4], T. WHO CST Team[5], C. Servili[5], E. Salomone[6], L. Pacione[5], A. Fekadu[2,7], C. Hanlon[8] and R. A. Hoekstra[1], (1)Department of Psychology, King's College London, London, United Kingdom, (2)Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (3)Department of Psychiatry, St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia, (4)Joy Center for children with autism, Addis Ababa, Ethiopia, (5)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland, (6)Department of Psychology, University of Turin, Turin, Italy, (7)Department of Psychological Medicine, Centre for Affective Disorders, Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, (8)Addis Ababa University and King's College London, Addis Ababa, Ethiopia*

Background: The World Health Organization (WHO)'s Caregiver Skills Training Programme (CST) for caregivers of children with developmental disorders (DD) aims to teach caregivers strategies to help them support their child's development and learning. The programme consists of nine group sessions and three home visits and can be delivered by non-specialists to suit low-resource settings. Ethiopia has a shortage of trained health personnel and severe lack of service provision for children with DD and their families (Tekola et al., 2016); the CST may be able to address this unmet need.

Objectives: Explore the perspectives of caregivers, professionals and other stakeholders to inform adaptation of the WHO CST to the Ethiopian context and culture.

Methods: Four different types of consultations were conducted: i) Stakeholder meetings were held in April 2015; July 2015; August 2016 and August 2017 soliciting input from local psychiatrists, psychologists, Non-Governmental Organisation representatives, and parents of children with DD. The first two meetings focused on local training needs and programme delivery considerations; the third meeting included draft CST training materials, allowing for targeted feedback on programme delivery and content; the forth meeting focused on implementing the programme in rural settings; ii) in August 2016 all draft CST materials were reviewed in detail by the research team; iii) during a Training of Trainers workshop in May 2017 feedback on CST content, length and intensity was received from Ethiopian Master Trainees; iv) two Theory of Change (ToC) workshops (de Silva et al., 2014) were conducted with professionals in Addis Ababa and community stakeholders in rural Sodo to map out how to implement the CST in rural Ethiopia.

Results: The participants of all consultations agreed that the CST programme addresses an urgent need and is relevant to the Ethiopian context. For the programme to be effective, acceptable and feasible in Ethiopia, several recommendations were made: i) there is a need for greater emphasis on psychoeducation, stigma, parental feelings of guilt, and expectations of a cure; ii) in light of context-specific beliefs on parenthood, the training should more strongly highlight the role caregivers can play to support their child's development; iii) consider the wider family context (e.g. grandparents) who may be able to support the child but could also be a barrier to progress if they resist the training; iv) some materials were too complex for caregivers with limited education. The stakeholder meetings and the ToC workshop in Sodo also highlighted the need for a community-based approach: The CST programme needs to be embedded into wider community initiatives to raise awareness about DD and reduce stigma, and needs embedding in a broader care framework, including referral pathways to other health services (e.g. for comorbid physical problems). A Theory of Change map was constructed showing the underlying pathways and the prerequisites and interventions needed to allow the CST to achieve its impact.

Conclusions: The WHO CST programme addresses a need in Ethiopia, but socio-cultural and contextual adaptations are likely to increase its relevance and impact. An adapted CST is currently being piloted in Ethiopia.

82 **109.082** Are Autistic Students More Stigmatized Than Other Types of Neurodiverse College Students?

***K. Gillespie-Lynch**[1], N. Daou[2], R. Obeid[3], S. Khan[4], S. Reardon[5] and E. Goldknopf[6], (1)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY, (2)McNeese State University, Lake Charles, LA, (3)Psychology, The Graduate Center, City University of New York, New York, NY, (4)College of Staten Island, CUNY, Staten Island, NY, (5)NA, Burlington, VT, (6)University of California, Los Angeles, Los Angeles, CA*

Background: A growing body of research focuses on assessing attitudes towards autistic college students to identify factors that may contribute to autistic people being less likely than students with most other disabilities to enroll in college, despite often high cognitive potential (Gardiner & Iarocci, 2014; Matthews et., al 2015; Wei et al., 2013; White et al., 2016). Little remains known about the degree to which autism is stigmatized relative to other disorders. Feldman and Crandall (2007) analyzed stigma towards 40 disorders by having participants rate vignettes consisting of a diagnostic label, core characteristics, and common representations of each disorder (e.g., an autistic *child*). They found that autism was one of the *least* stigmatized disorders. Heightened perceived rarity, dangerousness, and personal responsibility were associated with greater stigma. Given that their approach to creating vignettes made it impossible to distinguish between stigma arising from core characteristics, labels, and/or commonly co-occurring characteristics, cross-disability research is needed to identify targets of anti-stigma intervention.

Objectives: We compared stigma towards college students with different disorders and examined factors that contribute to stigma towards autism in particular.

Methods: College students from the U.S. (Male = 193, Female = 233) and Lebanon (Male = 86, Female = 98) were randomly assigned to rate labels (e.g., "college student with autism") or unlabeled vignettes describing 10 disorders (autism, eating disorder, social anxiety, addiction to pain medication, psychopathy, schizophrenia, learning disability, depression, mania, and ADHD). Separate vignettes depicted a withdrawn and a severe form of autism. Students completed an adapted Social Distance Scale (stigma assessment: Bogardus, 1933), a social desirability scale, and rated perceived dangerousness, rarity, and personal responsibility for each disorder.

Results: Only p-values ≤ .001 were considered significant. A repeated-measures analysis with stigma as the dependent variable and condition (label vs. vignette), country, and gender as independent variables revealed main effects of condition (labels were less stigmatized than behaviors) and gender (women endorsed less stigma than men) and interactions between stigma and country and stigma and condition. Across cultures, psychopathy and schizophrenia were the most stigmatized (see Table 1). Stigma towards the label "autism" was relatively low while stigma towards behaviors associated with autism was moderate. The only cross-cultural difference in stigma was toward the label "pain medication addiction". Regressions were used to examine predictors of stigma towards autism; stigma towards the label "autism" was associated with being male, greater belief that autism is dangerous, lower quality contact with autistic people, and lower autism knowledge. Only lower quality contact with autism was associated with heightened stigma towards the autistic college student vignettes.

Conclusions: Findings suggest that autism is less stigmatized on college campuses than disorders like psychopathy and schizophrenia which may be perceived as dangerous. Indeed, stigma towards the label “autism” was associated with perceived dangerousness. Stigma was consistently related to quality of prior contact with autism, suggesting that interventions which put autistic students into high quality contact with peers are powerful tools for stigma reduction.

83 **109.083** ASD Prevalence Study across Europe: Cross Sectional Study Design in Six European Countries

M. Posada[1], *A. M. Vicente*[2], *D. Schendel*[3], *C. Rasga*[4], *C. Café*[5], *A. Boilson*[6], *G. Oliveira*[7], *J. Fuentes*[8], *M. L. Scattoni*[9], *M. Efrim-Budisteneau*[10], *R. Kawa*[11], *L. Poustka*[12], *J. Xenia Kafka*[13], *P. Garcia-Primo*[14] *and R. Canal-Bedia*[15], *(1)Carlos III Health Institute, Madrid, Spain, (2)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL, (3)Aarhus University, Aarhus, Denmark, (4)Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisbon, Portugal, (5)University of Coimbra, Coimbra, Portugal, (6)Dublin City University, Dublin 9, Ireland, (7)Centro Hospitalar e Universitário de Coimbra - CHUC, Coimbra, Portugal, (8)Policlinica Gipuzkoa, San Sebastian, Spain, (9)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (10)'Victor Babes' National Institute of Pathology, Bucharest, Romania, (11)University of Warsaw, Warsaw, Poland, (12)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (13)Medical University of Vienna, Vienna, Austria, (14)Instituto de Salud Carlos III, Madrid, Spain, (15)University of Salamanca, Salamanca, Spain*

Background: Although ASD prevalence studies have been carried out worldwide, the lack of mechanisms to obtain consistent and reliable information about ASD trends across European countries has been an important obstacle for making policy decisions at both the European Union (EU) and individual national levels. The Autism Spectrum Disorder in the European Union (ASDEU – http://asdeu.eu) project is a multi-site European collaboration with several objectives including estimation of ASD prevalence and developing harmonized prevalence strategies. Objectives: The presentation will describe preliminary results of the harmonized multi-site field survey strategy aimed at children ages 7-9 years old. It will reflect upon lessons learned regarding the field survey methods and their practical implementation in real-world settings.

Methods: Eight ASDEU partners (Austria, Bulgaria, Ireland, Italy, Poland, Portugal, Romania, Spain) are conducting the prevalence field survey based on school screening methods in defined geographic catchment areas. In general, the field strategy first involves a “Teacher Nomination Form” (TNF) for teachers to nominate possible ASD cases in their classes, followed by completion of the SCQ by parents (of teacher-nominated children or all children in the classroom), followed by a clinical evaluation of nominated children using the ADOS-G and other tools; two countries only used the SCQ in the screening process. The presentation will focus on 6 countries (Spain, Portugal, Italy, Romania, Poland, Austria) with most progress to date. The six countries provided data from 9 different catchment areas; 4 countries used both the TNF and SCQ and 2 used the SCQ only. Each country implemented minor variations in the screening approach to comply with ethical committee or school approvals; to manage the relationship between researchers, teachers and school authorities; and to manage the timing of parental consent.

Results: Portugal, Poland, Austria and Romania screened children in both special needs and regular schools; in Spain and Italy special needs children are integrated into regular schools. Portugal, Italy, Austria and Romania randomly selected schools in their study catchment areas; Poland randomly selected schools in one study area and all schools in 3 areas; Spain included all schools in its study area. The number of selected schools ranged from 47-217 per country; the participation rate of schools across countries ranged from 49%-100%; 252-498 teachers per country contributed to the first screening phase of 5,951-13,335 students per country applying the TNF (Spain, Portugal, Poland and Romania) and 10,872 and 13,628 students from Austria and Italy, respectively, only using the SCQ. From 1.3% to 3.0% of children were TNF-nominated in Spain, Portugal, Poland, and Romania. The clinical assessment phase of nominated children is ongoing.

Conclusions: This is the first comprehensive European action to estimate ASD prevalence. Use of the TNF and SCQ as school-based screening tools suggests the TNF is feasible to administer, well received, and provides greater coverage of the target population with lower implementation costs than the SCQ. Analysis will compare prevalence estimates derived from the TNF versus SCQ screening tools and results will inform the development of future ASD prevalence strategies across EU countries.

84 **109.084** Autism Spectrum Disorder (ASD): Disease Conceptualization and Parental Roles in Puerto Rico

M. Chavarria, *Osteopathic Medicine/Anthropology, Michigan State University, East Lansing, MI*

Background:
Autism Spectrum Disorder (ASD) is a broad category encompassing a wide array of developmental delays, social-interactional differences, and sensory sensitivities. It is a diagnosis most frequently made during childhood and carries implications not only for the ASD child, but also for the broader community network raising and supporting them. Recent anthropological research has shed light on the complexities of autism conceptualization as both disease and expression of neurodiversity; along with parental conceptualization of autism as constructed around dominant biomedical and sociocultural paradigms. However, studies remain particularly scarce concerning the context of Latin America.

Objectives:

This study investigates how ASD parents in Puerto Rico conceptualize autism. The specific aims of this project are as follows: 1) to investigate how ASD parents frame and construct their conceptualization of autism as a disease and as a marker of identity, 2) to examine the dynamics of communication between ASD parents and treatment providers, noting in particular how each work together to navigate social-interactional and behavioral differences and/or challenges within the health care and educational setting, and 3) to examine how ASD parents advocate for their child and how they may stratagize to gain access to limited resources amidst a struggling socioeconomic and political environment.

Methods:

This study consists of preliminary dissertation ethnographic fieldwork conducted in May 2017 in Puerto Rico. Participant-observation was carried out at ASD-focused educational/therapeutic facilities and ASD-related community events. After obtaining written consent, 50 semi-structured interviews were conducted in either English or Spanish (dependent on subject's preference) with ASD parents and/or ASD community members, including extended family, treatment providers, and ASD organization members. Data analysis is in progress as interviews are coded for subject-specific and general thematic narratives.

Results:

Pervasive themes among the subject narratives concerned health/educational department management, inefficient government bureaucracy, and the current economic crisis faced by Puerto Rico. The ASD community of Puerto Rico struggles with the discontinuity of patient care, as the responsibility for the health and welfare of ASD children transfers from the Health Department (ages 0-3 years) to the Education Department (ages

3-21 years). There is little to no public institutional support or structure available for ASD children that age out of the system. ASD parents are placed in a role of advocate for their child to access medical and educational resources. Subject interviews demonstrated this role to be particularly challenging for individuals who lack financial or social resources to access legal aid or navigate the complex system of care on the island. Puerto Rico is currently experiencing dire economic struggle and mass exodus of the population to mainland USA. Subject interviews reveal how this has further marginalized the island's ASD community within this nation in crisis.

Conclusions:

Puerto Rican ASD parents and community members both construct and work within complex disease conceptualizations of autism. How ASD parents are thinking about autism influences how they approach navigating a difficult medical, educational, and legal system in order to gain access to limited resources for their ASD children.

85 **109.085** Autism Spectrum Disorder Symptoms' Perception: The Case of Andean-Ecuadorian Population

P. Buffle[1]*, M. G. Granero*[2] *and E. Gentaz*[3]*, (1)SMAS Laboratory, University of Geneva, Ge, Switzerland, (2)Universidad Nacional de Rosario, Rosario, Argentina, (3)Psycholgy, University of Geneva, Geneva, Switzerland*

Background: Adult identification of red flag behaviours in young children, as potential symptoms of developmental disorders, may increase the probability of seeking professional attention for early detection, which has been associated with better health outcomes. Perceptions of symptoms may vary according to different cultures, locations, and socio-economic factors. Hence, studies conducted in different countries are important in order to identify particularities that need to be taken into account during the diagnosis process.

Objectives: Autism Spectrum Disorder's detection is understudied in low and middle-income regions, such as Latin America. To our knowledge no studies related to ASD symptoms' perception have been undertaken in Ecuador or neighbouring countries. This study's aim is to analyse ASD behaviours that can be identified by general adult population as worrying symptoms that may lead them to seek for professional help.

Methods: We interviewed 54 subjects between 18 and 80 years old from different social classes and educational backgrounds, living in the Andean region of Ecuador. The questionnaire includes questions based on items extracted from screening and diagnosis tools, such as M-Chat and ADOS. Interviewers were asked to evaluate different behaviours present in children from 18 to 36 months as "normal", "strange" or "worrisome" (semi-structured questions). Participants were also asked to give a possible cause associated to such behaviours (open-ended questions). Answers to possible causes could be classified in six main categories: (1) personality/circumstantial causes ("his character", "is angry", "is too young"); (2) developmental causes (autism, language difficulty or "disorder"); (3) physical deficits (mostly referred as auditory or visual difficulties); (4) psychological causes (emotional impairment such as "trauma" or "stress"); (5) rearing/familiar causes.

Results: Preliminary results indicate that, most of the proposed behaviours are considered strange and worrisome. However, certain red flags such as the presence of unusual finger movements are considered normal by more than 50% of interviewers. Furthermore, explanations to these behaviours are not always associated to developmental concerns, but can also be perceived as a sensory and physical impairment, or as difficulties inherent to the child's personality that could improve with time.

Conclusions: Those findings suggest that adult perception of symptoms in Ecuadorian-Andean population could influence families' decision to ask for help and for a professional evaluation, which may increase the age of diagnosis. Being aware of these perceptions may also be informative during evaluation for ASD, as information from parents may not always correlate with the observation of a trained evaluator. Finally, as some of the red flags are being perceived as physical impairments, and some of the children presenting ASD symptoms may be addressed to practitioners in these fields, these findings highlight the importance of education on ASD identification among all health practitioners.

86 **109.086** Bilingualism in Autism: Language Learning Profiles and Social Experiences

B. G. Digard[1]*, S. Fletcher-Watson*[1]*, A. C. Stanfield*[2] *and A. Sorace*[3]*, (1)University of Edinburgh, Edinburgh, United Kingdom, (2)University of Edinburgh, Edinburgh, United Kingdom of Great Britain and Northern Ireland, (3)Department of Linguistics, University of Edinburgh, Edinburgh, United Kingdom*

Background: It is estimated that at least half the world's population is bilingual or lives in a bilingual environment, and theoretically, so does half the world's autistic population. This proportion may be reduced, due to the common belief among parents and practitioners that bilingualism may induce a cognitive overload for a child with autism. However, numbers may also be increased due to the many autistic people who adopt language-learning as a hobby.

Bilingualism impacts how our brain represents languages, but the influence of knowing several languages goes further, and changes the way people relate to others, and lead their lives. This is of particular interest in the case of autism, where social interaction presents many challenges. A better understanding of the overlap between the social variations of bilingualism and autism could unveil new ways to support the social experiences of autistic people.

Objectives: This research aims to understand the language learning and social experiences of autistic people who speak, one, two or more languages. We ask how people with autism become bilingual, and how this impacts their social life.

Methods: To address this question, we developed the Autism and Bilingualism Census (ABC), an online survey designed for monolingual, bilingual and multi-lingual adults with autism. The ABC consisted of:

1. General demographic questions;
2. Questions about social experiences including social life habits (such as the making and maintaining of friends, or the online and in-person engagement in social activities), and quality of life;
3. A language history section, to record how respondents had acquired and were using each of their languages.
4. Open-ended questions to gather qualitative data on the way language learning and knowledge had influenced respondents' lives.

Results: A total of 294 autistic adults took part in the ABC, including 86 monolingual English speakers, 98 bilinguals, 56 trilinguals, and 54 respondents knowing 4 languages or more. Respondents collectively reported knowledge of 55 spoken or signed languages. By combining the quantitative and qualitative assessments, respondent profiles emerged including: being raised bilingually; learning languages at school; learning languages later in life out of a passion for languages. We will report further quantitative and qualitative data comparing social life habits and quality of life between these groups. Early emergent themes drawn from section (iv) of the survey suggest that autistic people feel that bilingualism offers employment and educational opportunities, strengthens their ability to communicate with others, and teaches new ways of thinking.

Conclusions: This is the first study describing the language history and social experiences of a substantial sample of bilingual and multilingual autistic adults. It provides valuable insight into how autistic people can encounter a new language, learn it, and use successfully it in their daily life.

87 **109.087** Burden in Latin American Families of People with Autism Spectrum

C. S. de Paula[1,2], *A. Rattazzi*[3], *S. H. Cukier*[3], *G. R. Cunha*[4], *D. Bordini*[5], *D. Valdez*[6], *C. Montiel-Nava*[7], *G. Garrido*[8], *R. A. Garcia*[9], *A. Rosoli*[10] *and M. Irarrazaval*[11], *(1)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (2)Departament of Psychiatry, Federal University of São Paulo, São Paulo, Brazil, (3)PANAACEA, Buenos Aires, Argentina, (4)Departament of Psychiatry, Federal University of São Paulo - UNIFESP, São Paulo, Brazil, (5)Departament of Psychiatry, Federal University of São Paulo, Sao Paulo, Brazil, (6)Universidad de Buenos Aires-FLACSO, Buenos Aires, Argentina, (7)La Universidad del Zulia, Gainesville, GA, (8)Universidad de la República, Montevideo, Uruguay, (9)Universidad de Chile, Santiago, CHILE, (10)Projects, Organizacion Estados Iberoamericanos, Santo Domingo, Dominican Republic, (11)University of Chile, Santiago, Santiago, Chile*

Background: Studies conducted in developed countries indicate high burden to families of people with ASD, as well as high costs related to the disorder. However, few data are available about the lived experiences of families affected by ASD in the Latin America. To conduct international research collaborations related to ASD in Latin America, in 2015, researchers from Argentina, Brazil, Chile, Uruguay, Venezuela and Dominican Republic constituted the Latin American Autism Spectrum Network – REAL.

Objectives: To describe the stigma and financial impact of having a family member with ASD in six Latin American countries.

Methods: Study design: cross-sectional study. Sample: 2.953 parents/primary caregivers from six Latin American countries (convenience sample) – 1,243 from Brazil, 786 from Argentina, 375 from Uruguay, 291 from Chile, 147 from Dominican Republic and 111 from Venezuela. Instrument: Spanish/Portuguese version of the AS Caregiver Needs Survey (developed by Autism Speaks, Global Autism Public Health Initiative) with information about family demographics, affected individual characteristics, service encounters and parent/caregiver perceptions, including stigma and financial impact of ASD.

Results: More than 1/3 of the caregivers from all countries declared feeling powerless (overall 38.9%; ranging from 17.0% in Venezuela to 51.3% in Brazil) and discriminated (overall 34.4%, ranging from 17.0% in Venezuela to 38.3% in Uruguay) for having a child with ASD. A smaller proportion (14.6%) said that having a child with ASD imposes a negative impact over them (ranging from 5.7% in Venezuela to 16.8% in Brazil) and only 8.5% were worried that other people would know that they have a child with ASD (ranging from 6.0 in Uruguay to 10.7 in Chile).

Overall, 48.7% of the caregivers reported negative financial impact related to ASD, ranging from 42.8% in Argentina to 62.6% in Dominican Republic. Almost half of the participants (47.4%) declared that members of their family had to cut down working activities (ranging 43.9% in Brazil to 54.1% in Venezuela) and 35.5% had stop working (ranging from 27.9% in Dominican Republic to 39.6% in Venezuela).

Detailed description of data by country will be provided during the IMFAR.

Conclusions: A significant proportion of caregivers of individuals with ASD in Latin American have complaints related to stigma, mainly discrimination, with variation among countries. Perceived stigma is associated with decreased access to mental health care services, and delayed treatment may impact prognosis in these population. Further researches on the stigma of ASD in Latin American communities is necessary to clarify potential causes of stigma, address differences among countries and plan adequate interventions.

Additionally, having a child with ASD was associated with substantial financial burden with almost 50% of participants reporting some sort of burden in this field in most of the Latin America countries. Knowing that high costs should be affecting people with ASD throughout life, efficient use of health and educational resources is urgent, particularly in countries with limited resources as Latin America one

88 **109.088** Caregiver Health Related Quality of Life (HRQoL) and the Regularity of Family Routines in Families Raising Children with Autism Spectrum Disorder (ASD) in the Western Cape: A Descriptive Study

M. Harty, *University of Cape Town, Observatory, Cape Town, South Africa*

Background:

Literature states that the health-related quality of life (HRQoL) of caregivers may be impacted by caring for children with Autism Spectrum Disorder (ASD). Aspects of family life reported to be affected by the presence of a child with ASD include caregiver social, physical & mental health, and family routines. However, limited research exists which describes factors affecting well-being in families raising children with ASD in South Africa, a middle-income country. Available published literature indicates a direct and positive relationship between the regularity of family routines and families' satisfaction with their family quality of life for families of children with ASD living in South Africa. However, no studies have been conducted which describe the relationship between the regularity of family routines, and the health-related quality of life of caregivers who are raising a child with ASD in South Africa.

Objectives:

This study describes the HRQoL of caregivers raising children with ASD and the regularity of their family routines and explores the associations between these two variables.

Methods: A descriptive survey design was employed. Twenty-four parents of children with ASD participated in the online survey. The 36-Item Short Form Health survey (SF-36) was used to determine caregiver's HRQoL and the Family Routines Inventory (FRI) to determine the regularity of family routines. These surveys, together with a demographic survey were distributed to parents via SurveyMonkey, an online survey tool.

Results:

Sub-scale and total scale data for 21 participants were analysed using descriptive and correlational statistics. Data were normally distributed. Data obtained from the HRQoL measure indicates that caregivers of children with ASD experienced low levels of energy/vitality (M=48.57, SD=5.55), emotional well-being (*M*=57.33, *SD*=5.14) role limitations due to emotional health (*M*=57.14, *SD* =8.70), and social functioning (*M*=61.50, *SD*= 9.19). There was a significant correlation between social functioning and general health [$r = 0.484$, $n = 21$, $p = 0.026$]; and between emotional well-being and energy/vitality [$r = 0.738$, $n = 21$, $p = 0.000$]. Data obtained from the FRI measure indicate that, of all the routines explored in the FRI, bedtime (*M*=0.72, *SD*=0.014)), and leisure routines (*M*=0.75, *SD*=0.718) are implemented with the least regularity. Workday (*M*=1.65, *SD*=0.491), leaving and homecoming (*M*=1.65, *SD*= 0.246)), child focused routines (*M*= 1.492 *SD* = 0.542) and mealtime routines (*M*= 1.546, *SD*= 0.445) occurred with more regularity. There was no significant correlation between participant scores on the FRI and the SF-36 [$r = 0.195$, $n = 21$, $p = 0.199$].

Conclusions:

This data indicate that ASD impacts on caregivers' emotional well-being and social functioning, which are correlated with parents' perceptions of their general health and levels of energy/fatigue. When implementing routine-based interventions in the home, clinicians should focus on embedding goals in routines which happen regularly. Surveys such as the FRI can be used to assist clinicians and families to identify these routines.

89 **109.089** Developing a Group Intervention Programme to Enhance Communication Interaction for Parents of Young Children with Autism Spectrum Disorder.

M. Harty[1] *and A. Osman-Kagee*[2]*, (1)University of Cape Town, Observatory, Cape Town, South Africa, (2)Western Cape Department of Education, Cape Town, South Africa*

Background:

Group-based parent training is a cost-effective way of providing early intervention in resourced constrained settings, such as South Africa. Parent training literature from developed countries indicates that parent training improves sense of parenting competence and self-efficacy. However, limited parent training programs have been adapted for implementation in low-and-middle income (LAMI) countries, and even fewer have been developed and evaluated within LAMI contexts. This presentation describes the development and piloting of a group-based parent training program to facilitate the communication development of young children with ASD living in South Africa.

Objectives:

Four objectives will be discussed in this presentation:

1) To describe the content development of the program

2) To determine the program's social validity by soliciting feedback from professionals.

3) To pilot the program with a group of parents to determine the program's effect on parenting self-efficacy.

4) To determine the program's social acceptability by soliciting feedback from pilot participants.

Methods: The content of the training program was developed based on an extensive literature search for communication strategies which have a positive impact on child communication development and could be taught to parents. Four strategies were ultimately selected namely: environmental arrangement, contingent responding, modelling and expansion of language and creating opportunities to talk. To determine the social validity of the program an expert panel of 5 professionals (2 psychologists, 2 speech language pathologists, and an occupational therapist) were asked to evaluate the program. They were given access to the program manual, power point presentation materials and the video modelling material. Twenty-five parents completed the program. Pre-and post-test measures of parenting self-efficacy were collected using the Parenting Sense of Competence Scale (PSOC). They were asked to provide both qualitative and quantitative information about the social acceptability of the program.

Results:

Professionals were asked to rate the program on a 4-point Likert scale across 4 criteria (the relevance of the content, the comprehensiveness of the content, the relevance of the teaching tools, and the relevance of the delivery methods). Professionals rated all criteria either a 3 or 4, indicating they felt that the program content was appropriate and relevant. Pilot data indicate that parents' average PSOC efficacy score after training ($M = 37.26$, $SD = 4.27$) was significantly higher (indicating higher self-efficacy levels) than their average PSOC efficacy score before training ($M = 34.27$, $SD = 3.48$), with $t(24) = -3.26$, $p < .003$, $d = 1.33$. Eighteen parents (75%) reported they felt confident to use these strategies in play and daily routines. Twenty-one (84%) parents felt confident they could use at least 1 of the strategies at home with their child. Contingent responding was the strategy that parents reported they were most likely to use at home.

Conclusions:

The feedback from parents and professionals indicated that the program content was appropriate within the South African context. Data from the pilot study indicates that the program can improve parenting self-efficacy levels. Future research should determine if the COMPASS program positively impacts on the way in which parents interact with their child.

90 **109.090** The Effect of a Group-Based Training Program on the Parenting Self-Efficacy and Parent CHILD Interaction for Parents of Young Children with Autism Spectrum Disorder

ABSTRACT WITHDRAWN

Background:

A substantial body of evidence documenting the positive effects of group-based parent training in developed country contexts. Benefits include, but are not limited to, decrease in parental stress, increasing in parenting competence and increase in family well-being. However, relatively little research in low and middle-income countries like South Africa investigates the benefits of group-based training for parents of children with Autism Spectrum Disorder (ASD). The COMPASS parent training program is a group based training program which has been designed for implementation in the South African context. This training program aims to enhance parents' ability to support their child's communication development by teaching parents four language facilitation strategies (contingent responding, modelling, expansion of language and creating opportunities to talk).

Objectives:

This study investigated the effect of the COMPASS program on:

- Levels of parenting self-efficacy
- Parents communication interaction with their child.

Methods:

A pre-test post-test quasi experimental group design was employed. Parent's self-efficacy was measured using two parent self-report measures, namely the Parenting Sense of Competence Scale (PSOC) and the Parenting Self-Efficacy Measuring Instrument (P-SEMI). Parenting interactions were video recorded and analysed by blind assessors using the Parenting Interaction with Children Checklist Observations Linked to Outcomes (PICCOLO).

Results: Thirty-one parents with a mean age of 34 (*SD* 5.51) participated in the training program. Using an alpha level of .05, a dependent-samples *t* test was conducted to evaluate whether parents post training self-efficacy scores differed significantly from their pre-training scores. The data indicate that the parents average PSOC score after training ($M = 88.36$, $SD = 11.06$) was significantly higher (indicating higher self-efficacy levels) than their average PSOC score before training ($M = 85.00$, $SD = 13.78$), with $t(30) = 44.48$, $p < .000$, $d = 5.65$. Furthermore, parents average PSEMI score after training ($M = 117.87$, $SD = 27.23$) was significantly lower (indicating higher self-efficacy levels) than their average PSEMI score before training ($M = 129.10$, $SD = 34.15$), with $t(30) = 24.098$, $p < .000$, $d = 2.81$. The analysis of the parent interaction scores (pre and post-test PICCOLO data) is ongoing, however these data will be included in the presentation. Preliminary parent interaction results suggest that parents are able to incorporate the targeted communication strategies in their interactions with their child.

Conclusions: A group-based training program, such as COMPASS, improved the levels of parenting competence (specifically parenting self-efficacy) and increased parent use of the target communication strategies during parent-child interaction. Further research is needed to establish additional benefits of group based parent training for parents living in low and middle-income countries such as South Africa.

91 **109.091** Challenges and Priorities in Families of Children with Autistic Spectrum Disorders in Dominican Republic

A. Rosoli[1], *R. Mendoza*[2], *A. Rattazzi*[3], *C. Montiel-Nava*[4], *R. A. Garcia*[5], *G. Garrido*[6], *S. H. Cukier*[3], *D. Valdez*[7], *C. S. de Paula*[8] *and M. Irarrazaval*[9], *(1)Projects, Organizacion Estados Iberoamericanos, Santo Domingo, Dominican Republic, (2)CAID, Santo Domingo, Dominican Republic, (3)PANAACEA, Buenos Aires, Argentina, (4)Universidad Latina de Panama, Panama, Panama, (5)Universidad de Chile, Santiago, CHILE, (6)Universidad de la República, Montevideo, Uruguay, (7)Universidad de Buenos Aires- FLACSO, Buenos Aires, Argentina, (8)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (9)University of Chile, Santiago, Santiago, Chile*

Background:

In developing countries, access and quality to basic services can be a barrier to the developmental of an autonomous life especially for people with Autism Spectrum Disorders (ASD). These limitations are the ones that deal families with challenges to overcome to guarantee the quality of life of their children with the condition. In Dominican Republic there is a lack of information about the challenges and priorities experienced by caregivers of people with ASD. The access to this information can guide to political decision in order to strength or develop priorities services.

Objectives:

To identify the challenges and priorities experienced by caregivers of people with Autism Spectrums Disorders in Dominican Republic.

Methods:

This research was part of a study carried out in Latin America, and was led by specialists of Argentina, Brasil, Chile, Dominican Republic, Venezuela and Uruguay. AS for collecting information they used SEAN Caregiver Needs Survey. To administer the survey they used a digital platform. The National Committee on Bioethics in Health in the Dominican Republic approved the research project.

Results:

In Dominican Republic 152 surveys were collected, of which only 147 were completed. The three most important challenges presented by the families were: difficulties in communication (49.7%), difficulties in social interaction (42.2%), and problems behaviors (40.8%). As per challenges they identified: daily life skills (40.1%); concerns about safety/ notion of danger (34%); diet/feeding/feeding difficulties(21.1%); repetitive behaviors/ restricted interests/ insistence that things remain the same (11.6%); sleep problems (10.2%); health problems(6.8%); sexuality (9.5%); and sensory themes(6.1%).

For the largest number of families surveyed, the most compelling challenges were to get children to receive adequate education (80.3%), followed by having access to good health services for people with ASD (62.6%) and to ensure that the basic rights for people with ASD were protected (56.5%). The family's highest priority was to achieve better education services (75.5%), better health services (48.3%), better social services and social assistance (40.8%), more rights for individuals with ASD (33.3%), and greater awareness in the community (28.6%).

Conclusions:

The most significant challenges in Dominican Republic are related to opportunities in the context of education, health services and rights guarantees. In responding to priorities, families are again emphasizing the importance of education, health and rights services and adding social services and community's awareness to the condition. These results indicate the need to continued research about this situation in this country to create and support the development of policies and programs that can positively impact in the ASD population. More investigations to expand the sample are necessary.

92 **109.092** Changes in Knowledge on the Early Signs of Autism Among Female Community Health Volunteers in Nepal

R. Shrestha[1], *J. Barbaro*[2] *and C. Dissanayake*[2], *(1)La Trobe University, Melbourne, AUSTRALIA, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: Early identification and diagnosis of autism opens pathways to early intervention (EI) services, known to have positive developmental outcomes. Yet, children in low- and middle-income countries (LMICs) are diagnosed much later, missing the critical window for EI. A major barrier to early identification and diagnosis is a lack of knowledge of the early signs of autism amongst parents and professionals, coupled with a lack of early screening and surveillance programs and tools, as well as an inadequate number of trained health professionals. However, raising awareness in local communities through cost-effective training, and task shifting to community health workers, has been widely advocated to promote early identification of autism and other developmental problems in LMICs.

Objectives: Our objective was to evaluate knowledge regarding social attention and communication development and the early signs of autism among Female Health Community Volunteers (FCHVs), in a semi-urban community of Nepal, prior to and following training on Social Attention and Communication Surveillance (SACS). An evaluation of training on their day-to-day practice with families within their homes was undertaken.

Methods: 60 FCHVs (Mean age: 44.6 years; range 29.0-61.5), 82% having at least 6-years education and 73% with >10 years work experience, attended a workshop on typical and atypical social attention and communication development in young children, the early signs of autism, and the monitoring of key behaviours relevant to identification of autism in infants and toddlers. This was part of an implementation of SACS-Nepal into the daily practice of FCHVs in the Kirtipur Municipality. They completed a survey to assess their knowledge before and after the workshop. They also evaluated the training immediately after the workshop and 6 months after commencement of implementation of SACS-N. Change in FCHVs' confidence in monitoring and referring children at risk of autism was examined.

Results: The majority of participants were aware of social attention and communication development prior to training, with the exception of items: 'eye contact', 'gesture use', 'imitation', 'pretend play', and 'using words'; only 37% reported knowing the word "autism". Following training, they demonstrated significant improvement in their knowledge across all relevant behavioural items, including autism symptoms and its prevalence, diagnosis, and intervention. More than 96% reported greater confidence in monitoring and referring young children developing autism.

95% of FCHVs reported a positive impact of training on their work at 6 months, and rated the ease of implementation of SACS-N into their current practice; 73.3% agreed that parents were comfortable with the SACS-N being undertaken in their homes. Among those FCHVs who referred children for a developmental assessment, 98% reported that parents found it beneficial to participate in the SACS-N.

Conclusions: The findings indicate the effectiveness of training in improving FCHV's knowledge and confidence in monitoring and referring young children at risk of autism. These findings have important implications for lowering the age of diagnosis in low-resource settings by developing cost-effective services to monitor, identify and refer children at risk of autism early within the community as part of standard practice with families.

93 **109.093** Characteristics of Children Receiving an Initial Diagnosis of ASD in Jerusalem

J. Koller[1]*, T. P. Gumpel*[2]*, R. Shalev*[3] *and M. Begin*[4]*, (1)Seymour Fox School of Education, Hebrew University of Jerusalem, Jerusalem, Israel, (2)Seymour Fox School of Education, The Hebrew University of Jerusalem, Jerusalem, Israel, (3)The Hebrew University of Jerusalem, Jerusalem, Israel, (4)Hadassah Medical center, Jerusalem, Israel*

Background: Early access to services and better prognosis depend on the early diagnosis of ASD (Zwaigenbaum et al, 2015). Studies have consistently shown discrepancies in age of diagnosis between children from varying SES, cultural and ethnic backgrounds (Daniels & Mandell, 2013; Durkin et al., 2017). Recent studies have examined some of these issues in Israel, finding significant divergences between age of diagnosis across religious and ethnic groups (Raz et al, 2015; Davidovitch et al., 2013). The data in these studies have come from large national databases and provide important perspective on national trends. This broad vantage point necessarily sacrifices a nuanced understanding of local trends. Jerusalem is comprised of three primary groups of residents: secular and modern religious Jews (SMRJ), ultra-Orthodox Jews, and Arabs. The mixed nature of the city provides a unique opportunity to examine the interaction between demographics and clinical characteristics of children receiving a diagnosis of ASD.

Objectives: To examine the interaction between the sociodemographic and clinical characteristics of children receiving an initial diagnosis of ASD in a public child development center in West Jerusalem. Specifically, to understand factors associated with greater severity of autism symptoms as measured by the ADOS total score.

Methods: Chart review of every child diagnosed with ASD at Leumit Healthcare Child Development Clinic in West Jerusalem from 2011-2016. Information extracted included: age of referral, age of diagnosis, symptom severity, ethnicity, age and educational levels of parents, and presence of siblings with an ASD diagnosis.

Results: Of the 126 children diagnosed with ASD between 2011-2016, 37 were SMRJ, 69 ultra-Orthodox and 20 Arabs. Most were males (79%) with a mean age of diagnosis of 56.6 months (SD:31.9, range:13-172). While the general trend included fewer children being referred for evaluations as their age increased, it is noteworthy that after the age of 6 no Arab children were seen for an evaluation. Even more noteworthy is that all Arab children diagnosed with ASD were non-verbal.

A linear regression to predict autism severity (as measured by ADOS total score) shows that the linear combination of gender, ethnicity, current age, and relatives with ASD successfully predicted ASD severity (adjusted R^2 = 19.7, F (5, 98) = 6.04, $p < .001$), with lower age at time of referral (β = -0.38, $p < .001$) and Arab ethnicity (β = 0.20, $p < .05$) predicting the dependent variable. In contrast with previous findings, no differences were found between SMRJ and ultra-Orthodox Jews.

Conclusions: This examination of a public child development center in Jerusalem indicates that Arab children are likely to be referred for an evaluation only if they were under the age of six and non-verbal. Arab ethnicity, independent of child's age, is associated with more severe ASD symptomatology. Additionally, all children diagnosed at earlier ages are likely to be more severely affected by ASD. These findings bear significance regarding public health policy relating to awareness, screening and referral for ASD evaluations in sectors of Israeli society.

94 **109.094** Chinese Children with Autism Spectrum Disorder Show a Preference for Dynamic Geometric Compared with Social Images Which Is Also Associated with Symptom Severity

J. Kou[1]*, J. Le*[1]*, M. Fu*[1]*, Y. Zhang*[1]*, B. Becker*[1]*, L. C. Lee*[2] *and K. M. Kendrick*[1]*, (1)Life Science and Technology, UESTC, Chengdu, China, (2)Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

Background: Simple behavioral paradigms quantifying differential attention towards social vs non-social stimuli using eye-tracking measures may be potential markers for young children with autism spectrum disorder (ASD). One promising paradigm is where fixation on dynamic geometrical

images (DGI) is compared to dynamic social images (DSI) with ASD children showing greater interest in the geometric patterns[1]. However, other paradigms showing reduced attention towards biological as opposed to non-biological motion have also generated some positive findings[2]. It is also unclear the extent to which these measures are effective in Asian as well as Caucasian cultures.
Objectives: In this preliminary study on Chinese children diagnosed with ASD compared with age- and gender-matched typically developing (TD) children, we have investigated whether there is a similar bias attention towards DGI and away from biological motion, and if this is associated with symptom severity.

Methods: 40 children were recruited for the study. The ASD group consisted of 22 children diagnosed with autism (DSM-V) while the TD group consisted of 18 children (ASD mean±SD age = 4.47±2.05years; TD =4.18±0.45 years, t=.600, p=.552). All ASD children were assessed using the Autism Diagnostic Observation Schedule-2 (ADOS-2). Additionally, parents of children in each group completed the Social Responsivity Scale 2 (SRS-2), Caregiver Strain Questionnaire (CSQ), Social Communication Questionnaire (SCQ), and Repetitive Behavior Scale Revised (RBS-R). Data from 4 children were excluded due to parental interference, spending <50% time looking at the images or technical issues. A Tobii T120 Eye Tracker (Tobii, Stockholm, Sweden; www.tobii.com) was used to measure eye fixations during two paradigms: (1) a DGI vs DSI visual preference paradigm where 30 different pairs of videos were presented simultaneously side by side, each for 2 s. (2) a non-biological vs biological motion paradigm with pairs of videos with point-light displays depicting animate (cat or human) vs scrambled control inanimate images (cat or human control)(8, 10s trials).

Results: Fixation count and duration for DGI vs DSI stimuli in the two groups was analyzed using a one-way analysis of covariance (ANCOVA) in ASD and TD groups with age as a covariate. A significant difference was found for both fixation count [$F_{2,33}$=6.01 p=.02] and total duration [$F_{2,33}$=6.85, p=.013]. Post hoc analysis with Bonferroni correction showed that children in the ASD group had a significantly greater proportion of fixations (p<.020, Cohen's d=0.89) and total duration (p<.013, Cohen's d=0.96) on DGI than TD children. Pearson correlation showed that fixation number and total fixation duration to DGI in ASD subjects were significantly associated with the social affect (SA) score on ADOS-2 (r = 0.60, p=.007; r=0.57, p=.011). On the other hand, no significant difference was found between the ASD and TD groups in the biological motion paradigm.

Conclusions: Our results demonstrate that eye tracking measures showing greater attention towards DGI may be a sensitive marker for ASD and ASD symptom severity in Chinese subjects.

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95 **109.095** Coping, Distress, and Well-Being in Latina Mothers of Children with Autism

E. J. Lang[1]*, K. Martinez*[2] *and A. R. Neal-Beevers*[3]*, (1)Child Development in Context at The University of Texas at Austin, Austin, TX, (2)Weill Cornell Medicine, White Plains, NY, (3)The University of Texas at Austin, Austin, TX*

Background:

Autism Spectrum Disorder (ASD) represents a continuum of disordered behavior and deficits that can affect communication, social, intellectual, and developmental progression (APA, 2017). ASD is a complex diagnosis that can present many challenges and lifestyle changes for the parents of affected individuals, (Karst & Van Hecke 2012). While many studies have explored the mental and emotional implications of ASD on mothers, the majority of these studies have investigated participants from predominantly white, middle-to-upper class populations. Latinos constitute one of the fastest growing demographic groups in the United States (Pew Research Center, 2014), yet little research has examined coping and well-being in Latina mothers of children with ASD (Magaña, et al., 2006).

Objectives:

This study examined (1) how Latina mothers cope with their child's ASD and (2) if child ASD symptoms and maternal coping strategies are associated with maternal distress and wellbeing.

Methods:

Participants included 32 mothers of children with ASD who identified as Hispanic or Latina (see Table 1 for demographics). Mother completed online survey measures, including a demographic questionnaire and the following assessments: the Brief COPE to measure how mothers cope with parenting a child with ASD (Carver 1997), the Abbreviated Multicultural Acculturation Scale (Zea, et al., 2003), the Center for Epidemiological Studies Depression Scale – Revised (Radloff, 1977), the Social Responsiveness Scale – 2 (Constantino, 2012), and the Satisfaction with Life Scale (Diener, et al., 1985). The following variables were examined: problem-focused coping skills (active coping, planning, positive reframing) and emotion-focused coping skills (denial, venting, and behavioral disengagement), religion coping skill, maternal depression, maternal well-being, maternal U.S acculturation, maternal Hispanic acculturation, child maladaptive behaviors, and child ASD symptom severity.

Results:

Pearson Product Moment correlations were calculated to examine the relations between coping strategies, maternal acculturation, child maladaptive behaviors, ASD symptom severity, and maternal depression, and well-being (Table 2). Maternal depression was significantly positively correlated with utilizing behavioral disengagement and denial coping strategies. Maternal stress was significantly positively correlated with both child maladaptive behavior symptoms and ASD symptom severity. Maternal well-being was significantly positively associated with using religion as a coping mechanism and marginally positively associated with having higher scores on the Latina subscale.

Conclusions:

The current study found significant correlations between emotion-focused problem solving and greater maternal depression. These findings concur with previous research, showing that emotion-focused coping is associated with more negative maternal emotions (Benson, 2010). Also consistent with previous research, we found that heightened ASD severity and maladaptive behavior symptoms were related to significantly increased parenting stress. Interestingly, using religion as a coping strategy was associated with higher well-being in our mothers. While evidence supporting the use of religion as an adaptive coping strategy has been mixed (Benson, 2010), these findings suggest that using religion to cope may be adaptive for Latina mothers of children with ASD.

96 **109.096** Cultural Differences in Cognitive Flexibility and Autism Traits; A Comparison between Malaysia and the United Kingdom

M. de Vries[1]*, S. Abu Bakar*[2] *and E. Sheppard*[3]*, (1)Univerity of Nottingham Malaysia Campus, Semenyih, Malaysia, (2)School of Psychology, University of Nottingham Malaysia Campus, Semenyih, Malaysia, (3)University of Nottingham, Nottingham, United Kingdom of Great Britain and Northern Ireland*

Background:

Individuals with an Autism Spectrum Disorder (ASD) are reported to have daily life difficulties in cognitive flexibility. However, when measuring cognitive flexibility with experimental or clinical tasks, findings are inconclusive. Individuals with ASD seem to perform worse than typically developing (TD) individuals on the Wisconsin Card Sorting Task (WCST). Switch task findings are less clear, but performance on a Gender-Emotion Switch Task appears to be related to repetitive and stereotyped behaviour in children with ASD. Remarkably, Malaysian university students report more flexibility problems compared to students from the United Kingdom (UK) on the Autism Spectrum Quotient (AQ; attention switching subscale). It is unclear whether the higher AQ scores reflect an actual difference in cognitive flexibility, or a cultural difference in how individuals from these two countries fill in questionnaires.

Objectives:

The aim is to study whether there is a difference between students from Malaysia and the UK in cognitive flexibility when measured with a diverse range of tasks, and whether this can be explained by differing levels of autistic traits.

Methods:

A digital version of the Wisconsin Card Sorting Task (WCST), the Gender-Emotion Switch Task, the AQ, the Social Responsiveness Scale (SRS), and the Cognitive Flexibility Index (CFI) are administered to 120 students (60 from Malaysia and 60 from the UK). We expect that individuals in the UK who report more cognitive flexibility problems on the questionnaires will perform worse on the tasks. However, we expect that this relation will not be as clear in Malaysia. Moreover, we expect that Malaysian participants will report being less flexible on the AQ, SRS and CFI compared to UK participants, but we expect similar task performance in both countries.

Results:

Currently 28 individuals completed the study in Malaysia. Data collection in the UK will take place from November 2017 onwards. In the Malaysian subsample there were no significant correlations between the questionnaires and the task performance after Bonferroni correction. However, the correlation between the Switch Task (switch costs in error rate), and the SRS repetitive behaviour scale showed a trend towards significance $r = -.38$, $p<.05$, indicating that higher switch costs are related to less repetitive behaviour.

Conclusions:

The current study aims to unravel whether higher reported cognitive flexibility deficits in Malaysia compared to the UK reflect a difference in cognitive flexibility, or in answering tendency. In a broader sense, the aim is to determine whether western developed questionnaires that screen for ASD are applicable in Malaysia. If individuals in Malaysia score higher on ASD screeners in general, it might be indicated to heighten the cut off score. However, if the higher scores reflect an actual deficit or problem, this should be taken seriously. The next step is to study whether the findings are also replicable in individuals with ASD in both countries.

97 **109.097** Delivery of the Early Start Denver Model in Inclusive Vs. Autism-Specific Classrooms in a Community Preschool Setting in Australia: Implementation and Child Outcomes

G. Vivanti[1]*, C. Dissanayake*[2]*, E. Duncan*[3]*, K. Capes*[3]*, J. Feary*[3]*, S. Upson*[3] *and K. Hudry*[4]*, (1)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (3)Victorian Autism Specific Early Learning and Care Center, La Trobe University, Melbourne, Australia, (4)Victorian Autism Specific Early Learning and Care Center, Olga Tennison Autism Research Centre, Melbourne, Australia*

Background: The Early Start Denver Model (ESDM) is an early intervention approach developed and empirically tested in the USA across several implementation formats, including 1:1 delivery at the child’s home and at specialized (i.e. autism specific) center-based programs. More research is needed to examine feasibility and effectiveness of ESDM in different cultural and implementation contexts, such as group-based delivery in inclusive (i.e., mainstream) classrooms in non-US countries.

Objectives: We examined the feasibility, acceptability and preliminary effectiveness of adapting the ESDM for delivery in inclusive childcare classrooms in a preschool setting in Melbourne, Australia.

Methods: We randomly assigned 29 preschoolers with ASD to receive ESDM in classrooms that included mostly children who were typically developing (Inclusive setting group) or only children with ASD (Specialized setting). The two groups were compared on a variety of measures at baseline, and after at least 9 months of intervention.

Results: Family uptake into and retention within the trial were very good. Staff in both settings demonstrated similar levels of treatment fidelity. Children in both settings showed equivalent improvements across measures of communication, social engagement, imitation, and adaptive behavior and autism symptoms. Among those in the Inclusive setting alone, children with higher baseline social attention, as measured through eye-tracking, had better social communication outcomes.

Conclusions: Adaptation of the ESDM for group-based delivery to young children with ASD in an inclusive setting appears to be feasible, acceptable, and not less effective than delivery within specialized classrooms.

98 **109.098** Early Identification of Autism Using Social Attention and Communication Surveillance in Tianjin, China (SACS-C)

C. Wang[1]*, C. Dissanayake*[2]*, J. Barbaro*[2]*, G. Liu*[3] *and J. Wang*[3]*, (1)Nankai University, Tianjin, China, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (3)Child Health, Tianjin Women and Child Health Centre, Tianjin Shi, China*

Background: Advances in understanding the early autism phenotype means that earlier identification and diagnosis of Autism Spectrum Disorders (ASD) is now possible within the second year of life. However, this knowledge is largely based on studies undertaken in the Western world and published in English, with findings rarely impacting practices in non-English speaking nations. This situation is exacerbated in developing nations and low resource communities. The Tianjin Women and Children's Health Center sought a reliable and valid tool suitable for use by doctors in community hospitals, with high sensitivity and specificity, to detect ASD at younger ages within its community-based three level childcare network.

Objectives: Our objective was to translate evidence-based knowledge in developmental surveillance for ASD, by training early childhood medical professionals on Social Attention and Communication Surveillance - Chinese (SACS-C) in a pilot program in Tianjin, China.

Methods: Two-hundred and fifty two (252) medical professionals were trained to monitor early signs of ASD at 12-, 18- and 24-months of age as part of their routine developmental checks of babies. Sixty-two community hospitals in six urban districts in Tianjin participated in the study with 10,516 children monitored between 12 – 24 months of age: 3,178 at 12-months; 3,758 at 18-months; and 3,580 at 24- months (between May 2013 and October 2014). Children identified at risk of an ASD were referred to the Tianjin Women's and Children's Health Centre for further assessments and diagnosis.

Results: Eighty-nine (89) children were referred, and the referral rate was 0.85%; however, only 56 children (63% of referred families) attended the follow-up assessment session. Of these, 24 met the criteria for ASD (43% positive predictive value), 24 had a developmental and/or language delay (43%), and 8 were typically developing (14%). 50% (n=12) of those who had developmental and/or language delay were diagnosed with ASD at 3 years of age, resulting in a final Positive Predictive Value of 64%. Combining the number of children assessed who had a classification of an ASD, with 64% of those who were referred as "at risk" and not assessed, results in an estimated rate of 1:200 children with ASD in the sample monitored using SACS-C.

Conclusions: The findings indicate that it is possible to translate evidence-based practice from one cultural context to another. Developmental surveillance of social and communication behaviors, which differ according to the age at which the child is monitored, enables the accurate identification of children at risk for ASDs between 12- to 24-months. Clearly greater education about the early signs of ASD for all primary health-care professionals is needed to increase awareness of these conditions more widely and to highlight the importance of earlier diagnosis and intervention.

99 **109.099** Economic Burden of ASD

R. Linertova[1], *L. Garcia Perez*[1], *P. Serrano-Aguilar*[2], *V. Ramos-García*[1], *V. Lemmi*[3] *and M. Knapp*[4], *(1)Fundación Canaria de Investigación Sanitaria (FUNCANIS), Santa Cruz de Tenerife, Spain, (2)Servicio de Evaluación del Servicio Canario de la Salud (SESCS), Santa Cruz de Tenerife, Spain, (3)London School of Economics, London, United Kingdom, (4)PSSRU, LSE, London, United Kingdom*

Background: Getting a better understanding of costs associated with ASD can help decision makers weigh the relative merits of different ways to utilize, prioritize and allocate available resources. Costing information is also valuable for planning longer-term projections of the resources needed to support people with ASD under a range of alternative scenarios.

Objectives: To estimate current annual economic burden related to ASD in Europe.

Methods: A bottom-up approach was used to estimate the cost-of-illness in 12 European countries (Austria, Belgium, Bulgaria, Denmark, France, Ireland, Italy, Poland, Portugal, Romania, Spain and UK), collecting data directly from individuals with ASD and their families through a web-based survey. We used the "prevalence-based method" to estimate the current annual economic burden of ASD in each country from the societal perspective, i.e. including direct and indirect costs. Direct costs comprised education services, inpatient hospital services, residential respite care and other health and social care services. Indirect costs were based on lost productivity due to morbidity in persons with ASD and due to cessation or reduction of working time by the informal caregivers (parents or other).

Data on services utilization were gathered through an anonymous web-based questionnaire formed by 38 questions, translated from English to 11 languages and adapted according to the particular features of the healthcare and education system of each country. The survey was launched in most of the countries in February 2017 and it is still on-going.

Results: By September 2017 we collected 1,367 complete responses, mostly from Italy (276), Spain (257) and France (245). The mean age of individuals with ASD described by respondents was 16.2 years and 55% of them were male. Responders were mostly parents (61% of responses), although persons with ASD also responded in some cases (8%).

Among health and social services, the services mostly used were from psychiatrists (40% in Belgium, 36% in Poland), psychologists (37% in France, 32% in Spain), general practitioners (30-40% in all countries) and speech and occupational therapists (15-30% in all countries). Among special educational services, the most commonly used services were from educational psychologists (47% in Spain, 36% in Italy), classroom assistants (34% in Spain, 31% in France), specialist teachers (58% in Italy, 39% in Portugal) and speech and language therapists at school (34% in Portugal, 30% in Poland). All surveyed resources were assigned a unit cost in local currency and a total annual cost per patient will be estimated.

Only a small part of adult individuals with ASD were currently employed (paid or unpaid). Absences from work will be evaluated and together with production losses and informal costs of care provided by unpaid caregivers will form the indirect cost per patient. Finally, total annual cost per patient will be calculated, which will be combined with prevalence data in each country to obtain the ASD economic burden.

Conclusions: This cost-of-illness study provides valuable information on economic burden of ASD across Europe, based on individual data using the bottom-up approach.

100 **109.100** Examining Stigma Towards College Students with Withdrawn and Disruptive Autism: Does the Label "Autism" Confer a Protective Effect?

R. Obeid[1], *N. Daou*[2], *A. Cosenza*[3], *S. Khan*[4], *E. Goldknopf*[5] *and K. Gillespie-Lynch*[6], *(1)Psychology, The Graduate Center, City University of New York, New York, NY, (2)McNeese State University, Lake Charles, LA, (3)College of Staten Island, City University of New York, Staten Island, NY, (4)College of Staten Island, CUNY, Staten Island, NY, (5)University of California, Los Angeles, Los Angeles, CA, (6)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background:

Stigma towards autism remains apparent in college communities (Matthews et al., 2015). Perhaps to avoid stigma associated with the label "autism", only *one-third* of students identified as autistic in high school identify themselves as autistic in college (Newman et al., 2011). This choice may often be counterproductive as research suggests that college students are more accepting of peers who exhibit autistic behaviors when they are labeled as autistic (Brosnan & Mills, 2016; Matthews et al., 2015). However, prior research examining attitudes towards college students who exhibit autistic behaviors has focused on students who exhibit *mild* symptoms of autism and has confounded the label "autism" with a description of characteristics of autism and an indication that the autistic student is exceptionally intelligent. Potential benefits of the label "autism" are also likely to vary across cultural contexts (Obeid et al., 2015).

Objectives:

We examined if the label "autism":

- is less stigmatized than behaviors associated with autism among college students in the U.S. and Lebanon,
- confers protective benefits by reducing stigma towards symptoms of autism,
- is described differently than unlabeled symptoms when participants are asked to define the student's condition after reading a label, an unlabeled vignette, or a labeled vignette.

Methods:

College students from the U.S. and Lebanon were randomly assigned to evaluate the label "college student with autism," unlabeled vignettes describing college students with mild/withdrawn and severe/disruptive autism, or labeled vignettes by using an adapted version of the Social Distance Scale (assessing stigma; Bogardus, 1933) and by defining "the student's condition." Reliability of qualitative coding exceeded 95%. Only *p*-values ≤.001 were considered significant.

Results:

A repeated-measures analysis with stigma toward mild and severe autism as the dependent variables and group (label, vignette, or label plus vignette), country, and gender as independent variables revealed that stigma was higher for severe than mild symptoms of autism, highest among participants assigned to unlabeled vignettes, lower among participants assigned to labeled vignettes (a protective effect of the label), and lowest among participants assigned to the label autism (*ps* < .001). The attached table displays results from qualitative analyses comparing labels to vignettes in both the US and Lebanon. Participants in the US were more likely to name other disorders (such as ADHD or social anxiety) in the autism vignette condition relative to participants in Lebanon. Participants in both countries were less likely to identify autism in the vignette depicting a disruptive student with autism relative to the label.

Conclusions:

Consistent with research examining stigma more generally (Link et al. 1999), symptoms of autism are more stigmatized than the label "autism". In line with our prior research (Obeid et al., 2015), participants in the US were more likely to confuse autism with other disorders. Findings suggest that the behaviors of autism are stigmatized (particularly disruptive behaviors), and many people are unaware of what these behaviors consist of, suggesting that if more college students were educated about the different levels of severity of autism, they might become more accepting of their neurodiverse peers.

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101 **109.101** Experiences of Autism Diagnosis: A Survey of 293 Parents in Saudi Arabia

F. Alnemary[1], *F. Alnemary*[2], *A. Al Saud*[3], *M. Zakaria*[3], *A. Alotaibi*[3] *and H. Al Dhalaan*[3,4], *(1)Taif University, Taif, Saudi Arabia, (2)UCLA, Los Angeles, CA, (3)Center for Autism Research, Riyadh, Saudi Arabia, (4)King Faisal Specialist Hospital and Research Center, Riyadh, Saudi Arabia*

Background: Investigations about parents parents' experiences attaining autism spectrum (ASD) diagnosis for their children in Saudi Arabia are scarce (Alnemary, et al., 2017).

Objectives: To examine parents' experiences attaining autism spectrum (ASD) diagnosis for their children in Saudi Arabia.

Methods: A convenience sample of 293 parents of children with ASD completed an online survey about their experiences and opinions attaining the ASD diagnosis for their children.

Results: The results revealed that the median age of the child when parents first noted atypicalities was 2.0 years. The median of the delays that parents experienced before they sought professionals help and to attain the diagnosis for their child were 0.3 years and 0.5 years, respectively. Just over one of third of parents were satisfied with the overall diagnostic process. Satisfaction was linked with higher perceived collaboration with professionals, higher perceived helpfulness of received information, higher perceived helpfulness of post-diagnosis support, lower household income, and shorter delay to attaining the diagnosis for those who live in a major city.

Conclusions: Findings provide a valuable picture of an important group of families affected by ASD in Saudi Arabia, pointing the need to increasing ASD awareness and mandating early identification in Saudi Arabia. National efforts for conducting research are needed to better understand and manage the access and use of diagnostic and ASD services in Saudi Arabia.

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102 **109.102** Exploration of Diagnostic Validity of Autism Diagnostic Interview-Revised (ADI-R) in Korean Population.

M. Oh[1], *G. Bong*[2], *I. H. Cho*[3], *Y. S. Lee*[4], *M. S. Kim*[5], *H. J. Yoo*[6], *D. W. Han*[7] *and C. Y. Shin*[8], *(1)Psychiatry, Seoul National University Bundang Hospital, Sungnam, Korea, The Republic of, (2)Psychiatry, Seoul National University Bundang Hospital, Seungnam, Korea, Republic of (South), (3)Dr. Cho's Child & Adolescent Psychiatric Clinic, Seongnam, Korea, Republic of (South), (4)Department of Physiology, Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of (South), (5)Department Applied Chemistry, Kyung Hee University, Seoul, Korea, Republic of (South), (6)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, The Republic of, (7)Dept. of Stem Cell Biology, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South), (8)Department of Neuroscience, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South)*

Background: Autism Diagnostic Interview-Revised (ADI-R) is a semi-structured investigator-based interview, which has been characterized as one of the gold-standards in the assessment of children and adults with autism spectrum disorder (ASD). Research on the use of the ADI-R and its applicability for accurate identification of individuals with ASD among non-English speaking populations is significantly limited.

Objectives: The objectives of the current study is to examine the validity of the Korean version of ADI-R to determine its efficacy in identifying individuals with ASD aged 24 months to 34 years.

Methods: We used pooled data from an ASD genetic study, clinical trial of social skills training, research on the development of early screening instruments, and clinical record of Seoul National University Bundang Hospital, from 2008 to 2017. The subjects were composed of individuals with ASD, their unaffected siblings, children referred as developmental delay, and typically developing children volunteered in community. The ADI-R were administered and scored by professionals having research reliability for the instrument. ADOS (Autism Diagnostic Observation Schedule) was also completed for the subjects referred for diagnosis. Other measurements for ASD symptoms were also administrated, including Social Responsiveness Scale (SRS), Social Communication Questionnaire (SCQ) and Korean version of the Childhood Autism Rating Scale (K-CARS). We applied the cut-off scores for K-CARS (cutoff=24) and SCQ (cutoff=12 for 48 months and over, 10 for below 47 months) based on the validity studies performed in Korea (Kwon et al., 2017; Kim et al., 2015). Clinical best estimate diagnosis of ASD was confirmed by two board-certified psychiatrists based on DSM-IV-TR and DSM-5^{TM} criteria. We classified the clinical diagnosis into ASD (including pervasive developmental disorder and Asperger's syndrome) *versus* non-ASD in the validity analyses. Statistical analyses were used t-test and Cohen's kappa for comparison of two groups.

Results: Total 1,073 subjects (age 93.48 ± 62.42 months, male = 760, female = 313)participated. The sensitivity and specificity of ADI-R were 99.39% and 84.65%, respectively. Positive Predictive Value was 92.50 (between 84.21 to 95.31) and Negative Predictive Value was 98.64 (between 97.96 to 100) in all age group (below 48 months and 48 months and over) and language levels (with or without verbal language). In Individual items within diagnostic algorithms of ADI-R showed significant differences in scores for all algorithm items between ASD and non-ASD group in all age and language subgroups ($p<0.05$). The agreement between ADI-R and other measurements in diagnosing ASD was good to excellent level (Cohen's kappa of K-CARS, SCQ and SRS with ADI-R = 0.78, 0.66, 0.65, respectively).

Conclusions: This study examines the diagnostic validity of the Korean version of the ADI-R. The Korean version of ADI-R showed high levels of sensitivity, specificity, positive predictive value, and negative predictive value in all age groups and verbal language levels. This study suggests that ADI-R might be valuable diagnostic instrument for individuals with ASD, across countries with different languages, cultural backgrounds and levels of awareness for ASD.

103 **109.103** Francophone Students with Autistic Spectrum Conditions: What Do They Have to Say Regarding Their School Inclusion Experiences?

M. Aubineau[1,2]*, J. C. Kalubi*[3] *and T. Blicharska*[4]*, (1)Université de Toulouse, Toulouse, France, (2)Université Toulouse Jean Jaurès, Toulouse, France, (3)University of Sherbrooke (Canada), Longueuil, QC, Canada, (4)Psychology, University of Toulouse Jean Jaurès, Toulouse, France*

Background: In the last years, an increasing number of students diagnosed with high functioning autistic spectrum disorders (HFASD) was able to attend mainstream high schools in both France and Quebec. Despite international studies and governmental recommendations to involve directly youth with HFASD in research, their own perspective is rarely taken into account in francophone research settings.
Objectives: Grounded in an ecological approach where participants are acknowledged as experts and knowledge co producers, our work aims at understanding how Francophone youth with ASD cope with mainstream education in high schools.

Methods: 26 teenagers with HFASD (13-17) collaborated in this research, in France (n=17) and in Quebec (n=9). They took part in semi-structured interviews and completed two questionnaires: the *Friendship Qualities Scale* (FQS) and the *Self-Perception Profile for Adolescents* (SPPA).

Results: ***Questionnaire analysis.*** Cluster analysis identified three profiles for friendship representations, mainly distinguished regarding two dimensions: companionship and help/aid from the friend. Three dimensions (social acceptance, close friends and physical appearance) differentiate self-perception into a 4-group typology (SPPA). Moreover, social skills training support (individual or group sessions) are correlated positive with friendship and self representations. ***Thematic analysis.*** Managing school sensory aspects, perceived immature behaviors from their peers and tiredness resulting from to important workload are identified as the main obstacles for their wellbeing in high school. On the contrary, being included in an intensive or international academic program, being driven by a passion or a clear objective and having a friend in the school environment appear to be important enablers for inclusion success. In France, the benefits *vs* limits of the teaching assistant' presence in class (between 12 to 20 hours per week) needs to be examined more closely, regarding the specific challenges for self esteem and autonomy. Although strongly dependent of peers' representations, the autistic identity is generally well lived and accepted, especially outside of high school. Finally, health and school system organization differences between France and Quebec appear to have few impacts on adolescents' well-being but raise a number of questions regarding provision support access inequalities for families, considering the frequent use of private services in France.

Conclusions: When France and Quebec are currently releasing their new national plans for autism, transition from adolescence to adult life will constitute one of the major challenges for youth with HFASD in the next few years and has to be anticipated as soon as possible. This preparation would allow the adolescents to gain autonomy and practical skills to understand their needs and strengths and be able to speak for themselves in a professional environment. Finally, our work highlights the urge for Francophone research and society to move from a deficit-led approach to a neurodiversity paradigm, promoting empowerment of individuals and considering ASD as a valuable contribution to human diversity.

104 **109.104** Impact of the Early Start Denver Model on the Cognitive Level of Children with Autism Spectrum Disorder: First Results of the European French-Speaking Countries Study.

M. Geoffray[1]*, M. J. Oreve*[2]*, M. Speranza*[3]*, S. Marignier*[4]*, S. Bahrami*[3]*, I. Massat*[5]*, V. A. Delvenne*[6]*, N. Georgieff*[7]*, S. Grisi*[8]*, A. Zelmar*[9]*, G. Tenant*[10]*, L. Bouveret*[11]*, S. Carlier*[12]*, A. Denis*[4]*, S. Touzet*[13,14]*, C. Schröder*[15] *and S. Sonie*[16]*, (1)child and adolescent psychiatry, CH le Vinatier CNRS UMR 5229 UCB Lyon 1, Lyon, France, (2)CH Versailles, Paris, France, (3)CH Versailles, Versailles, France, (4)HCL, Lyon, France, (5)Service de Pedopsychiatrie , Hôpital Reine Fabiola, National Fund of Scientific Research, Université Libre de Bruxelles, ULB, Brussels, Belgium, (6)Head of child and adolescent department, Hôpital Universitaire des Enfants Reine Fabiola, Université Libre de Bruxelles, bruxelles, Belgium, (7)CH le Vinatier, BRon, France, (8)CH le Vinatier, bron, France, (9)Pôle IMER, HCL, HCL, France, (10)Vinatier, bron, France, (11)HCL, bron, France, (12)CH Bruxelles, Bruxelles, France, (13)EA 7524 - Health Services and Performance Research (HESPER), Universite Lyon I, Lyon, France, (14)Hospices Civils de Lyon, Lyon, France, (15)CHU Strasbourg, strasbourg, France, (16)TED DEPARTMENT, Saint Jean de Dieu, Lyon, France*

Background:
Early intervention for autism spectrum disorder (ASD) in the European French-speaking countries is heterogeneous and poorly evaluated to date. Early intervention units applying the Early Start Denver Model (ESDM) for toddlers and young children with ASD have been created in France and

Belgium to improve this situation. It is essential to evaluate this intervention for the political decision-making process regarding ASD interventions in European French-speaking countries.

Objectives:

We will evaluate the effectiveness of 12 hours per week ESDM intervention on the cognitive level of children with ASD, over a 2-year period.

Methods:

The study is a multicenter, randomized controlled trial using a two-stage Zelen design. Children aged 15-36 months, diagnosed with ASD and with a developmental quotient (DQ) of 30 or above on the Mullen Scale of Early Learning (MSEL) are included. The sample size required is 180 children (120 in the control and 60 in the intervention group). The experimental group is scheduled to receive 12 hours of ESDM per week by trained therapists; 10 hours per week in the centre and 2 hours in the toddlers' natural environment (alternatively by the therapist and the parent). The control group is receiving care available in the community. The primary outcome will be the change in cognitive level measured with the DQ of the MSEL scored at 2 years. Secondary outcomes will include changes in autism symptoms, behavioral adaptation, communicative and productive language level, sensory profile and parents' quality of life. The primary analysis will use the intention-to-treat principle.

Results:

The first descriptive results of the cohort showed a very heterogeneous population on the MSEL DQ, nonverbal and verbal DQ, autism severity and behavioral adaptation. The protocol study is well accepted by the families, few data are missing and we have rare study discontinuation. We have very rare non-consent for children randomized in intervention group.

Conclusions:

This multicenter, randomized controlled trial is feasible and well accepted by the families. It will add information about the effectiveness of ESDM intervention in European French-speaking countries over a 2-year period. A follow-up study will also predict how this intervention reduces autism severity and the effects on schooling 5 years after the initial inclusion.

105 **109.105** Implementation of Social Attention and Communication Surveillance in Gunma, Japan (SACS-J)

E. Kezuka[1] *and M. Okuno*[2]*, (1)Faculty of Literature, Gunma Prefectural Women's University, Gunma, Japan, (2)School of Nursing, Gunma Paz University, Gunma, Japan*

Background: Autism Spectrum Disorders (ASDs) emerge over the first two years of life, and early signs of ASDs are recognizable during this period. In Japan, over 90% of children have health check-ups at around 18 months and 36 months in compliance with the Maternal and Child Health Act. The 18-month check-up, in particular, is expected to play a role in early identification of developmental disorders, including ASDs. Public health centres provide the check-ups, and nurses are responsible for screening infants to identify developmental risk. The Japanese M-CHAT is utilized in some community health check-ups, but it’s still the case that old-fashioned questionnaires and/or behavior observation lists, which are not adequate for screening for ASDs, are commonly used at many health centres in Gunma.

Objectives: The goal in this study was to confirm the feasibility and effectiveness of Social Attention and Communication Surveillance (SACS) as a Level 1 screening tool within two health centres in Gunma, Japan.

Methods: The original SACS items were used and modified to adapt to the mass check-ups undertaken in Gunma. The number of items were reduced to enable implementation within 10 minutes. Fine and gross motor items were also added and some items adapted to take into account cultural differences. In Gunma, the SACS-J was first implemented in Tamamura (270 births/year) and then in Shibukawa (500 births/year). As there were slight differences in the age at which checkups were undertaken across the two settings (Tamamura: 15-, 20-, 27-, and 38-months; Shibukawa: 10-, 18-, 24-, and 36-months), the SACS-J items were appropriately modified to suit each age.

Results: In Tamamura, a total of 166 infants were monitored longitudinally (2012 – 2015; the first cohort born in 2011), and attended the 15- and 20-month check-ups. Infants were classified into 4 groups at 20 months, depending on their failure on more than 2 items at each age. 12 infants (7.2%) failed more than 2 items at both 15 and 20 months, and their low pass rates lasted through to 27 months. In this group, 4 infants were diagnosed with ASD (around 2%), and the other 8 infants comprised: 1 severe Developmental Delay, 1 ASD suspected, 1 ADHD suspected, and 5 infants who had caught up developmentally by 38 months. In Shibukawa, a total of 271 infants were monitored (2015 – 2017; the first cohort born in 2014), and attended the 18- and 24-months check-ups. 23 infants (8.5%) failed more than 2 items at both 18 and 24 months. 69.6% of these infants were considered to be at risk for ASD and 30.4% were not considered to be at risk by clinical psychologists.

Conclusions: Successive failure (at two ages) in SACS-J items indicates serious risk for ASD indicating that continuous developmental surveillance within the first 2 years of life is successful in identifying ASD in young children in two low resource community settings. The feasibility and effectiveness of implementing the SACS in a different cultural context was confirmed.

106 **109.106** Implementing Esdm in Africa - Is Caregiver Coaching Acceptable in South Africa and Which Joint Activity Routines Can We Target?

L. Franz[1,2,3]*, K. Ramseur*[1]*, J. Guler*[4]*, N. Shabalala*[3,5]*, N. Seris*[3,5]*, G. Dawson*[6] *and P. J. de Vries*[3]*, (1)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (2)Duke Global Health Institute, Duke University, Durham, NC, (3)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (4)Clinical Child Psychology Program, University of Kansas, Lawrence, KS, (5)Department of Psychology, University of Cape Town, Cape Town, South Africa, (6)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Background:

A small but expanding evidence-base from low-and middle-income countries demonstrates that caregivers can be engaged to deliver early ASD intervention. In caregiver-mediated early ASD intervention, caregivers are taught strategies to embed learning in everyday activities with their child. To date, there are no published studies in sub-Saharan Africa regarding the acceptability of a caregiver coaching approach. In addition, limited African data exist about narratives of joint activity routines between young children with ASD and their caregivers.

Objectives:

In this formative study, we assessed the acceptability of a caregiver coaching approach and examined descriptions of joint activity routines.

Methods:

Focus groups and in-depth interviews were carried out with a lower socio-economic, multi-cultural group of 28 caregivers of young children with ASD in Cape Town, South Africa. In addition, four in-depth interviews with 6 caregivers of children with ASD who received two pilot sessions of parent coaching (1 in-clinic and 1 in-home) were conducted. Data were translated, transcribed, and coded using content analysis.

Results:

Caregivers who received pilot coaching sessions found the approach acceptable and noted that both they and their children had acquired skills as a result. For example, some caregivers noted they were able to use strategies to capture their child's attention, and reported that their children had gained personal independence/activities of daily living skills such as feeding themselves with a spoon or brushing their teeth. They described low-resourced home environments, with limited living space and access to child play materials. Caregivers reported regularly engaging in joint activity routines with their young children with ASD. Some but not all caregivers routinely joined in play with their child and intuitively incorporated learning opportunities into joint activity routines. Caregivers were aware of child affect and social cues. Multiple child play partners, particularly in sensory social routines, including grandparents, siblings, aunts, and uncles were reported by caregivers. Daily routines that occurred on a regular basis included meal and bath time. Some caregivers noted that their children were aware of steps of the routine and would participate, for example they would help lay the table and say the evening prayer before dinner time.

Conclusions:

Descriptions of joint activity routines and perception of the acceptability of a caregiver coaching approach in South Africa suggest that caregiver-mediated interventions may be feasible in low-resourced South African settings. The challenges of in-home implementation given limited resources, however, require careful consideration.

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109.107 The Contextual and Policy Landscape for Caregiver-Mediated Early Intervention in South Africa

L. Franz[1,2,3]*, J. Guler*[4]*, K. Adewumi*[2]*, N. Seris*[3,5]*, N. Shabalala*[3,5]*, M. Viljoen*[3]*, G. Dawson*[6] *and P. J. de Vries*[3]*, (1)Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC, (2)Duke Global Health Institute, Duke University, Durham, NC, (3)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (4)Clinical Child Psychology Program, University of Kansas, Lawrence, KS, (5)Department of Psychology, University of Cape Town, Cape Town, South Africa, (6)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Background:

To ensure an intervention developed in one setting can be implemented in a new often dramatically different setting, a thorough understanding of the contextual landscape is essential. In South Africa, a middle-income country, marked by extreme economic and health disparities, little is known about the perspectives of caregivers of young children with ASD on contextual factors they deem important in early ASD intervention. Also, little is known about the perspectives of policymakers regarding which governmental/non-governmental sector and what type of provider would be most feasible and sustainable to deliver an early ASD intervention in South Africa.

Objectives:

Here we set out to investigate caregiver perspectives about contextual factors of importance to them, and policy-maker perspectives about policy and implementation of early interventions for ASD in South Africa.

Methods:

Focus groups and in-depth interviews were carried out with a lower socio-economic, multi-cultural group of 28 caregivers of young children with ASD in Cape Town, South Africa. In addition, eight in-depth interviews with District and Provincial leaders in the Departments of Health, Education, and Social Development and the Non-Profit sector in the Western Cape Province of South Africa were conducted. Data were transcribed and coded for emerging themes using content analysis.

Results:

Eight contextual factors including culture, language, location of treatment, cost of treatment, type of service provider, support, parenting practices, and stigma, emerged as important to caregivers of young children with ASD. Caregivers reported a preference for an affordable, in-home, individualized early ASD intervention, where they had an active voice in shaping treatment goals. Some caregivers were distrustful of community health workers. Challenges associated with ASD-related stigma were identified. Caregivers noted that they felt blamed for their child's behavior and that their children were often labeled as "naughty". ASD-related stigma was compounded when caregivers were immigrants or refugees. Policy stakeholders identified a national policy potentially relevant to early ASD intervention, reported the need for collaboration between sectors and highlighted the importance of integrating early ASD intervention into existing platforms of care. Provider capacity-building, increased ASD awareness and stigma reduction emerged as key areas of need. Community health workers, early childhood development workers and parents of children with ASD were identified by policy-makers as non-specialist workers who could deliver an early ASD intervention.

Conclusions:

Large-scale implementation of early ASD intervention in South Africa will likely require careful integration of parent/caregiver preferences with low-cost, sustainable funding approaches, in order to ensure a contextually-appropriate strategy within a collaborative multi-sectorial plan, preferably embedded into existing national policies.

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109.108 Incidence of Comorbidities in Children with Neurodevelopmental Disorders in a University Teaching Hospital, Lagos, Nigeria

T. A. Fagbayi[1] *and J. Okpuzor*[2]*, (1)University of Lagos, Lagos, Nigeria, Lagos, Nigeria, (2)Cell Biology & Genetics, University of Lagos, Nigeria, Nigeria*

Background:

Comorbidities associated with neurodevelopmental disorders in children frequently complicate the course of diagnosis and treatment. These conditions may appear in form of medical, psychiatric or other neurodevelopmental problems occurring at different frequencies in different disorders. In recent times, the term 'comorbidity' has gained popularity in the field of neuro-paediatrics, with the increasing recognition that many conditions are rarely present in isolation.

Objectives: The present study aims to investigate the occurrence of comorbid conditions in children with neurodevelopmental disorders

Methods: Medical records of the neuro-peadiatric clinic were obtained from the health records department of the Lagos University Teaching Hospital (LUTH) and analyzed using statistical methods. Diagnoses of the disorders were done using the DSM criteria while the diagnostic codes were deciphered using the International Statistical Classification of Diseases & Related Health Problems (ICD).

Results: A total of 845 records were obtained with a male: female sex ratio of 1.3:1 (470 males and 375 females). An incidence of comorbid conditions were observed in 44% of the cases revealing cerebral palsy (CP), Down syndrome (DS), seizure disorder and Autism were the major neurodevelopmental disorders. Cerebral palsy presented with the highest frequency of comorbid conditions of 62.2% followed by autism (57.14%) and DS (55.3%) while seizure disorder had the least incidence of comorbidities (33 %). However, attention deficit hyperactivity disorder (ADHD) was the most prevalent comorbidity associated with autism, CP was the most prevalent in seizure disorder, while developmental delay and convulsions were the most common in DS and CP respectively. Convulsions, developmental delay, speech and language disorder and birth asphyxia were the most common comorbidities taking the four neurodevelopmental disorders taken together.

Conclusions: It is apparent that most neurodevelopmental disorders are closely phenotypically linked as have been strongly suggested that neurodevelopmental disorders lie on a spectrum. Understanding the pattern of the incidence of medical comorbidities would aid better-staged diagnosis and interventions, and also improved epidemiological profiling of the disorders.

109 **109.109** Knowledge and Awareness of Autism Amongst Somali Parents in the United Kingdom

A. M. Hussein[1], E. Pellicano[2] and ***L. Crane**[1]*, *(1)Centre for Research in Autism and Education, UCL Institute of Education, University College London, London, United Kingdom, (2)Macquarie University, Sydney, Australia*

Background: Despite rapid growth in autism research over the past few decades, little attention has been given to understanding autistic individuals in minority ethnic communities – placing them at serious risk of being under-recognised and under-served. The current study focuses on autism among the UK Somali community – one of the largest and most established communities in Europe, and one of the many immigrant groups affected by autism. While emerging work has examined UK-based Somali parents' experiences of accessing an autism diagnosis for their children, little is known about parents' knowledge and awareness of autism more broadly.

Objectives: The aim of the current, qualitative research was to examine knowledge and awareness of both typical and atypical development amongst UK-based Somali parents (of both autistic and non-autistic children); a minority group that has, until relatively recently, been neglected in autism research.

Methods: 32 parents (30 women, 2 men; from separate families) participated in this research, including 16 parents of autistic children (M age = 39.56 years) and 16 parents of non-autistic children (M age = 39.50 years). Parents were presented with seven vignettes, each of which described a child with typical or atypical development (including autism, attention deficit hyperactivity disorder, or global developmental delay). After reading each vignette, parents were asked to reflect on whether the behaviours described were similar to those of other children they knew; if not, they were asked whether they have a 'name' for these behaviours and to consider what might cause them. This was complemented by more general questions regarding how children develop as they grow older. Parents of autistic children were also asked to reflect on their own children's development.

Results: Interview data were analysed using thematic analysis. Four key themes were identified: (1) 'Somali people don't understand', reflecting a general lack of understanding of autism within the Somali community and the prejudice and discrimination that might ensue; (2) 'Differences between Somalia and the UK', reflecting how many parents felt autism did not exist in Somalia and the lack of provision available for autistic children in Somalia; (3) 'Strong reliance on faith', in enabling parents to understand and accept their children's diagnosis; and (4) 'Ways to support Somali families of autistic children in the UK', to promote awareness of autism and build capacity to better support families of children on the autism spectrum.

Conclusions: The parents of autistic children in this study highlighted the difficulties they experienced with understanding autism, as well as barriers in accessing help and support; some of which were unique to the Somali community, and some that were perceived to be more general across ethnic groups. Promoting acceptance of autism within the Somali community – in the UK and internationally – seems to be a key target for intervention efforts.

110 **109.110** Latino Caregivers' Facilitators and Recommendations for Accessing an ASD Diagnosis and Services in California

***F. Reinosa Segovia**[1]*, *N. Muldoon[2], L. Hughart[2], J. Goldblum[3], P. Luelmo[4] and C. Kasari[2], (1)UCLA, Hawthorne, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)UCLA, Westwood, CA, (4)Special Education, San Diego State University, San Diego, CA*

Background: Numerous barriers have been associated with the challenges involved in obtaining comprehensive early intervention for children with Autism Spectrum Disorder (ASD). Specifically, several studies have found that race, ethnicity, and socioeconomic status have been associated with a delay in the diagnosis of ASD and access to services (Liptak et al., 2008; Mandell et al., 2005; Parish et al., 2012). Latino children are typically diagnosed at a later age and receive poorer quality of health care compared to their white peers (Mandell et al., 2009; Magaña et al., 2013; Magaña et al., 2016; Parish et al., 2012). Furthermore, few studies have thoroughly examined the cultural relevance of ASD interventions to meet the needs of Latino children with ASD and their families. The present investigation examines how sociocultural factors influence Latino immigrant families' navigation efforts of California's Health Care System.

Objectives: This study's primary objective was to examine Latino Spanish-speaking caregivers' experiences that facilitated a prompt ASD diagnosis for their children, as well as caregivers' recommendations on how to navigate systems of care more efficiently.

Methods: Participants were 12 Latino caregivers for children with autism (m_{age} *(SD)* = 38.9 (5.2), n = 11 females). Two focus groups and three interviews were conducted across two sites in California. The aim was to collect information regarding caregivers' experiences in gaining access to an ASD diagnosis and services for their children. Eligible participants must have had a child between the ages of two and eight who had received a diagnosis of ASD within the last two years. All participants reported a low income or little access to resources at the time of recruitment. Interviews and focus groups were led by Spanish-speaker moderators, audio-recorded, and later transcribed into Spanish. Guided by the principles of thematic analysis, transcripts were open-coded to elicit major themes.

Results: Analyzed data revealed eight overarching themes concerning accessibility to an ASD diagnosis and obtaining ASD-specific services. These themes were grouped into two overarching domains: process facilitators and caregivers' recommendations. Four themes were identified for caregiver experiences after securing evaluations and services for their children: (a) caregiver proactivity, b) identification of ASD symptomology, c) caregiver support, and d) resource accessibility. Specifically, caregivers consistently noted advice and support from friends, service providers, medical providers, and other paraprofessionals that proved essential when searching for diagnoses and services. Qualitative data also revealed caregiver recommendations for successfully navigating healthcare systems and seeking an ASD diagnosis: obtaining knowledge regarding ASD symptomatology and services, standardizing more efficient ways to disseminate information, identifying ASD red flags in a timely manner, and accessing comprehensive evaluations and early intervention services.

Conclusions: Disparities persist in access and utilization of ASD quality care among families from low-SES and ethnic minority backgrounds. In this study, immigrant caregivers' provided several process facilitators and recommendations as a means to gain access to comprehensive evaluation services, and secure early intervention services for their children. Future research should attempt to incorporate these findings into evidence-based intervention programs that can be best disseminated and implemented in community settings.

111 **109.111** Linking Knowledge and Attitudes: Determining Neurotypical Knowledge about and Attitudes Towards Autism

M. Falkmer[1], *R. L. Kuzminski*[2], *J. Netto*[3], *J. Wilson*[3] *and T. Falkmer*[4], *(1)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (2)School of Occupational THerapy and Social Work, Curtin University, Perth, Australia, (3)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (4)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia*

Background:

Following an on-line discussion with the autism community in Australia about areas of research they prioritise, the responses frequently reported experiences of being misunderstood and meeting numerous misconception about autism in society. These experiences may be a result of stigma. Stigma contains three key elements; knowledge issues (ignorance); attitudinal issues (prejudice), and behavioural issues (discrimination). Therefore, knowledge and attitudes may contribute to how autistic people are treated, and are important to identify. However, there is a paucity of studies exploring attitudes toward autism and existing studies have reported inconclusive results, often based on small sample sizes. In addition, no studies have been conducted in Australia.

Objectives:

This study and aimed to explore neurotypical knowledge about, and attitudes towards, autism and to identify factors that influenced these attitudes.

Methods:

Co-produced with an autistic researcher, a cross sectional on-line survey was distributed. One section of it explored attitudes using the existing Societal Attitudes Towards Autism (SATA) scale. A second section explored knowledge. It was developed in consultation with the wider autistic community and comprised of four different areas of knowledge. The survey was distributed to neurotypical adults throughout Australia. A total of 1,078 entries completed the SATA section and were used for analysis of attitudes. As 24 of these participants did not completed the knowledge section, 1,054 entries were considered for further statistical analysis. The sample represented the Australian population with the exception of a larger proportion with tertiary degrees and coming from metropolitan as opposed to regional parts of Australia (Table 1). Men were on average older than women (Men=43, SE=1 vs. Women=40, SE=0.5, p<.01).

Results:

The SATA scores were totalled for each participant, with high scores representing a positive attitude. Questions from the knowledge section of the questionnaire were grouped into areas, as shown in Table 2. Each area scores were summed. Following this, backwards entry multiple linear regression modelling were conducted, in order to determine the independent variables that were seen to influence the SATA scores. Overall, 81.3% of participants reported a strong positive attitude towards autism and 81.5% of participants had a high level of knowledge. Knowledge total scores (ranging from 21-65; mean 51.3) proved being positively related to the attitudes (SATA) in the model. Knowledge was then entered into a refined model (r^2 =.129) by its sections (Table 2), which included Section 1, Societal Views and Ideas (Standardised β=0.205, β 95% CI=0.268 - 0.510, p<.001), Section 2: What could it be Like to Have Autism (Standardised β=0.121, β 95% CI=0.109 – 0.346, p<.001), the dichotomous response to the question: "Do you know and have you spent time around someone with autism?" (Standardised β=0.115, β 95% CI=0.697 – 2.188, p<.001) and, finally, gender (Standardised β=0.071, β 95% CI=0.167 – 1.649, p=.016).

Conclusions: Knowing somebody with autism and being female had a positive impact on attitudes on top of the two knowledge sections whereas age, residential area or formal education had no impact; results that can inform targeted information interventions.

112 **109.112** Opinion and Satisfaction of Families Participating in the Different Stages of Universal ASD Screening in Spain

M. Magan Maganto[1], *Á. Bejarano*[2], *C. Fernandez Alvarez*[1], *A. Hernández Fabián*[3], *N. Flores*[1], *C. Dominguez Martin*[4], *M. A. Parrilla Escobar*[4], *M. Martinez Velarte*[5], *C. Jenaro*[1] *and R. Canal-Bedia*[1], *(1)University of Salamanca, Salamanca, Spain, (2)UNIVERSITY OF SALAMANCA, Salamanca, Spain, (3)Hospital Clínico Universitario de Salamanca, Salamanca, Spain, (4)Hospital Clínico Universitario de Valladolid, Valladolid, Spain, (5)Hospital Provincial de Zamora, Zamora, Spain*

Background:

Since 2005, Spain has been implementing an early Autism Spectrum Disorders (ASD) detection program in the public health services of Salamanca, Zamora and Valladolid with the M-CHAT (Robins et al., 2001) and from April 2014 with the revised version M-CHAT-R (Robins et al., 2014). This makes the program one of the longest running general population ASD screenings in the world. Nevertheless, the satisfaction of families participating in the screening procedures in Spain has not been reported. It is well known that early identification leads to access to better resources, and therefore, an improvement in the quality of life of the people with autism and their families; yet, there is scarce information regarding the opinion of the families implicated in the different early detection procedures.

Objectives:

The aim of this study is to describe and analyse the opinions of participating families in a universal ASD screening program taking into consideration the different stages in the process (from the moment that the caregivers complete the M-CHAT-R, and before and after the diagnosis is given).

Methods:

Three different forms were created to evaluate the satisfaction of the families collaborating in the ASD screening program. Copies of the first form were distributed to all the paediatricians participating with the study. These forms were randomly distributed amongst the families that signed the informed consent to participate in the study when attending the 18 months and/or 24 months Well-baby-Check-up-visit. The second form was given to the parents that came for diagnostic evaluation after a positive screen, but before the assessment was performed. Finally, the third form was given after receiving the diagnosis.

Results:

306 families responded the first form, and 24 the second and third forms. 90.5% of the parents who completed the first form assessed the global process as a positive/or/very positive experience, and 88.2% of families agreed that the public health system safeguards their child's health. 90.5% disagreed that answering the M-CHAT-R questionnaire was a waste of time, and approximately 90% of the parents consider including screening programs in the public health system as very important, also agreeing that it is useful to detect problems early in the children's communication and socialization development. On the second form, 75% evaluate this stage, as positive/or/very positive. However, there are mixed results concerning the waiting time between the phone call to attend the evaluation and the actual day of the assessment was too long, as 33.3% totally agree and 33.3% totally disagree. 100% of the families surveyed after the evaluation agree/or/totally agree in feeling glad about the information given about their child difficulties, prognostic, treatments, etc., during the assessment debrief.

Conclusions:

Most of the families highly valued the universal early detection system for communicative and social problems in their different stages, agreeing that implementation of the screening program is of great usefulness. Professionals and public health institutions should take into account these results, in order to provide and improve resources for children with ASD and their families.

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109.113 Parent Ratings of Executive Function and Functional Communication in Children with ASD Exposed to One or Multiple Languages

G. Iarocci[1] *and S. M. Hutchison*[2]*, (1)Simon Fraser University, Burnaby, BC, Canada, (2)University of British Columbia, Vancouver, BC, Canada*

Background: Although exposure to a second language may have benefits for typically developing (TD) children, particularly in executive functioning (EF) (Bialystok, 2007), in children with ASD, the effects of exposure to a second language (L2) on EF and functional communication is unknown. Families and educators have relied on anecdotal evidence to make decisions about language learning, in some cases, limiting exposure to the language of education (typically English) despite lack of empirical evidence (Paradis, 2007). However, some parents have reported exposing their children with ASD to multiple languages and considered them able to achieve bilingualism (Bird, Lamond, & Holden, 2012). Bilingual children with ASD were found to be as proficient in English language production and vocabulary compared to monolingual children with ASD (Petersen, Marinova-Todd, & Mirenda, 2012).

Objectives: The aim of our study was to compare parent rated functional communication (FC) and executive function (EF) in youth 6-18 years with and without ASD exposed to a second language (L2) or only one language, as reported by their parents. Specifically, we wanted to examine whether any EF benefits from L2 exposure were apparent in children with ASD, as well as whether parent's ratings of FC differed across groups.

Methods: One-hundred and seventy-four youth between the ages of 6 -18 years (M= 12.04 years) were matched on age, IQ (WASI-II), maternal education, and were divided into four groups: ASD-L2 Exposure, TD-L2 Exposure, ASD-No L2 Exposure, and TD-No L2 Exposure. Each caregiver completed a demographic questionnaire and the BASC-2 rating forms that include EF and FC indices.

Results: An analysis of variance (ANOVA) was conducted between groups and the results indicated that although there was a significant difference in EF and FC in children with and without ASD, the children with ASD exposed to a second language were not significantly different from those with ASD who were exposed to only one language. Thus, second language exposure in the children with ASD was not associated with delay in EF and functional communication skills, rather, there was evidence of a reduced clinical impact in those with a second language exposure as indexed by a lower percentage of children whose FC and EF ratings fell within the clinical range.

Conclusions: The findings are consistent with previous evidence that exposure to a second language is not associated with an adverse impact on the communication and cognitive skills of children with ASD. Future research on clinical/functional rather than simply statistical differences between groups is needed to further elaborate on the potential benefits to EF in children with ASD exposed to a second language. Observational and qualitative methods may be particularly helpful in identifying any differences in language environments and EF and communication performance.

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109.114 Parental Experiences in the Sultanate of Oman

P. Perepa*, University of Northampton, Northampton, United Kingdom of Great Britain and Northern Ireland*

Background:

Although we are aware that autism impacts children across the world, there is little research focusing on parental experiences from countries outside Europe and the English speaking world. This study focused particularly on the experiences of parents living in the Sultanate of Oman. As autism is not recognised as a separate condition in the country, this research shows the unique differences that these parents experience.

Objectives:

- To understand parental understanding of autism and its causes.
- To understand parental experiences of accessing services to support themselves and their children on the autism spectrum.

Methods:

The research used semi-structured interviews and focus groups. Altogether 24 interviews and focus groups were conducted with parents across the country. Both mothers and fathers were interviewed. Parents had children across a wide range of ages. All the interviews were conducted in

Arabic with an interpreter. The data was then analysed using thematic coding.

Results:

The results indicate that parents in the country have a wide range of perceptions with regards to characteristics of autism and its causes. While some parents attribute autism to fate and religious interpretations, others had a more scientific understanding of the condition. A number of difficulties in accessing services right from getting a diagnosis, to appropriate education and vocational options have been mentioned by the parents. They also mentioned about the lack of knowledge amongst professionals about the condition which made seeking support especially difficult for them. The research also found some unique barriers which are presented by the geography of the country where some communities live in small communities.

Conclusions:

This research reiterates some of the experiences and issues recorded in existing research on the topic from other parts of the world. It also highlights the need to develop services which address the cultural, social and economic realities of the country where the families live, and how the existing principles of good practice in autism may need to be adapted to meet these needs.

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109.115 PILOT Experience of Promoting Adequate Conditions for Autism EARLY Detection from a National University in Salta (NORTHWEST ARGENTINA)

C. Ruiz-Danegger[1] *and E. Guantay*[2]*, (1)ICSOH-CONICET-UNSa / CISEN-UNSa, Universidad Nacional de Salta, Salta, Argentina, (2)Cátedra Biología. Medicina. UNT - Sede Salta, Universidad Nacional de Salta, Salta, Argentina*

Background: Salta is rich in cultural diversity (in its territory, more than ten native languages are used in addition to Spanish) and its social and economic reality generally imply numerous context challenges for development. It was observed that, due to some lack of official actions, the community of relatives of children with ASD and local professionals were concerned with doing early detection campaigns for autism, but without noticing certain inadequacies in the devices (since used instruments did not adapted neither that was considered necessary) and interpretations (in general the same notion of "early detection" was often somewhat indistinguishable in some practice near of “diagnosis”). There was no statistics on this issue at any level. Advanced this project, it emerged the need to broaden our view and to consider autism among other development challenges, as well as to emphasize in formative/educational aspects.
Objectives: As a strategy, to project and pilot a set of devices and practices towards the realization of early detection campaigns of autism and other development challenges according to provincial priorities of public health. Coherently with their academic mission in a challenging context, this university project emphasize both in connecting Salta’s people with the most advanced knowledge about this issue and doing training at all levels, as well as promote and empowering the local knowledge construction.

Methods: a) To analyze national and international background. b) To establish several interdisciplinary teams around key objectives and activities. c) To promote alliances and intra- and inter-institutional synergies with other professionals de Salta, community organizations, and public agencies (National Secretariat for University Policies and Secretariat of University Extension-UNSa, Ministry of Public Health, Statistics Division of the Province), as well as convening volunteers (among those who included people with ASD). d) Strategically, to conduct actions through continuous assessment, consultations on specific aspects to national and international experts, and request for evaluation and monitoring to UNICEF.

Results: a) To get some 'more refined' sense of need for early detection, using adequate instruments and to better distinguish the notion and scope of these actions, in general. b) Generate a device to raise awareness by “walk a mile in the shoes...” of various groups regarding the ASD, through the cinema. c) Develop local versions of the M-CHAT-R / F **in Spanish and Wichí** (one of the original indigenous languages) and pilot the Spanish version on the ground, as a preparation for to be validate. d) Create a suitable cascade training device for the interviewers who pilot such local version of M-CHAT-R/F on the ground, as well as design mixed teams with university volunteer students of Education, Nursing, and Medicine. e) Produce the first statistical data and estimations of Salta about this concerns. Data were collected by probabilistic sampling -elaborated by experts of the Salta Government, and being correlated with a corpus of context data relayed by the Permanent Household Survey. f) Elaboration of a plan of postgraduate courses related to this issues.

Conclusions: In their final form, this project seems adequate, replicable and sustainable in the time.

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109.116 Quality of Life and Education of Adolescents and Adults with ASD in Argentina. Preliminary Analysis Based on an Online Survey

S. H. Cukier[1]*, N. Barrios*[2]*, J. P. Berman*[3]*, A. Rattazzi*[1]*, R. Geloso*[4]*, M. Gotelli*[5]*, F. Satorra*[6]*, K. Solcoff*[7]*, D. Valdez*[8] *and C. Ysrraelit*[5]*, (1)PANAACEA, Buenos Aires, Argentina, (2)Fleni, Capital Federal, ARGENTINA, (3)PANAACEA, Programa Argentino para Niños, Adolescentes y Adultos con Condiciones del Espectro Autista, Buenos Aires, Argentina, (4)Asociacion Asperger Argentina, Buenos Aires, Argentina, (5)Fundación Brincar por un Autismo Feliz, Buenos Aires, Argentina, (6)TGD Padres TEA, Buenos Aires, Argentina, (7)FLACSO. Facultad Latinoamericana de Ciencias Sociales., Buenos Aires, Argentina, (8)Universidad de Buenos Aires- FLACSO, Buenos Aires, Argentina*

Background: In Argentina, services for adolescents and adults with ASD are sparse. Supports for education after primary school are only emerging. In 2016 RedEA (¨Autism Spectrum Network¨), an association of parent support groups and NGOs in Argentina, developed a survey to assess the current situation of adolescents and adults with ASD in relation to quality of life, services, education, employment and other variables.
Objectives: Provide a picture of the quality of life and challenges of adolescents and adults with ASD in Argentina related to the level of education attained, with the specific goal of thinking of ways to improve educational services and develop long-term policy solutions related to ASD in the region.

Methods: The Transition and Adulthood ASD Survey had been broadly disseminated via social networks of RedEA organizations in Argentina in 2016/2017. Caregivers of individuals over 13 and/or adults with ASD older than 18 completed it online. The survey solicited information about different variables including educational and Quality of Life issues. The educational background and main difficulties that individuals found to achieve their educational goals were analyzed and the association of these variables with current perceived quality of life.

Results:

534 surveys were completed. 31 % of people reported not being currently studying (15% of people reported working). Among those not currently studying, 64% reported that they haven't achieved their desired educational level.

The main obstacles to educational achievement described by individuals with ASD and their families were disagreement with teachers or institutions, difficulties to integrate, financial limitations, behavior problems, low cognitive level (services not being adapted to level). However, over half of those not currently studying have achieved the secondary level of education or higher. Almost half (46%) of the respondents expect to study at university and 17% already have. Variables related to emotional Quality of Life showed a strong association with the level of education achieved by adolescents and adults currently not studying.

Conclusions: This results together with current educational challenges reported by families affected by ASD in Argentina demonstrate the need for the identification of knowledge gaps, service needs, and inclusive education for these individuals and their families. It is also important in the development of culturally relevant strategies for raising awareness about adulthood and ASD, guiding the implementation of successful and improved ASD educational services and setting priorities for long-term national and regional public policy solutions in this age group

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109.117 Semantic Fluency in Monolingual and Bilingual Children with ASD, ADHD, or Typical Development: Assessing the Role of Language and Executive Functioning Skills

S. Vanegas[1] *and S. Magaña*[2,3]*, (1)School of Social Work, Texas State University, San Marcos, TX, (2)Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX, (3)University of Texas at Austin, Austin, TX*

Background: Little is known about how children with neurodevelopmental disorders learn and use two or more languages (Valicenti-McDermott et al., 2012). Although some advantages have been reported in executive functioning among typically developing bilingual children (Barac & Bialystok, 2012), it is unclear whether these findings will be similar among bilingual children with ASD or ADHD, considering that language can be an area of significant difficulty for these children (Kuijper et al., 2017). An important aspect of language development is the efficient and accurate retrieval of words, a concept often termed semantic or verbal fluency. To date, only one study has examined semantic fluency in bilingual children with ASD, finding that bilingual experience was associated with greater fluency when compared to monolingual experience among children with ASD (Gonzalez-Barrero & Nadig, 2016). However, it is unclear whether semantic fluency varies as a function of language experience (monolingual, bilingual) or diagnosis (ASD, ADHD, no diagnosis).

Objectives: The objective of the current study is to examine semantic fluency among children with ASD, ADHD or typically development and examine the contributions of language experience, language skills, and executive functioning skills.

Methods: Children between 6 and 14 years of age who communicated verbally and had consistent monolingual (English) or bilingual (English/Spanish) experience were recruited to participate. Children could have a diagnosis of ASD, ADHD, or no diagnosis of a neurodevelopmental disorder. Parents completed a language background questionnaire, documenting demographic characteristics, children's early language milestones, and language exposure. Parents also completed measures of clinical symptomatology through the Social Communication Questionnaire and the Conners-3. Children were assessed on nonverbal reasoning (Raven's Standard Progressive Matrices), overall language skills (Clinical Evaluation of Language Fundamentals – 4th version, CELF-4), and executive functioning skills (Behavior Rating Inventory of Executive Function).

Semantic fluency was assessed through the Word Association subtest of the CELF-4. This task requires participants to state as many items within 60 seconds for three semantic categories (animals, food, professions/clothing). Semantic fluency will be evaluated on total correct responses, number of switches between clusters, and the average cluster size. Bilingual children completed the CELF-4 and the Word Association subtest in English and Spanish.

Results: Data collection is ongoing, with an anticipated overall sample of 120 children. Data collected thus far includes a sample of 19 children with ASD (Monolingual n = 9; Bilingual n = 10). Preliminary analyses found no differences between monolingual and bilingual children with ASD on early language milestones, including age of 1st word (p = .878), short phrases (p = .243), and sentences (p = .091). Complete analyses will include comparisons across language (monolingual, bilingual) and diagnostic (ASD, ADHD, no diagnosis) groups on semantic fluency accuracy and retrieval strategies, including the role of language and executive functioning skills.

Conclusions: Overall, the results of this study will provide insight into the underlying processes of semantic fluency among children with neurodevelopmental disorders who have bilingual language experience. These results can inform educational and therapeutic strategies used in clinical and community settings to support children with diverse language experiences.

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109.118 The Asdeu Multi-Site Survey of Services for Autistic Adults in Europe, Focusing on Customer Service Practices in Adult Services

D. Schendel[1]*, C. Warberg*[1]*, S. Cramer*[1]*, L. Poustka*[2,3]*, R. Diehm*[4]*, G. Iskrov*[5]*, R. Stefanov*[5]*, L. Bouvet*[6]*, B. Roge*[7]*, A. Staines*[8]*, M. R. Sweeney*[9]*, A. Boilson*[10]*, T. Leosdottir*[11]*, E. Saemundsen*[12]*, M. L. Scattoni*[13]*, I. Moilanen*[14]*, M. Gissler*[15]*, T. Parviainen*[16]*, P. Tani*[17]*, R. Kawa*[18]*, A. M. Vicente*[19]*, C. Rasga*[20]*, M. Efrim-Budisteneau*[21]*, I. Dale*[22]*, C. Povey*[23]*, N. Flores*[24]*, C. Jenaro*[24]*, P. Garcia-Primo*[25] *and M. Posada*[26]*, (1)Aarhus University, Aarhus, Denmark, (2)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (3)Medical University of Goettingen, Goettingen, Germany, (4)Medical University of Vienna, Vienna, Austria, (5)Institute for Rare Diseases, Plovdiv, Bulgaria, (6)Psychology, Université Toulouse - Jean Jaures, Toulouse, France, (7)University of Toulouse - Jean Jaures, Toulouse, France, (8)Dublin City University, Dublin, Ireland, (9)Dublin City University, Glasnevin, Ireland, (10)Dublin City University, Dublin 9, Ireland, (11)Education and research, State Diagnostic and Counselling Centre, Kópavogur, Iceland, (12)State Diagnostic and Counseling Center, Kopavogur, ICELAND, (13)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (14)Child Psychiatry, University of Oulu and Oulu University Hospital, Oulu, Finland, (15)National Institute for Health and Welfare, Helsinki, Finland, (16)Finnish Association for Autism and Aspergers Syndrome, Helsinki, Finland, (17)University of Helsinki, Helsinki, Finland, (18)University of Warsaw, Warsaw, Poland, (19)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL, (20)Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisbon, Portugal, (21)'Victor Babes' National Institute of Pathology, Bucharest, Romania, (22)The National Autistic Society, Sheffield, United Kingdom, (23)The National Autistic Society, London, United Kingdom, (24)University of Salamanca, Salamanca, Spain, (25)Instituto de Salud Carlos III, Madrid, Spain, (26)Carlos III Health Institute, Madrid, Spain*

Background: The research base on ASD in adulthood is underdeveloped and there is very little knowledge regarding autistic adult services practices and delivery.
Objectives: To improve understanding of current services practices for autistic adults and opportunities for improvement as part of the Autism Spectrum Disorder in the European Union (ASDEU) project comprised of 20 partners in 14 European Union (EU) states. The presentation will describe ASDEU's anonymous survey designed to obtain information on services availability and user experiences related to autistic adult services in the EU, focusing on adult customer services practices.

Methods: Survey questions were based on published guidelines regarding services for autistic adults; separate versions were created for autistic adults, carers of autistic adults and professionals in adult services. The survey was translated into 11 languages and distributed by ASDEU partners via electronic media hosted by ASD organizations and in-country adult services facilities. The presentation will provide an overview of survey content and results, focusing on 'theme' questions on specific 'good' services practices that are repeated in different sections of the survey. The specific theme questions concerned services staff members' customer service competencies: level of ASD knowledge, knowledge of services availability for autistic adults, and providing information in ways autistic adults could understand. Analyses were performed on responses from all three respondent groups to theme questions in sections concerning adult services in general, and residential, employment, adult education, financial and social services areas, specifically.

Results: Currently, 945 respondents have completed the ongoing survey (358 autistic adults (65% female; 50% 18-35 years old), 297 carers of autistic adults (autistic adults described by carers: 27% female; 81% 18-35 years old), 290 professionals in adult services); > 85% of responders are from Denmark, Finland, France, Iceland, Italy and Spain; and 50-60% of responders are from communities of 1 million-20,000 inhabitants. Across all three respondent groups, all services areas, and all theme questions regarding customer service experiences in the past 2 years when applying for services, < 50% of respondents reported that they had experienced 'good practices': staff who seemed knowledgeable about ASD; seemed knowledgeable about services that were available for autistic adults; or provided information in understandable ways. Social services offices scored most favorably (35%-48% of adults or carers experienced these good practices) and financial services offices scored least favorably (9%-20% of adults or carers experienced these good practices); a financial service was the most frequent service applied for in the past 2 years by autistic adults (59%) and carers (74%). Carers tended to report a higher rate of experiencing these good practices in the last 2 years (30%-48%) compared to autistic adults (10%-40%).

Conclusions: The ASDEU adult services survey is best viewed as a detailed pilot study based on a large EU convenience sample. In these data, all three respondent groups consistently reported low rates of experience with basic measures of good customer service practices: knowledgeable and trained staff and understandable communication. Redressing these shortfalls may both improve customer service experiences and the efficiency of services delivery for autistic adults.

119 **109.119** Improving Access to Caregiver-Mediated Early Interventions: The Who Caregiver Skills Training for Families of Children with Developmental Disorders or Delays

ABSTRACT WITHDRAWN

Background: The majority of children with ASD and other developmental disorders live in low- and middle-income countries, where the treatment gap for these conditions is estimated to exceed 80%. The lack of skilled human resources, especially at the primary health care and community level, is recognized by the World Health Organization (WHO) as a major barrier to increasing service provision. The WHO mhGAP Intervention Guide provides guidance on developmental assessment and monitoring, and management of developmental disorders at primary health care level. The management plan includes offering caregiver-mediated early interventions, in light of the evidence of significant gains to children and families, but open-access, affordable caregiver-mediated programs that can be delivered by non-specialists in low-resource settings are not currently available.
Objectives: to develop a Caregiver Skills Training program for families of children with developmental disorders or delays (CST) meeting feasibility criteria for implementation at scale in low-resource settings.

Methods: A formative process was set up by WHO and partners, including: a) literature review, including analysis of implementation processes and components analysis using meta-regression techniques, and b) expert consultation. The expert consultation comprised of a meeting hosted by WHO and subsequent distance consultation with experts to define the intervention content and structure and capacity building strategies. Major issues discussed included target age group, inclusion/exclusion criteria for families receiving the intervention, number and length of sessions, strategies to reduce attrition, approaches to enable addressing individualized and heterogeneous needs of families and involvement of other family members.

Results: The literature review showed that caregiver-mediated interventions can be effectively delivered by non-specialists, and even low-intensity programs lead to improved child developmental and behavioral outcomes and improved family well-being. The moderation analysis showed that programs including behavior management techniques and instruction on the use of cognitive interventions to the caregivers had larger effect sizes. Caregiver skills training programs that used a combined delivery format of group and individual sessions had greater effect sizes in problem behavior reduction. A family-centered approach and stepped-care model were recommended, whereby the specific strengths and needs of families are assessed to ensure the program is relevant and referral to other available services is made whenever required. The need to allow for adaptation and flexibility to meet the realities of the local context and local health and educational systems was highlighted. The engagement of families and communities was considered paramount to make caregivers' attendance and participation to the program feasible. A modular organization, with 'core' sessions followed by additional optional sessions, as per specific needs and availability of resources, was proposed. Continuous support and supervision was discussed to be a critical element for effective implementation of CST by non-specialist providers.

Conclusions: Based on the evidence and experts' guidance, a package comprising intervention manuals, and adaptation, capacity building and Monitoring & Evaluation tools was developed and made available for field testing. The program aims to improve children's communication and adaptive behaviors and caregivers' wellbeing. The CST is currently being field tested in 30 countries from all regions, including high-income and low-and-middle-income countries.

120 **109.120** The Cultural Adaptation and Clinical Efficacy of the PEERS® Program in Israel

S. Israel Yaacov[1,2]*, N. Kanter*[3]*, I. Mor Snir*[2]*, E. A. Laugeson*[4] *and O. Golan*[1,2]*, (1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for Children at Risk, Givat-Shmuel, Israel, (3)Clinical Child Psychology, Association for Children at Risk, Givat-Shmuel, Israel, (4)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition, characterized by social communication deficits and restricted, repetitive behavior patterns. Adolescence is a particularly troubling period for persons with ASD, with increased awareness of teens to the difficulties they encounter when interacting with peers, and their susceptibility to isolation, rejection and bullying. Learning to make and keep friends is especially difficult for teen with ASD. Thus, teaching the necessary skills may have significant life long impact for this group. In Israel, research supported social skills training has been available only for elementary school aged children within the educational settings (Bauminger, 2007). The Program for the Education and Enrichment of Relational Skills (PEERS®; Laugeson & Frankel, 2010) is a parent-mediated social-skills program for adolescents with ASD that has been well validated with and out of North-America.
Objectives: The current study had two objectives: (1) to culturally adapt PEERS® in Israel. (2) to clinically evaluate the efficacy of the adapted PEERS® protocol with Israeli adolescents with ASD and their parents in a clinical setting.

Methods: The PEERS® protocol has been translated to Hebrew and culturally adapted by a team of clinicians specialized in ASD. The adapted protocol was administered to sixty-one adolescents (7 girls), aged 10-16, and their parents, who attended social skills groups at the 'Bait Echad' clinical center for individuals with ASD. Questionnaires were filled out pre- and post-intervention. Parents reported on autism symtomatology (SRS-2) social skills (SSIS), and quality of socialization (QSQ). Teachers reported on autism symtomatology (SRS-2) and social skills (SSIS). Adolescents reported on social skills knowledge (TASSK), quality of socialization (QSQ), autism symtomatology (AQ), empathy (EQ), loneliness (UCLA), and social anxiety (SAS). Qualitative interviews were conducted with teens, parents, and clinicians who took part in the first two groups.

Results: Participants' and clinicians' feedback supported the applicability of PEERS® to adolescents with ASD in Israel. Cultural adaptations have been conducted around several themes, including choosing appropriate friends, appropriate use of humor, good sportsmanship, use of electronic communication, and the management of get-togethers. Questionnaire results show a significant improvement on adolescents' social skills knowledge ($p<.001$), and a greater frequency of social get togethers ($p<.001$). In addition, teens reported reduced feelings of loneliness ($p<.05$), enhanced empathy ($p<.05$), and reduced autism symptomatology ($p<.05$). Parents reported a significant reduction in autism symptomatology ($p<.01$), and both parents ($p<.01$) and teachers ($p<.05$) reported on improved social skills.

Conclusions: Results of this clinical trial support PEERS® as a promising evidence-based intervention for adolescents with ASD in Israel. A randomized controlled trial of the Israeli adaptation is currently undergoing. The significant effects of the intervention, conducted with a broader age range of participants, suggest PEERS® may also be applicable to a younger age group.

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109.121 The Current State and Outlook of Autism in Mainland China

***Y. Fan**, South China Normal University Autism Research Center, Guangzhou, China*

Background:
In China, there are more than ten million (10,000,000) people on the autism spectrum as estimated by the prevalence of 1% in the whole population of one point three billion people. It is an extremely large population but little is known about their living conditions.

Objectives:

The present study provides a systematic review of 8 perspectives of the current situations of people with autism spectrum disorders (ASD) in mainland China, including prevalence, diagnosis, intervention, education, employment, family issues, research, and law.

Methods:

Literature Review

Results:

Results from a review of 26 epidemiological studies from 2000 to 2016 showed that the average prevalence rate was 0.30% ($SD = 0.32$). Diagnosis were mainly made by pediatricians using translated tools, such as DSM-5. However, there were very few of them certified to use ADOS, ADI-R or other established diagnosing and assessment instruments. With regard to intervention, there were around 2000 service providers in mainland. Among the 47 interviewed organizations, only 37% of intervention approaches they used were established and evidence-based. According to a survey of 1202 organizations, 92% of them provided rehabilitation and education service while only 8% of them provided employment service and adult care service. School-aged children with ASD had five options of education placements, including autism schools, special schools for children with mental retardation, and other three types of placements in mainstream schools. Our review also analyzed the financial burden of families with a child having ASD. Besides, number of publications in the field of autism were analyzed by year from 2000 to 2015. We found a consistent growing tendency which implied that autism was becoming a more and more popular research topic in China. Lastly, we have reviewed the development of laws related to individuals with ASD and its limitations.

Conclusions:

Based on the systematic review of the current state of individuals with ASD in China, suggestions of the future development in diagnosis, vocational education and support, and training professionals were proposed.

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109.122 The Emergence of Autism Spectrum Disorder in Costa Rica

***D. Schelly** and A. Ohl, Clarkson University, Potsdam, NY*

Background:
In the U.S., the history of autism spectrum disorder can be traced to deinstitutionalization and the crisis of psychiatry that preceded the DSM-III in 1980. Parents of children with autism, some of them psychiatrists and psychologists, influenced the expansion of diagnostic criteria that would contribute to the autism "epidemic" of the 1990s (Eyal et al. 2010). But the history of autism does not end in the U.S.; as the category continues to be adopted globally, there is a collision between Western diagnostic criteria and local culture (Grinker 2007). The aftermath of this collision has been partially documented for autism, especially in India (e.g., Daley 2004) and South Korea (e.g., Grinker and Cho 2013), but nowhere has the lead

up to the adoption of the category been described, including the first diagnosed case and the eventual diffusion of autism in the new setting.

Objectives:

This paper considers the adoption of the diagnostic category of autism in Costa Rica, where cases were recruited in the early-2000s for a genetic study. What led to those first diagnosed cases? How do "networks of expertise" (Eyal et al. 2010) operate in relation to the category? How are the autism experts in Costa Rica tied to networks of expertise in the U.S. and abroad?

Methods:

The present research stems from a collaborative project with the Hospital Nacional de Niños (HNN), the diagnosing clinic for all children in Costa Rica. Interviews were conducted with the primary diagnosing physician—a developmental pediatrician—and other staff at the hospital, and medical files of early cases of autism were reviewed. Finally, all genetic studies on human populations in Costa Rica leading up to the autism study were complied, and connections among the 108 authors were mapped in a two-mode network diagram.

Results:

The network diagram reveals a dense interconnected network of 16 genetic studies, beginning in the early 1990s, involving collaboration between physicians, microbiologists, statisticians, and cytogeneticists in Costa Rica and researchers in the U.S., Canada, and several countries in Europe. A pharmaceutical company was the source of one bipolar study, but the remaining studies focused on Costa Rica because of its founder population. Almost by happenstance, a California author initiated the autism study after moving to an autism research center in New York and then hearing that the pediatrician, who had completed a residency in Boston, was inquiring about a possible autism case. The pediatrician was recruited for case recruitment, and after completing an ADOS course in the U.S., she eventually devoted time each week for diagnosing autism and began training other clinicians to consider the diagnosis.

Conclusions:

The importation of autism in Costa Rica was likely inevitable, but this study illustrates how network ties to research institutions with substantial financial resources can drive the diffusion of diagnostic practices and categories. In no way does the process appear exploitative or paternalistic; rather, both sides benefit from the collaborations, and medical practices in the U.S. are effectively transmitted to small countries with limited resources.

123 **109.123** The Standard and Practice of Assessing Response to Intervention for Children with Autism in Ethiopia

W. A. Zeleke[1,2] *and R. J. Charette*[3]*, (1)Counseling, Psychology and Special Education, Duquesne University, Pittsburgh, PA, (2)Duquesne University, Pittsburgh, PA, (3)Western Psychiatric Institute & Clinic, Pittsburgh, PA*

Background: Behavioral and educational intervention service for student with autism in Ethiopia is still primarily provided by the two parent owned autism centers. The primary goal of these center is to address the student's behavioral, developmental, social and academic needs, which is an intensive undertaking process that requires many hours each week of different instruction and therapies. In this process, it is crucial to assess intervention response on an individualized basis, especially in a country like Ethiopia where service is offered with limited resources and human power. However, the implementation of assessment to intervention response has received scant attention (Zeleke, Hughes, & Chiytio, 2017).

Objectives: The purpose of this study was to assess the standard and practice of intervention implementing plan for students with ASDs in Ethiopia.

Methods: Using mixed method, data was collected from 120 students with ASDs, 12 program coordinators, 32 teachers, and 12 parents. Survey questionnaires, direct observation, focus group discussions, and individual interviews were utilized to gather information on the standard and practice of (a) intervention selection, (b) identification of reasonable strength of intervention, (c)implementing the intervention, (d) assessing progress, and (e) applying decision rules to the resulting data.

Results: The preliminary results indicate that even though a substantial service provision practice that addresses student's behavioral, developmental, social, and academic needs observed, lack of documentation on intervention plan and implemented interventions were marked.

Conclusions: Implication on the role of plan implementation and how to assess response to intervention can be used to inform implementing an entitlement process in which services are integrated with assessment and a due process protection for students are discussed.

124 **109.124** Translation, Cultural Adaptation and Initial Testing of PEERS in the Netherlands

K. Greaves-Lord[1,2]*, S. Idris*[1]*, B. van Pelt*[1,2] *and G. Jagersma*[2]*, (1)Erasmus MC, Rotterdam, Netherlands, (2)Yulius, Dordrecht, Netherlands*

Background:

The PEERS intervention can be considered a well-established, evidence-based intervention in the USA. However, testing the efficacy of cultural adaptations of PEERS is still ongoing. So far, only Yoo et al. (2014) investigated the efficacy of PEERS outside the USA, and their study demonstrated promising findings regarding the Korean version of PEERS. More and more, the involvement of all stakeholders in the development and evaluation of interventions is acknowledged as crucial for the longer term implementation of interventions across settings. Therefore, in the current project, teens with ASD, their neurotypical peers, parents, teachers, clinicians as well as management staff were involved in the development and evaluation of the Dutch version of PEERS.

Objectives:

The current presentation covers the formative phase (1) and the preliminary adaptation test phase (2) of the cultural adaptation of evidence-based interventions, as adapted from Barrera and colleagues (M. Barrera & Castro, 2006; M. Barrera, Jr., Castro, Strycker, & Toobert, 2012), i.e. describing the process of adaptation of the PEERS program to the Dutch culture and care system (1), and presenting results from the preliminary adaptation test among 32 12-18 year old adolescents with ASD (2).

Methods:

In phase 1, a panel inventory on common vocabulary was conducted among 70 teenagers (and their teachers) from special and regular education aged 12-18 years old. This inventory concerned 14 key constructs from PEERS, e.g. areas of interests, locations for making friends, common peer groups and crowds inside and outside of school, activities with friends, commonly used ways for electronic communication, ways for handling disagreements, and common teasing comebacks. Also, 15 clinicians were involved in the translation and cultural adaptation process. The translation and cultural adaptation process was guided by the research team, and who included input and feedback from all stakeholders through an iterative feedback incorporation procedure. In phase 2, The parent-reported Social Responsiveness Scale (SRS) and the the Test of Adolescent Social Skills Knowledge (TASSK) were assessed pre- and post intervention to evaluate potential treatment outcome.

Results:

The most striking cultural adaptation - reflecting the standpoints of all stakeholders - concerned the strategies for handling rumors and gossip, which were suggested to be taught using a similar approach as the teasing comebacks, more in line with 'down-to-earth' Dutch standards. The preliminary testing of this adapted version indicated that the adolescents with ASD significantly improved their social knowledge (TASSK; t_{31} = -10.9, p<.01) and in parent-reported social responsiveness (SRS; t_{33} = 3.9, p<.01). In addition, subjective evaluations of teens with ASD, their parents and clinicians were positive.

Conclusions: Although these preliminary results are promising, larger scale controlled research is needed. Methodological and practical considerations in the design and implementation of a recently started randomized controlled trial will therefore be discussed.

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109.125 Understanding Autism Spectrum Disorder in Context: A Comparison of Parent/Caregiver Perceptions of Functioning in a High-Income and Middle-Income Country

M. Viljoen[1], *S. Mahdi*[2], *S. Bolte*[3] *and P. J. de Vries*[1], *(1)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (2)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (3)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: Autism Spectrum Disorders (ASD) are heterogenous and functional outcomes can be highly variable in different individuals. The World Health Organization International Classification of Functioning, Disability and Health (ICF) is widely-used to measure functioning. Core Sets for ASD were recently developed. The process included a qualitative preparatory study to explore parent/caregiver perceptions of functioning and environmental factors in five highly divergent countries (Canada, Sweden, India, Saudi Arabia and South Africa). However, the context in which individuals live strongly influences functional ability or disability and it is not known whether functional themes in these diverse environments would have been similar or different.

Objectives: The purpose of this study was therefore to examine the association between context and functional ability/disability in children with ASD by deliberately comparing and contrasting two of the most divergent countries who participated in the qualitative preparatory study. We aimed firstly to compare and contrast the *frequency* of functional items reported by parents/caregivers between a High Income Country (Sweden) and a Low/Middle Income Country (South Africa). We secondly set out to compare and contrast the *content* of the functional items reported by parents/caregivers in these two countries.

Methods: For the ICF core sets study focus group and individual semi-structured interview data from 35 participants were analyzed following ICF procedures to link themes to ICF-CY categories. In this secondary analysis we compared South African (22 participants) and Swedish data (13 participants). The identified ICF-CY categories were ranked and compared for similarities and dissimilarities in frequency of reporting and analyzed for similarities and dissimilarities in the content of the themes.

Results: Complete *frequency* agreement was seen in 4 categories - three 'Activities and Participation' (carrying out daily routines, dressing, complex interpersonal interactions), and one 'Environmental Factors' (immediate family). Dissimilarities were observed in one 'Environmental Factors' category (health professionals), 6 in 'Body Functions' (e.g. involuntary movement functions, gait patterns, basic cognitive functions, and mental functions of language) and 3 in 'Activities and Participation' (managing one's own behaviour, speaking, and undertaking a single task). Only four ICF-CY categories differed in *content* between South Africa and Sweden. Immediate family was reported as both a barrier and facilitator to functioning in South Africa and only as a facilitator in Sweden, attention was reported as a facilitator in Sweden and barrier in South Africa, and products and technology for personal use was reported as a facilitator in Sweden and barrier in South Africa. Interestingly, health professionals were mentioned as a barrier to function in Sweden and facilitator in South Africa.

Conclusions: In spite of the divergent nature of contexts, few differences were observed in parental perspectives about environmental factors relevant to functioning in ASD. Surprisingly, perceptions more frequently differered regarding body functions and activities & participation. The content of perceptions were, with a few exceptions, similar. Our results suggest that the interaction between context and functioning is more complex than we predicted. We recommend that more comparative studies on ASD and functioning should be conducted to gain a better understanding of ASD in different contexts.

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109.126 Understanding "Autism Community Wealth" within the Latino Community in Los Angeles County: A Theoretical Framework

T. De los Santos[1], *I. Arriaga*[1], *A. Gulsrud*[1] *and D. Hayes-Bautista*[2], *(1)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (2)David Geffen School of Medicine at UCLA, Los Angeles, CA*

Background: It is well documented that Latino parents of children with autism spectrum disorder (ASD) in the United States face barriers to obtaining diagnoses and treatment for their children (Zuckerman et al., 2013). However, little is known about how Latino parents manage to overcome barriers to accessing autism services (Fryer 2008). This study uses Yosso's six-part Cultural Wealth Model, which includes six types of capital (i.e., familial, social, linguistic, resistance, aspirational, navigational), to conceptualize how Latino parents utilize cultural capital to overcome barriers and access autism-services for their children (Yosso, 2005).

Objectives:To identify community cultural capital used by low socioeconomic status (SES), Latino parents of children with ASD to access care for their children.

Methods:IRB approval was obtained to interview 21 self-identified English- and Spanish-speaking Latino parents of children with ASD and 3 key informants (community leaders). Criteria for study participation included residency in Los Angeles County, being of Latin American descent, of low SES, as defined by the U.S. Federal Poverty Guidelines, and a parent of a child between the ages of 2 and 10 years with a professional diagnosis of ASD. Key informants were eligible if they worked with low-income, Latino parents of children with autism. Focus groups were conducted utilizing open-ended prompts to elicit discussion. Focus groups were audio-recorded, transcribed verbatim, and independently coded for major conceptual models. Exploratory, qualitative analyses were conducted using a modified grounded theory approach. Six raters coded each transcript to ensure reliability. Data triangulation and methodology triangulation were employed to ensure validity and reliability of data interpretation.

Results:Latinos show the greatest wealth in the area of **(1)*Familial capital***, such that their *familias (kin)* provide significant emotional and informational support, particularly once they accepted the diagnosis. The strong kinship in the home, often expands into the community with professionals (e.g., teachers, doctors, etc.) and other parents, which then becomes their **(2)*Social capital***. Key informants report noting a kinship within these groups that helps parents stay informed and connect to more resources. Following the establishment of these relationships, they build a greater **(3)*Linguistic Capital*** within the realm of ASD as they become comfortable with the jargon. For monolingual Spanish-speaking parents, linguistic capital was depressed because of language barriers and resources were not usually offered in Spanish. Nonetheless, with the **(4) *Resistance capital*** they possessed, all parents indicated a stronger self-confidence that promoted their ability to advocate for their child and themselves. Consequently, in the face of biased practices they have the ability to counteract these comments. But of these capitals, their ***(5)Aspirational Capital***, which refers to their ability to maintain hopes and dreams for the future, motivates them the most to advocate for their children. Yet, this is limited by their concerns about their own future health.

Conclusions:Understanding how these parents use Community Wealth to navigate autism services for their children may facilitate the creation of novel and culturally sensitive educational and outreach strategies that may make early intervention diagnostic and interventions more accessible to low-income Latino communities.

127 **109.127** Uses of Semiotic Objects and Mediation in Early Triadic Interactions in Siblings of Children Diagnosed with Autistic Spectrum Disorder in the Province of Santa Fe, Argentina.

D. Valdez[1]*, J. Benassi*[2] *and C. Rodriguez*[3]*, (1)Universidad de Buenos Aires- FLACSO, Buenos Aires, Argentina, (2)FLACSO, Buenos Aires, Argentina, (3)UAM, Madrid, Spain*

Background: Latino children are diagnosed with ASD later in life, usually with more severe symptoms, compared with non-Latino children. Possible reasons for such disparities could be due to lower levels of parent education, lower socioeconomic status and limited knowledge of parents about autism spectrum disorder.(Montiel, Chacín et al. 2017) Our study proposes lines of research in the early development in search of risk indicators that allow to favor policies of early intervention in the context of our region. The learning of the conventional use of objects occurs in triadic units and through operations with signs. Thus, communicative interactions are fundamental in the semiotic processes involved in the child's entrance to the socially shared uses of objects. Taking into account that communication is one of the dimensions of development in which children with ASD present their main alterations, it is possible to think that the genesis of socially shared uses of objects also follows a particular course.

Objectives: Describe the development of triadic child-adult-object interactions in children from Santa Fe at risk of ASD, from 3 to 15 months of age

Methods: Understanding that the prospective longitudinal study with population at risk is recommended (eg. Zwaigmbaum et al., 2013); and considering that siblings of children diagnosed with ASD are at particular risk, a longitudinal, prospective case-based evolutionary design is performed. The sample is of the intentional type composed of 4 infants at risk of developing ASD, between 3 and 15 months of age, in accordance with the ages studied in the previous typical development research, in which this project is framed (Cárdenas, Rodríguez, & Palacios, 2014; Moreno-Núñez, Rodríguez & del Olmo, 2017).

Results: Through a pilot study, the preliminary categories of this research were reviewed, taken from our previous studies: rhythmic uses, non conventional, proto conventional, conventional, instrumental, symbolic and private / self-regulation of objects; as well as the production of gestures in contexts of triadic interaction. They analyze both the adult and the child, their communicative means, gestures, expressions, looks, language and uses of objects. The work emphasized the importance of considering the ostensible actions of the adult as a communicative tool, which favors the joint attention and action. Second, distant demonstrations of the uses of objects, structured in character, represent the most effective rhythmic-sound manifestations to attract the attention of the child, allowing their involvement in the pauses it generates. The mentioned data are analyzed with attention in the semiotic performances that the adult unfolds for the child with the selected object. Preliminary results indicate some variations, compared to previous studies in typical development, in triadic interactions, where the communicative intention is still the responsibility of the adult.

Conclusions: The findings indicate the need to continue investigating the early development of signs in the at-risk population. This allows to develop new instruments that contribute to the evaluation of alarm indicators, as well as to the development of early intervention tools consistent with the evaluation of the uses of objects in the light of a pragmatic semiotic approach.

128 **109.128** Who's Waiting for a School? a Systematic Database Search for Children with Autism Spectrum Disorder Waiting for Educational Services in the Western Cape Province of South Africa

S. Pillay[1]*, P. J. de Vries*[2] *and M. Duncan*[3]*, (1)Health Sciences, University of Cape Town, Cape Town, South Africa, (2)Centre for Autism Research in Africa, Division of Child & Adolescent Psychiatry, University of Cape Town, Cape Town, South Africa, (3)Occupational Therapy, University of Cape Town, Cape Town, South Africa*

Background:

Little is known about education for children with Autism Spectrum Disorder (ASD) in South Africa and in other low- and middle-income countries. We previously searched for all children with an ASD diagnosis in school in the Western Cape Province of South Africa. We identified only 940 children, representing a rate of less than 0.1%, significantly lower than the expected prevalence. The Western Cape Education Department (WCED) has a database for children waiting for school placement, but no previous analysis of this database has been undertaken. An understanding of this sample is important for identifying their needs in order to develop appropriate support and educational systems.

Objectives:

The objective of the study was to perform a systematic database search for children with ASD or suspected ASD waiting for educational services.

Methods:

The WCED Centralised Database for children with ASD waiting for educational services was first compiled in 2012. After appropriate ethical approvals, all relevant ASD-related data in the database and supporting referral documents were extracted on 27 June 2016. Variables of interest were demographic information, referral information, disability information and educational needs.

Results:

There were 744 children with ASD or suspected ASD waiting for educational services in the Western Cape Province. The male: female ratio was 5:1. Ninety percent were from South Africa, 6% from other countries (Angola, Burundi, Congo, Ethiopia, Libya, Malawi, Mali, Nigeria, Somalia, Zimbabwe and Bangladesh), and 4% did not specify country of origin.

A total of 17 different home languages were reported: English in the majority (52%), one of the 10 other official South African languages in 47%, and 1% non-South African languages.

The age range was between 1 and 17 years, with a median of 5 years. The majority of children waiting for services were in the 3-8 year age group. The legal school-going age for children in South Africa is 7 years. Forty five percent of children were waiting for formal school placement (aged 7 years and over) and 55% for Early Childhood Development (ECD) services (ages less than 7 years). Forty eight percent of the sample had been waiting for services for less than a year, 26% for more than a year, 19% for more than two years and 7% for more than three years.

Most referrals to the Centralised Database were made by medical practitioners from the state health sector. Ten percent of children had comorbid physical or mental health conditions, and a family history of ASD was reported in 4% of the sample. The majority of children (89%) referred were from urban areas, with only 11% from rural areas.

Interestingly, between 2012 and 2016, there was a 276% increase in the number of children waiting for educational services.

Conclusions:

The database investigation of children with ASD showed alarmingly high rates of children with ASD waiting for educational services in the Western Cape Province of South Africa. Findings support the need for urgent action to generate novel approaches for the identification, monitoring and education of all children with ASD in the country.

Poster Session
110 - Interventions - Non-pharmacologic - Preschool & Infant
11:30 AM - 1:30 PM - Hall Grote Zaal

129 **110.129** Determinants of Response to Music Therapy in Autism: Insights from the Time-a Study

E. Grossi[1] *and C. Gold*[2], *(1)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (2)GAMUT, Uni Research Health, Uni Research, Bergen, Norway*

Background:

Music therapy (MT) may facilitate skills in areas affected by autism spectrum disorder (ASD), such as social interaction and communication. The TIME-A study (Bieleninik et al. JAMA 2017) examined the effect of improvisational MT on generalized social communication skills of children with ASD and represents the largest randomized controlled trial of MT for ASD. In this assessor-blinded trial of 364 children aged 4-7 years across nine countries worldwide, those assigned improvisational MT, where trained music therapists sang or played music with each child, attuned and adapted to the child's focus of attention, to help children develop affect sharing and joint attention. The proportion of responders to MT, defined as having improved ADOS social affect score after 5 months, was 52%.

Objectives:

The availability of this large data set gives the possibility to assess the determinants of the response to MT by analyzing the baseline profile of 165 subjects randomized to improvisational MT. By using advanced machine learning systems, we are able to develop a semantic connectivity map of the factors associated with response to the therapy with the aim to derive possible new insights in interpretation of trial results.

Methods:

Data of the TIME-A study were re-analyzed with a special kind of unsupervised artificial neural network (Auto-CM). Auto-CM produces a semantic connectivity map in which the matrix of connections, visualized through a minimum spanning tree filter, takes into account nonlinear associations among variables and captures connection schemes among clusters. In this way, the patient state can be viewed as an hyperpoint in a "multimorbidity space" in which each dimension corresponds to a quantitative phenotype.

Results:

In the semantic map(fig.1), male gender was directly linked to response; age over 5 years and presence of mental retardation were linked with response through male gender followed by ADOS score above 14 and verbal ability. Concomitant treatments such as sensory-motor therapy, speech and language therapy, behavioral and educational interventions, as well as therapeutic leisure activities all pointed to the non-response node. A further reanalysis performed in the trial data set confirmed a completely different trend in response rate between the non-MT arm and MT arm. In the first subgroup the total number of hours in concomitant treatment was not correlated with difference in response rate (response rate in < 40 hours/month and > 80 hours/ month of concomitant treatment equal to 50% and to 54% respectively) while in the second group a marked difference in response rate was evident (response rate in < 40 hours/month and > 80 hours/ month of concomitant treatment equal to 66% and to 40% respectively).

Conclusions:

Response to MT depends on a complex interaction of variables. The prototypical responder to MT, as appears from TIME-A study data set, is a male child able to speak, with ADOS-SA over 14, age over 5, and mental retardation. Excess of concomitant treatments seems to interfere with response to improvisational MT.

130 **110.130** "I Wanna Play Too": Increasing Social Interactions of Preschool Children with Autism Spectrum Disorder through

Cooperative Outdoor Play

***S. M. Ziegler** and M. Morrier, Psychiatry and Behavioral Sciences, Emory University School of Medicine, Decatur, GA*

Background: Recent estimates from CDC's ADDM Network indicate that for 4-year-old children, the prevalence of ASD is 1 in 74. Thus, early educational settings have increased numbers of children with ASD attending. In these settings, daily outdoor recess is usually offered, allowing children to play in an unstructured manner. Such unstructured times, often lending children with ASD to spend the majority of recess isolated, socially disconnected, and engaging in non-functional behaviors, represent missed opportunities to teach needed peer-related social skills.
Objectives: This study examined if a structured, cooperative play recess curriculum with a focus on natural modelling and imitation: (a) increased the rate of proximity of children with ASD to peers with NTD, (b) increased the number of social bids from children with ASD to peers with NTD, and (c) increased the number of social bids from peers with NTD to children with ASD. Specific objectives included: (a) examining if the intervention increased social behaviors in children with ASD, and (b) examining factors related to the overall increases in social behaviors demonstrated by participating children as a whole.

Methods: Thirty-five preschool-aged children with and without ASD participated. A multiple baseline across classroom design was used to investigate the effect of the intervention on social communication behaviors, in one intervention and two generalization settings. The intervention consisted of child dyads singing randomly chosen movement songs in front of one another, in a larger group setting. Data was collected using a 120-s observe; 30-s record, partial interval system. A MANOVA was performed to determine the effects of study phase, ASD status, and age of child. Based on the results of the MANOVA, one-way ANOVA was conducted to determine how each variable played into the results obtained.

Results: Participants with ASD increased their social bids towards peers with NTD. Pre-K students generalized and maintained these increases in the free-play setting, whereas younger children did not generalize skills. Examination of factors related to increases showed significant differences based on child ASD status, child's age, and study condition. ANOVA results with age range as the between group factor indicated significant differences for rate of typical proximity, for rate of ASD proximity, for ASD receives, and for ASD gives. Study condition indicated significant main effects for rate of typical proximity and for rate of ASD proximity. Study condition was also significant for typical receives, and ASD receives. In terms of initiations of social bids to peers, only typical gives was significant for study condition.

Conclusions: Once the intervention was introduced, social interactions between children with ASD and their peers increased over baseline levels. These increases generalized and maintained for older, but not younger participants. The ASD status of the target child was investigated to determine which population of child, typical or ASD, made the most improvements. Results from this study support previous research on structuring peer interactions during unstructured times as a means to increase social bids between typical peers and peers with ASD, and extends the research downward in age to toddler and preschool-aged children.

131 **110.131** A Long-Term Follow-up of Participants Who Received Parent-Mediated Intervention for ASD in Toddlerhood: Stories from the First Cohort of the Social ABCs Pilot Study –Where Are They Now?

*J. A. Brian[1], **E. M. Dowds**[2], A. Solish[1], J. H. Leef[3], L. Senman[4], L. Zwaigenbaum[5] and S. E. Bryson[6], (1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Autism Research Centre, Holland Bloorview Kids Rehabilitation Hospital-Autism Research Centre, Burlington, ON, Canada, (3)Department of Applied Psychology and Human Development, University of Toronto & Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Autism, Bloorview Research Institute, Toronto, ON, Canada, (5)University of Alberta, Edmonton, AB, Canada, (6)Dalhousie University, Halifax, NS, Canada*

Background: The *Social ABCs* is a parent-mediated intervention (Brian et al., 2016) based on empirically supported Pivotal Response Treatment (PRT; Koegel & Koegel, 2006). The main targets of the *Social ABCs* are functional early (vocal/verbal) communication and positive affect sharing between child and caregiver for infants/toddlers who have suspected or diagnosed Autism Spectrum Disorder (ASD).
The *Social ABCs* was developed as a pilot study ten years ago to explore very early intervention in infants and toddlers showing early signs of ASD or related symptoms. The original participants included young toddlers between 12-30 months of age, across two sites (Halifax, NS and Toronto, ON). This abstract explores the long term developmental outcomes of the child participants from our pilot phase of the *Social ABCs*-Toronto cohort.

Objectives: Bolstered by evidence of positive (short-term) treatment outcomes, we sought to explore long-term developmental outcomes of early participants in the *Social ABCs*. We hope this can help us to understand how early intervention may interact with development and symptoms of ASD over time. Longitudinal exploration includes questions such as: "*What did social-communication look like in toddlerhood, before intervention, and what does social-communication look like now?", "Is response to treatment associated with current functioning?"*.

Methods: We have re-assessed six of the initial 11 participants from the Toronto site of the *Social ABCs* pilot within the context of our longitudinal infant sibling study (Zwaigenbaum et al., 2005). Analysis entails a mixed-methods approach. Through chart review, we examined each participant's performance on standardized measures of development, as well as ASD-related symptoms based on ADOS, ADI-R and parent interviews, from toddlerhood (mean age = 2 years) into middle childhood (mean age = 10 years). We will incorporate parents' informal anecdotal feedback and supplement this with qualitative interviews with parents at the long-term follow up assessment in order to explore themes relating to the perceived long-term impacts of the *Social ABCs* on the child and family.

Results: Data from the middle-childhood follow-up assessment revealed: (1) the children in the *Social ABCs* pilot group made considerable gains in standardized measures of cognitive, language, and social-communication development; (2) most of the participants did not go on to receive an ASD diagnosis; (3) parents in the pilot group spontaneously shared themes of positive feelings about the impact of the *Social ABCs* intervention on the child's social communication abilities over time; these reflections will be supplemented by formal interview data.

Conclusions: Significant gains were observed in the six pilot participants at a follow-up assessment in middle-childhood. Parents reported positive feelings about the *Social ABCs* and describe possible influences on their child's development and ASD symptoms. In order to further investigate the role of the *Social ABCs* on development over time, we will conduct formal interviews with this group of parents. Future work includes exploring the long-term development of a larger cohort of participants from our RCT.

132 **110.132** Integrating the Early Start Denver Model (ESDM) in ASD Preschools in Israel – Results of a Matched Controlled Study

***T. Gev**[1,2], Y. Sinai[1], G. Vivanti[3], I. Mor Snir[2] and O. Golan[1,2], (1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for*

Children at Risk, Givat-Shmuel, Israel, (3)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA

Background:
The Early Start Denver Model was previously shown to be effective as an intensive home- and group based intervention (Dawson et al., 2010; Vivanti et al., 2014). However, there is currently no evidence for the effectiveness of the ESDM integration into existing community preschool-services. In Israel, this setting is the main provider of intervention services for young children with ASD. It is therefore important to assess the effectiveness of the ESDM when applied in this setting.

Objectives:

To conduct a controlled trial, comparing an implementation of the ESDM in ASD community preschools, to the eclectic program commonly applied in such preschools in Israel. The model has been adapted to the community preschool settings through: (1) translation of relevant training materials (2) A workshop on ESDM principles and teaching techniques conducted for preschool educational and clinical staff (3) weekly individual and group play activities conducted together by preschool aids and ESDM therapists.

Methods:

Fifty-eight children, aged 35-57 months, from eight ASD preschools, participated in the current study. Thirty-three (7 girls) attended preschools in which ESDM was integrated, and twenty-five (3 girls) attended eclectic preschools. Groups were matched on age and developmental level. Both groups received 30 hours per-week of educational intervention and 10 treatment hours per-week by a multidisciplinary team (psychologist/psychotherapist, occupational therapist, speech and language pathologist, physiotherapist, behavior analyst). The implementation of the ESDM included the use of the model's curriculum and treatment practices, and therapists' adherence to the ESDM fidelity rating system. Educational staff incorporated ESDM principles and objectives into the daily preschool routine. In addition, in the ESDM-based program, parents attended weekly parent-child therapy sessions.

Changes in children's cognitive ability (MSEL) and adaptive behaviors (teacher and parent reported VABS-II) as well as parent reported sense of stress (PSI-SF) and competence (P-SOC) were measured pre- and post- 8 months of intervention.

Results:

Both groups showed significant gains in MSEL visual reception, fine motor, receptive and expressive language age-equivalent scores. However, the ESDM-based intervention group showed significantly higher increases in receptive and expressive language, and in fine-motor age-equivalent scores, compared to the eclectic intervention group.

Both groups showed significant gains in all teacher and parent-reported VABS-II subscales. However, the ESDM-based group showed significantly higher gains in the teacher-reported receptive and expressive language, domestic and coping skills subdomains, and in parent-reported play and domestic skills. Parent-reported sense of competence increased in both groups. Additionally, in the eclectic group, parents' perceived stress decreased at post-intervention, while no such decrease was observed in the ESDM-based group.

Conclusions:

The current study's results indicate that the ESDM is cross-culturally valid in Israel, and that it can be integrated into existing community preschools, with positive child outcomes. Cultural and logistical barriers and adaptations introduced to overcome such barriers will be discussed. Additionally, parental involvement in the intervention improves parental competence, but maintains parental stress in the ESDM group, possibly due to the intensive parental involvement and commitment required in the current program, as well as the time-consuming and emotionally charged nature of the treatment process.

133 **110.133** Developmental, Adaptive and Parental Characteristics of High- and Low-Responders to a Preschool-Based Esdm Intervention

Y. Sinai[1], *T. Gev*[1,2], *G. Vivanti*[3], *I. Mor Snir*[2] *and O. Golan*[1,2], *(1)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel, (2)Association for Children at Risk, Givat-Shmuel, Israel, (3)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA*

Background:
In the effort to move towards evidence-based treatment individualization for children with ASD, current research attempts to characterize developmental, functional and familial profiles of children with different levels of response to treatment. The Early Start Denver Model is a relationship- and play-based behavioral intervention shown to be effective in home and group settings (Dawson et al. 2010, Vivanti et al. 2014). Previous research exploring outcome predictors in children receiving the ESDM in a group setting has pinpointed chronological age, autism severity, functional use of objects, and imitation abilities as predictive variables of intervention gains.

Objectives:

To identify the profiles of high- and low-responders to treatment in a group of preschool children receiving the ESDM in community specialized-preschool settings in Israel.

Methods:

Thirty-three children (7 girls), aged 34-57 months from four ASD-preschools participated in the current intervention. The ADOS-2 was administered to validate ASD diagnosis. Children received 40 hours per-week of educational and therapeutic preschool-based intervention. The implementation of the ESDM included the use of the model's curriculum and treatment practices, and therapists' adherence to the ESDM fidelity rating system. Educational staff incorporated ESDM principles and objectives into the daily preschool routine. Additionally, parents attended weekly parent-child therapy sessions.

To evaluate intervention gains, children were assessed with the Mullen Scales of Early Learning (MSEL) and parent and teacher reports on the Vineland Adaptive Behavior Scales-II (VABS-II), collected pre- and post an 8-month intervention period. Additionally, parents filled out the Parenting Scales of Competence (PSOC) at both timepoints. Total MSEL age-equivalent score differences were compared to overall treatment-length (in months). High treatment-response was defined as a gain equal to or higher from treatment-length, while smaller gains defined a low-response.

Results:

High treatment-responders showed higher age-equivalent scores pre-intervention on the MSEL visual reception, fine-motor, and receptive and expressive language scales. Furthermore, they had higher communication and daily-skills scores pre-intervention, as reported by teachers and parents, higher parent-reported socialization skills, and higher teacher-reported motor skills. The high-responding group also showed lower levels of autism symptom severity, pre-intervention. The groups were not significantly different on age at entry to the program. While not statistically significant, all girls in the sample pertain to the high-responders group. Parents of high responders have reported higher levels of parental satisfaction pre-intervention.

Conclusions:

Higher levels of developmental and adaptive skills, together with lower ASD symptom severity are related to a more significant response to the preschool-based ESDM. Children may need to have a certain baseline of developmental and adaptive skills to benefit from this program. Children with low developmental and adaptive scores may need to receive individual, intensive treatment before they could benefit from preschool-based ESDM.

The current analysis also indicated that high parental satisfaction might be a facilitating factor in response to the ESDM. In the current program, parents participated in weekly joint ESDM-sessions with their children. High parental satisfaction might be associated with higher motivation to take part in the therapy process and to apply learnt principles in other contexts.

134 **110.134** Early Intervention Focused on Social and Communicative Abilities for Autism: A Systematic Review and Meta-Analysis

Á. Bejarano[1], *M. Magan Maganto*[2], *C. Fernandez Alvarez*[2], *S. L. Jonsdottir*[3], *E. Saemundsen*[3], *A. M. Vicente*[4], *C. Café*[5], *C. Rasga*[6], *M. Posada*[7] *and R. Canal-Bedia*[2], *(1)UNIVERSITY OF SALAMANCA, Salamanca, Spain, (2)University of Salamanca, Salamanca, Spain, (3)State Diagnostic and Counseling Center, Kopavogur, ICELAND, (4)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL, (5)Hospital Pediátrico de Coimbra, Coimbra, Portugal, (6)Instituto Nacional de Saúde Doutor Ricardo Jorge, Lisbon, Portugal, (7)Carlos III Health Institute, Madrid, Spain*

Background: Interventions based on social and communicative skills have become the core of most therapies for children with Autism Spectrum Disorder (ASD), as the demand for such interventions has increased for this population (Wang, Parrila and Cui, 2012). Social reciprocity allows children to participate in shared activities, while improving joint attention and other communicative and social behaviours with peers (Kasari, Gulsrud & Wong, 2010). A wide range of focused practice models have been developed with the aim of helping children with ASD to enhance their social and communicative skills and reduce the number of symptoms in this area. However, comparisons of these models are limited. The quality and effectiveness of these therapies should be further studied to have a better understanding on the subject and suggest best practices.

Objectives: The aim of this study is to conduct a systematic review and meta-analysis to explore the effects of early intervention focused practices in children with ASD on the following 6 abilities: imitation; eye contact; joint attention; pointing; gestures; and play. Furthermore, the analysis aims to identify the most effective interventions according to the characteristics of the participants and the programs, as well as the participation of caregivers.

Methods: Six systematic searches, one for each target ability, were conducted in Medline, PsycINFO, CINAHL and ERIC, to identify peer-reviewed publications from 2000 to April 2017 using ASD and social-communicative intervention-related terms. Inclusion criteria required that studies include participants of 0-6 years of age and described intervention programs, excluding systematic reviews and meta-analyses. A quality review was performed to screen the references, using the EBP inclusion criteria checklist. Meta-analytical methods were implemented, including quality assessment, sensitivity analysis, meta-regression and meta-analysis of studies of different metrics.

Results: 1418 non-duplicate citations were retrieved, and 54 studies were eligible for inclusion in the meta-analysis. Results suggest that socio-communicative interventions lead to positive, medium to large effects in terms of acquisition of imitation (0.48), eye contact (0.88), joint attention (0.57), gestures (0.68), pointing (0.67) and play (0.52) skills. The effects are greater in programs with naturalistic approaches based on behavioural child development, with effect sizes approaching 0.6, and also in those in which caregivers play an active role in therapy conjointly with the main therapist (0.64). Meta-regression analyses show larger effects with younger participants and higher levels of cognitive development, language and dosage intervention.

Conclusions: Naturalistic and behavioural-based development programs are the most effective to improve socio-communicative skills. In addition, if intervention begins as early as possible and caregivers actively participate in high intensity therapy, better outcomes should be expected. As cognitive and language development is a key factor for intervention outcome, further research should be conducted to identify interventions that are effective for children with severe delays. Professionals and caregivers should take into account these results, in order to provide children with ASD the most effective interventions possible. Furthermore, as caregivers' role in therapy seems to be important, this suggests that early intervention programs should be adapted to the characteristics and needs of each child with ASD.

135 **110.135** Early Intervention for Toddlers with Autism Spectrum Disorder Affects Outcome at Adolescence: A Long-Term Follow-up Study

D. A. Zachor[1] *and E. Ben-Itzchak*[2], *(1)The Autism Center/Pediatrics, Tel Aviv University / Assaf Harofeh Medical Center, Zerifin, Israel, (2)Bruckner Center for Research in Autism, Communication Disorder, Ariel University, Ariel, Israel*

Background:

Most studies in autism spectrum disorder (ASD) have examined short-term intervention outcomes after 1-4 years, and showed positive gains in cognitive and adaptive skills. Studies have suggested that individuals with 'optimal outcome' generally received earlier and more intense interventions before three years of age. The current study focused on outcome in young adolescents diagnosed with ASD at a very early age.

Objectives:

To examine long-term outcomes 8-15 years after an early childhood ASD diagnosis (<3 years). The study compared outcomes in autism severity and adaptive skills of children who were enrolled in center-based early intensive intervention programs for ASD to those who were not.

Methods:

The study included 53 participants, 49 males and 4 females, with an age range of 11:0 – 17:10 years (M=13:8, SD=1:10 years). All the participants were diagnosed with ASD (T1) in the age range of 1:3-3:1 years (M=2:2, SD=0:5 years) and were reassessed after 8:7-15:7 years (M=11:7 (SD=1:10) years (T2). The diagnosis of ASD at baseline was obtained using two standardized tests, the Autism Diagnosis Interview-Revised (ADI-R) and the Autism

Diagnosis Observation Schedule (ADOS). Outcome measures included adaptive skills using the Vineland adaptive behavior scales (VABS), and autism severity using the ADOS social affect calibrated severity scale (SA-CSS) and restrictive and repetitive behaviors severity scale (RRB-CSS) at T1 and T2.

The study population was divided into two groups based on the toddlers' educational placement after the ASD diagnosis. One group (n=29) received early intervention in an ASD-specific center-based program for six days per week (total of 40h/w) for at least one year. The second group (n=23) was enrolled in regular day care centers or stayed at home at least until the age of 36 months.

Results:

To examine the outcome at T2, two 2X2 MANOVAS (2 GroupsX2 Times) for ADOS-CSS and VABS scores and 2X2 ANOVA with repeated measures for time were performed.

Autism severity: A significant Time X Group interaction was observed [F(2,48)=4.03, p=.024, h^2 =.144]. The interaction was significant for ADOS-SA-CSS, but not for ADOS-RRB-CSS. While the group of early ASD-specific intervention showed a decrease in SA severity [T1: 7.18(2.19); T2: 6.82(2.98)] the non-ASD-specific placement group showed an increase [T1: 6.74(2.28); T2: 8.65(1.11)] in this measure.

Adaptive behaviors: The analysis showed a significant Time main effect [F(3,35)=3.39, p=.029, h^2 =.225]. A significant increase in the VABS communication scores [T1: 68.79(9.47); T2: 76.95(18.75)] and in the daily living skill scores [T1: 67.92(6.97); T2: 77.46(18.35)] was noted (p=.016, .005 respectively), but not in the socialization subdomain. No significant Time X Group interaction was found.

Conclusions:

Outcome in social communication abilities in adolescents who received ASD-specific intensive early intervention in a center-based setting is more favorable than in those who were not enrolled in these types of centers. Communication and daily living, but not socialization adaptive skills, significantly improved with time and intervention in adolescents with ASD. This study emphasizes the importance of early intensive ASD-specific intervention and indicates improved functioning over time.

136 **110.136** Early Intervention Provider Ratings of Strategies to Promote Social Communication: Differentiating “All” Children from Children with ASD

*M. Maye[1], **V. E. Sanchez**[2], A. K. Stone MacDonald[1] and A. S. Carter[1], (1)University of Massachusetts Boston, Boston, MA, (2)Division of Developmental Medicine, Boston Children's Hospital, Boston, MA*

Background: Several evidence-based naturalistic, developmental, and behavioral interventions (NBDIs) exist for toddlers with autism spectrum disorder (ASD; Schreibman et al., 2015; Wong et al., 2015). However, these types of interventions have been rarely tested within community settings (Nahmias, Kase, & Mandell, 2014; Vivanti, Zierhut, Dawson, & Rogers, 2017). Yet, toddlers with ASD receive early intervention services from Early Intervention (EI) providers who translate research findings into practice (Campbell & Halbert, 2002; Fleming, Sawyer, & Campbell, 2011). Translation will require identification of interventions’ common active ingredients as well as strategies that are more easily disseminated in community settings (Kasari 2012, Pellecchia et al., 2015). Given that EI’s are implementing these strategies in the community, their perceptions about the clinical effectiveness of evidence-based NBDI strategies are needed to inform dissemination efforts and to identify specific behavioral strategies to evaluate as potential active ingredients in future research.

Objectives: To explore early intervention providers’ perceived beliefs of the clinical effectiveness of various intervention strategies on specific behaviors in “children with an ASD” and “all children.”

Methods: Early interventionists who reported providing early intervention services for a toddler with ASD between 12-to-36 months of age within the last 12 months were recruited via email to complete an Internet based survey evaluating the perceived effectiveness of 31 strategies on specific target behaviors. Of 48 early intervention directors invited to distribute surveys to all of their EI providers, 28 responded and 22 agreed to distribute our survey. Ninety-three EI providers completed our survey. EI providers were predominantly female (n=91) and were highly educated (75 MA, 17 BA, 1 PhD). EI providers rated 31 behavioral strategies from 1-to-5 from least to most effective for each group (i.e., ASD, all children). Providers ranged in years of experience between 0 to 33 years (M= 9.25, 8.34).

Box-cox transformations were completed on 38 (of 62) variables to address non-normality. Then, paired samples t-tests were completed for 31 intervention strategies comparing EIs ratings of efficacy for each strategy across “children with an ASD” and “all children.” Effect sizes were calculated for all significant pairs.

Results: Twenty-two of the intervention strategies were rated as significantly more effective for “all children” than for children with ASD. Effect sizes were robust with 6 strategies having large effect sizes (>0.8), 10 strategies having medium effect sizes (≥0.5, and ≤0.8), and 6 strategies having small effect sizes (≥0.2, and ≤0.5). No intervention strategies were rated as being statistically more effective for children with ASD on any of the behavioral targets. EI provider ratings did not result in significant mean differences for children with ASD or “all children” for the remaining strategies.

Conclusions: EI provider ratings indicated different effectiveness expectations for intervention strategies when applied to children with autism versus all children. Strategies related to make-believe play resulted in the largest effect sizes (*d*=.99-1.05) whereas strategies related to establishing routines and some aspects of joint attention were rated comparably. These findings could be useful in developing interventions that are sensitive to community settings (i.e., inclusive versus special education).

137 **110.137** Early Robot-Based Intervention May Reduce the Degree of Gestural Delay in Children with Autism

***M. K. Y. Wong**[1], W. Y. Lam[1], C. H. E. Cheng[1], J. Yang[1], H. Ying[2], H. C. J. Man[3], A. Pang[1] and W. C. So[4], (1)The Chinese University of Hong Kong, Hong Kong, Hong Kong, (2)The Chinese University of Hong Kong, HONG KONG, China, (3)The Chinese University of Hong, Hong Kong, Hong Kong, (4)Educational Psychology, The Chinese University of Hong Kong, Hong Kong, Hong Kong*

Background: Abundant research has shown that children with autism spectrum disorders (ASD) have delayed gestural development throughout their childhood (Charman et al., 2003; Mastrogiuseppe et al., 2015; So et al., 2015b). Particularly, they have challenges in producing intransitive gestures (those include socio-communicative intent, e.g., waving hand for bye-bye, arms opening wide for welcoming others). However, there is a lack of effective intervention techniques designed to teach ASD children intransitive gestures. Recently, So and her team pioneered the use of

social robots in teaching school-aged children with ASD gestural communication skills. Robots are operated on predictable and lawful systems, thereby favoring children with ASD (empathizing-systemizing theory;Baron-Cohen, 2009). Their results reported robot-based intervention yielded significant differences between pretests and posttests in gestural production (So et al., 2016b; 2017). Yet, it is not known about whether ASD children still have delayed gestural production, in comparison to their age-matched typically-developing(TD) peers, after completion of training.
Objectives: The present study investigated whether ASD children could catch up to the level of gestural production in age-matched typically-developing (TD) peers in both trained and novel situations. If so, their accuracy in producing intransitive gestures would be on par with that of age-matched TD peers. Otherwise, children with ASD would still performed poorer than their TD peers.

Methods: ASD children(N=30;4;2-6;11;SD=.62) were randomly assigned to two conditions: intervention and wait-list control. ASD children in the intervention condition(N=15) were taught 14 intransitive gestures (e.g., welcome, awesome) demonstrated by a social robot, NAO, who was narrating different stories. There were four training sessions, twice per week. ASD children in the wait-list control condition(N=15) and all TD children(N=15;4;3-6;3;SD=.65) could opt for training after completion of research. At the beginning of the experiment, all children had their motor skills, attention, language and communication ability, and gestural recognition assessed. They also took the pre-tests before training in the intervention condition began. In the pretests, an experimenter asked the child, "Show me an action for welcome?", when narrating stories and gave him/her 10s to demonstrate the gesture. The pre-tests were completed after 14 gestures were tested. Immediate and delayed posttests, which were identical to the pretest, were administered right after and two weeks after training respectively. Generalization pretests and posttests were also administered for novel stories not presented during training. A gesture was considered accurately produced when all four parameters (use of hands, handshapes, movements and directionalities) were correct.

Results: Table 1 shows the task performance for three groups of children. After controlling for the language, cognitive, and motor skills, there was significant time(pretests,posttests)xgroup(ASD,TD)xstory(trained,novel) interaction, F(4,82)=10.91,p<.001,η^2=.34. Specifically, for trained stories, ASD children generally performed poorer than TD in the pretests, ps<.04, but ASD children in the intervention condition outperformed TD in the immediate and delayed posttests,ps<.04. However, for novel stories, ASD children performed poorer than TD in the delayed posttest,p<.03.

Conclusions: Early robot-based intervention may reduce the degree of gestural delay in children with autism but its effectiveness is only salient in the trained stimuli. Further study should improve the power of generalizations.

138 **110.138** Educating Parents of Children with Autism Spectrum Disorder on Direct and Interactive Teaching Techniques – Editt Program

*K. Rajaraman[1], **A. Jayaraman**[2] and N. Mundkur[1], (1)Centre for Child Development and Disabilities, Bangalore, India, (2)Center for Child Development and Disabilities, Bengaluru, Karnataka, India*

Background: In India, >10 million children are affected by autism spectrum disorder (ASD). With improvements in diagnosis, the number of cases is expected to greatly increase; however, there continues to be a deficit of professionals in the field of autism intervention. Parent-implemented intervention has shown better outcomes for both children and parents compared to other forms of intervention for ASD, and has extended the benefits of intervention to the home environment. We have designed and implemented two programs that empower parents as interventionists as well as provide development appropriate activities in the four developmental domains – Socio- emotional, Receptive communication, Expressive communication, and Play.
Objectives: To develop programs to involve and support parents in the developmental intervention of children with ASD.

Methods: We have developed an online parent-based program called SCoPE (**S**ocial **Co**mmunication **P**lay and **E**motional) that provides development appropriate activities for children with developmental delays including ASD. In addition, we have developed EDITT (**E**ducating parents on **D**irect and **I**nteractive **T**eaching **T**echniques), a novel hands-on training program to empower parents with home-based parent-delivered developmental intervention using SCoPE. In the EDITT program, parents (n = 30) received 4 group-training sessions with their child and 4 individual sessions in the first month. They were assessed by the trainer for knowledge acquisition and practical application on a weekly basis. After the first month, parents have the option of enrolling for monthly maintenance sessions of 1 h for 6 months. At the end of 6 months, parents will be assessed for retention of knowledge and practical application. In addition, we also assessed the mental status of parents using modified Beck's Depression Inventory (BDI) and SF-36 forms before and after the training sessions. Data were analyzed using paired t-test with a significance level of 0.05.

Results: The mental status of parents in the EDITT program showed significant improvement between pre-training and post-training (p = 0.0018). Although there was no significant difference in the knowledge acquisition level between weeks 1 through 4, the parents showed significant improvements in the practical application between weeks 1 and 2 (p = 0.0001) and between week 2 and weeks 3-4 (p = 0.0008). The 6 month-data will be available for analyses in the coming months.

Conclusions: Based on our pilot data, we can conclude that the EDITT program is helping parents to be more sensitive and responsive to their children with ASD as well as training them to facilitate socio-emotional, functional communicative and play development through theoretical and practical knowledge. We have already seen significant improvements in parents as interventionists who extend their training to their home environment and everyday activities of their children. We also observed a significant improvement in their depression status and quality of life after the training and a sense of empowerment.

139 **110.139** Effect of Parent and Teacher Training with Project Impact on the Social Communication of Children with Autism Spectrum Disorder during Play

***S. Van der Paelt**, H. Roeyers and P. Warreyn, Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background: There is growing consensus that intervention for children with autism spectrum disorder (ASD) should include their natural interaction partners to make the intervention cost-effective and to help children generalize skills to a range of situations. Project ImPACT (Ingersoll & Dvortcsak, 2010) is a social communication intervention originally developed to train parents, which makes use of interactive and more direct behavioural techniques. Since children with ASD spend a large part of their day at school, there could be an additional benefit of training not only parents, but also teachers to stimulate the social-communicative skills of children with ASD during the school day.
Objectives:

1. To study the effect of Project ImPACT on social-communicative skills of children with ASD at home and at school.
2. To assess whether progress in these skills starts already after the introduction of interactive techniques or only after the introduction of behavioral techniques.

Methods: We used a multiple baseline design with four children with ASD between 2.5 and 6 years old. Parents and teachers each received 24 semi-weekly sessions at home and in the school respectively. Teacher training started 5-7 weeks after the start of the parent training. Children were followed-up until 4-6 months after completion of the intervention. Treatment effect was assessed by weekly video-observations of parent-child and teacher-child interaction, in which social engagement, requesting and imitation were coded. The data were analyzed visually and by calculating an effect size *d1*.

Results: A clear effect was found of the parent training on the duration of *social engagement*. For two children this effect was clear during the phase where only interactive techniques were used (*d1* = 1.6-7.2). For the other two the effect only became clear in the phase where behavioral techniques were introduced (*d1* = 1.1-1.7). There was no added effect of the teacher training on social engagement. Three out of four children showed an increase in the number of *requests* to their parents after the introduction of interactive techniques (*d1* = 1.5-2.0). All children showed an increase in the number of requests after the start of the teacher training. For three of them this effect was visible from the beginning of the intervention (*d1* = 1.7-4.2). Only one child started to *imitate* more during parent-child-interaction after the start of the parent training. All children imitated their teachers more after the start of the teacher training. Two children already did this during the interactive teaching phase (*d1* = 0.5-0.6), while the other two needed more direct instruction (*d1* = 0.5-1.5). Most of these effects were maintained until follow-up.

Conclusions: Project ImPACT had the clearest effect on the requesting skills of the children, since these skills improved with both parents and teachers, soon after the introduction of the intervention in the respective contexts. Social engagement only improved during parent-child interaction, while imitation skills only improved during the teacher-child interaction. For some children these effects were only visible after the introduction of behavioral techniques, providing support for the effect of both types of techniques.

140 **110.140** Effectiveness of Community-Based Early Intervention for Children with Autism Spectrum Disorder- a Meta-Analysis

A. S. Nahmias[1], *M. Pellecchia*[2] *and D. S. Mandell*[3], *(1)MIND Institute, UC Davis Medical Center, Sacramento, CA, (2)University of Pennsylvania, Philadelphia, PA, (3)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Research trials of early intervention programs for children with ASD generally produce medium-to-large gains, on average, compared to "treatment as usual," in cognition, communication, social ability, and adaptive behavior (Hedges's *g* 0.4 – 1.2). Almost all children with ASD receive their treatment through community-based services, however, and previous research has suggested that evidence-based interventions rarely make their way into community practice. Understanding the effects of community-based early intervention is the first step in developing strategies to improve wide-scale implementation of effective early intervention.

Objectives: To estimate the average effects and predictors of cognitive, social, communication, and adaptive behavior outcomes among children receiving community-based early intervention.

Methods: Studies of community-based early intervention for children with autism were identified through a systematic search of online databases, hand-searching relevant journals, and reviewing references. Community-based early intervention was defined either as "treatment as usual" control groups in randomized or quasi-experimental trials or in studies that explicitly examined treatment outcome in community settings. Changes in cognitive, communication, social, and adaptive behavior functioning from pre-treatment to post-treatment were assessed using standardized mean gain scores. Uncontrolled effect sizes (Hedges's g) were calculated by dividing the mean change from pre-to post-treatment by the pooled standard deviation of the difference score. Overall effect sizes were estimated using random effects models. The Q-statistic and the I^2 index were used to examine heterogeneity of effect sizes. Moderators of interest included type of community EI program, year of publication, intervention duration, and total intervention hours, sample selection methods, age at intake, their effects were assessed using analysis of variance of mixed-effects models and meta-regression analyses.

Results: Forty groups from 29 studies met inclusion criteria (1496 participants, mean age 37.4 months, 84.9% male). There was significant improvement in each of the four domains; however, the gains were small. Hedges's *g* ranged from 0.21 for adaptive behavior to 0.31 for communication outcomes, after removing outliers and correcting for publication bias. "Model" early intervention programs (e.g., those associated with universities and hospitals) were generally superior to other community early intervention program types across all four outcomes (Hedges's *g* ranged from 0.4 - 0.5 for "Model" programs and from 0.01 – 0.3 for other community programs). Only communication outcomes demonstrated increasingly larger effect sizes in more recent years. Intervention duration and total intervention hours were negatively associated with effect sizes for communication and adaptive behavior outcomes. Studies in which participants were randomly assigned to receive community treatment had smaller effect sizes for social outcomes than studies utilizing other treatment group allocation strategies. Age at intake did not significantly moderate outcomes in any of the four domains.

Conclusions: These results indicate that there remains a large gap between research and community practice, and that for most outcomes community-based early intervention has not improved over time. Further research is needed to close the gap in outcomes observed in children receiving treatment in randomized trials and those observed in children receiving treatment in community settings.

141 **110.141** Effects of School-Based Literacy Interventions for Preschoolers with ASD: 1 Year Follow up

R. F. Hudson, *E. Sanders and C. Gasamis, University of Washington, Seattle, WA*

Background: It is well established that readers need to develop proficiency in word reading and general language comprehension to read with comprehension (Oakhill, Cain, & Bryant, 2003). This study compares two school-based interventions that target one side of the simple view of reading. Both interventions were 1:1, 4 days a week for 20 weeks. One intervention was Interactive Book Reading (IBR), which was found to increase expressive vocabulary (*d = .29)* and listening comprehension (d = .30) in comparison to a BAU control group immediately after intervention. The other intervention was phonological awareness (PA), which increased phonological awareness (*d* = .39) immediately after intervention. A remaining question is whether these gains have maintained 1 year later.

Objectives: Determine the longer term effects of treatments for preschool children with ASD

Methods: This study followed a sequential cohort design. Across the three years, children with ASD were randomly assigned to IBR (n = 48), PA (n= 43) or BAU control (n = 44) group. The inclusion criteria were (a) a medical diagnosis of ASD or an educational identification, (b) an active IEP and receive services for ASD, (c) enrolled in their last year of preschool, (d) no known co-occurring neurological or genetic disorders, and (e) a minimum standard score of 55 on the OWEPVT. Children were given the following measures pre- and post-intervention and one year later: Peabody Picture Vocabulary Test–IV, Expressive One-Word Picture Vocabulary Test–IV, Oral Communication, Letter-Word Identification, and Following Directions subtests of the Woodcock-Johnson III Tests of Achievement, the Phonological Awareness and Concepts About Print subtests of the Test of Preschool Early Literacy. In the spring of Kindergarten, children were also administered the Passage Comprehension subtest of the WJ-III and Oral Reading Fluency on two first grade passages.

Results: A multilevel modeling approach for testing differences among three conditions, while adjusting for pretest, was employed to account for dependencies in the data due to classroom and site. Initial results indicate that children in the IBR condition had generally better outcomes one year later despite the initial results favoring IBR on language variables. Specifically when looking at Standard Scores, the PA group was significantly higher than the IBR group on the following variables: receptive vocabulary, listening comprehension, passage comprehension, and oral reading fluency. In addition, the PA group was significantly higher than the BAU group on letter-word ID. No differences between BAU and IBR were found.

Conclusions: These results are somewhat surprising given that the PA intervention focused on developing phonological awareness and not oral language and these effects were not found immediately after intervention. However, it is in line with the findings of Dynia et al. (2017) that found PA to be an important emergent literacy predictor for kindergarten decoding among children with ASD. They are also somewhat surprising given that children with ASD tend to have difficulties in listening and reading comprehension, which one might expect to find improved after an intervention that demonstrated a large gain in vocabulary and listening comprehension immediately after intervention.

142 **110.142** Engaging Peers in Play: Community Partnered Adaptation of a Social Communication Intervention to Support Pairs of Toddlers with Autism

S. Y. Shire[1], *W. I. Shih*[2], *C. McCracken*[3], *S. Bracaglia*[4], *M. Kodjoe*[4] *and C. Kasari*[2], *(1)University of Oregon, Eugene, OR, (2)University of California, Los Angeles, Los Angeles, CA, (3)Loyola Marymount University, Los Angeles, CA, (4)New York Center for Child Development, New York, NY*

Background: Community Partnered Participatory Research can support the adoption of research-based practices in real world settings. To match the needs and context of a community center-based toddler program, the current project focused on adapting a one-to-one social communication intervention for children with autism, to include a peer in play based interactions. A randomized controlled trial was conducted where paraprofessionals in half the classrooms were taught to deliver the adapted peer intervention while half continued to deliver the original one-to-one model, both designed to target children's social communication and play skills.

Objectives: First, to explore paraprofessional teaching assistants' (TAs) implementation of a naturalistic developmental behavioral intervention-Joint Attention, Symbolic Play, Engagement, and Regulation (JASPER: Kasari et al., 2008; 2014) adapted to include a peer (referred to as jasPEER). Second, to examine children's social communication and play skills for those randomized to the novel jasPEER sessions (including a TA and two children) versus one-to-one TA-child JASPER sessions.

Methods:

Forty-eight TAs, and 113 toddlers (mean age=32.28 months) across 4 classrooms were randomized to JASPER with a peer present (jasPEER) or one-to-one JASPER waitlist control. Children had received an autism spectrum disorder (ASD) diagnosis (n=1 with Down Syndrome). All but two TAs, and two children were members of an ethnic minority group.

Intervention. Significant effects of JASPER over treatment as usual on joint engagement, joint attention gestures, play skills, and language were demonstrated with this center in a prior trial (Shire et al., 2017). Building upon TAs' knowledge of one-to-one JASPER, they were provided with two weeks of in-vivo training and ongoing video feedback from the research team to learn the jasPEER adaptation. Children in waitlist classrooms received JASPER for 30 minutes a day for 11 weeks, while children in immediate jasPEER received the adapted peer version during this time.

Measures. Ten-minute video recorded TA-child interactions at entry, midpoint, and exit were coded for children's joint engagement (JE), and TAs' implementation. Independent assessors also administered the Short Play and Communication Evaluation, a brief semi-structured measure of play, and joint attention.

Results: TAs in jasPEER demonstrated significant gains in implementation scores from entry to exit ($f(1,74)=10.23$, $p=0.002$), with average exit scores of 72%. Children in jasPEER started with significantly lower JE in session with TA and peer ($f(1,246)=2.95$, $p<.01$). However, the children made significant gains in JE to exit ($f(1,246)= 5.14$, $p<.01$), such that the groups were not significantly different in JE by exit ($p=.64$). Overall, children in both groups demonstrated significant gains in initiations of joint attention ($f(1,162)=52.71$, $p<0.001$) and play diversity across levels (simple: $f(1,162)=5.56$, $p=0.019$; combination: $f(1,162)=7.68$, $p=0.006$; pre-symbolic: $f(1,162)=24.42$, $p<0.001$; symbolic: $f(1,162)=29.24$, $p<0.001$). No significant between group differences were found.

Conclusions: TAs learned to implement a peer adaptation of JASPER well by exit. Limited child JE at entry in jasPEER may be influenced by the learning curve required of TAs for the adaptation while JASPER TAs could continue with existing skills and strategies. Overall, children in both groups made significant gains in core skill domains including social communication and play.

143 **110.143** Examining Mediators of an Adaptive Communication Intervention for Young Children with Autism Spectrum Disorders

E. Fuller[1], *L. H. Hampton*[2] *and A. P. Kaiser*[1], *(1)Special Education, Vanderbilt University, Nashville, TN, (2)Northwestern University, Evanston, IL*

Background: As many as 30% of children diagnosed with ASD are classified as nonverbal or minimally verbal at age 5 despite access to early intervention (Tager-Fluberg & Kasari, 2013). Persistent minimal verbal status is associated with poor long-term prognoses for social and adaptive functioning (DeMyer et al., 1973; Liss et al., 2001). In order to better address the skill deficits of young, preverbal preschoolers who are at risk for becoming minimally verbal children, an intervention combining two evidence-based treatments, J-EMT (Kasari et al., 2014) and DTT (Smith, 2001) was developed and manualized for implementation in a RCT. The intervention was designed to specifically target foundational skills for communication that individual children did not display and to modify instruction based on their progress during intervention. These foundational skills included: joint attention, receptive language, imitation, and proficiency in using a speech-generating device (SGD). These skills have shown to be predictive of long-term outcomes in language and communication (e.g. Charman, 2003; Luyster, et al., 2007; Gernsbacher, 2008; Kasari, et al., 2014).

Objectives: The objective of the current study is to examine how changes in foundational communication skills mediated the outcomes of an adaptive communication intervention by asking the following question: Do joint attention initiations, receptive language ability, imitation skill, and SGD proficiency mediate the effect of group assignment on social communication outcomes?

Methods: Data for this analysis are from a RCT (R40MC27707). Seventy-three children with ASD were randomly assigned to either a 36-session intervention combining DTT and J-EMT including an SGD or a business as usual control group. The dependent variable, defined as the total number of social communicative utterances, was measured in a 20-min language sample with an unfamiliar assessor. The putative mediators were measured as follows: initiating joint attention (IJA) was measured from the Early Social Communication Scales (ESCS; Mundy et al., 2003); receptive language was measured from the auditory comprehension subscale of PLS-5 (Zimmerman, et al., 2011); verbal imitation was measured as the number of attempted consonants during the Profiles of Early Expressive Phonology (PEEPS; Williams & Stoel-Gammon, 2014); SGD proficiency was measured as the size of visual field from which the child is able to identify an object on the SGD. Mediators were measured at posttest; the dependent variable was measured 2-months following posttest.

Results: Baseline characteristics are presented in Table 1. There were no significant between-group differences on relevant variables at pretest. Coding and analysis for all time-points are currently 80% complete. Mediation analyses will be used to examine the underlying mechanism driving the relationship between the independent variable (group assignment) and dependent variable (social communicative utterances; Hayes, 2009).

Conclusions: Findings of this study will identify foundational skills that mediate language and communication outcomes for preschooler-aged children with ASD who are at risk for becoming minimally verbal. These findings may lay the foundation for developing and testing a decision-making framework for early intervention targets, including establishing criterion levels of behavior change on specific malleable factors required to benefit from interventions based in naturalistic principles.

144 **110.144** Examining the Stability of Social Communication Measures for Young Children with Autism Spectrum Disorders

J. K. Heidlage[1]*, L. H. Hampton*[2]*, E. Fuller*[3] *and A. P. Kaiser*[3]*, (1)Vanderbilt, Nashville, TN, (2)Northwestern University, Evanston, IL, (3)Special Education, Vanderbilt University, Nashville, TN*

Background:

Identifying stable measures of social communication has important implications for evaluating the impact of early intervention. This may be especially important for the estimated 30% of children with ASD who are preverbal or minimally verbal because these children often show floor effects on standardized assessments of language (Anderson, et al., 2007; Kasari et al., 2013). Initiating joint attention (IJA) gestures are predictive of later language use (Charman 2003; Kasari et al., 2012) and frequently used to characterize emerging communication skills. Evaluating changes in these gestures, as well as language is used to indicate the effectiveness of interventions as well as to evaluate child progress.

Objectives:

The objective of this analysis was to (1a) use a generalizability study (G-study) to evaluate the stability of early measures of IJA and language across two different observational measurement contexts and (1b) use a decision study (D-study) to estimate the number of additional observations required to provide optimal estimates of IJA and language in preverbal children with ASD.

Methods:

Data were analyzed from pre-intervention assessments of 73 participants enrolled in a recently completed RCT (HRSA #R40MC27707) examining outcomes for young, preverbal children with ASD between the ages of 36 and 54 months (mean age=42.88 months) who were at risk for remaining minimally verbal. Occurrences of IJA were coded from two different observational measurement contexts: a standardized language sample (LS) and the Early Social Communication Scales (ESCS; Mundy et al., 2003). A G-study was conducted to assess the stability of IJA by evaluating the *g* coefficient, which provides an index of the amount of variance that is attributable to true variance in measurement rather than to sources of measurement error. A higher *g* co-efficient indicates less measurement error; a *g* co-efficient that ranges from 0.6 to 0.8 is considered to produce a stable estimate (Bakeman et al., 1997). After conducting the G-study, a D-study was conducted to estimate the number of different measurement contexts needed to achieve a stable estimate of IJA. An additional G-study is currently being conducted to evaluate the stability of a measure of language (number of different words produced) across two observational measurement contexts (LS and parent-child interaction). A D-study will be conducted to estimate the number of additional observations needed to achieve a stable estimate.

Results:

Results from the G-study indicated that two measures of IJA were not sufficient for achieving a stable estimate (*g*=0.43). Results from the D-study indicated that up to four observations of IJA may be required to achieve a stable estimate in preverbal children with ASD (*g*=0.60), and that up to 10 observations may be required to achieve an optimal stability estimate (*g*=0.80).

Conclusions:

The low value of the *g* coefficient across the two measures indicates a need for additional measures of IJA to increase the stability of existing measures. An aggregated measure of IJA may provide a better measure of the predictive value of these skills on spoken language. These results are important given use of gestures is often evaluated by a single measure.

145 **110.145** Feasibility, Acceptability and Effect on Classroom Teaching of Delivering Early Intervention in an Inclusive Setting

K. Capes[1]*, K. Hudry*[2,3]*, S. Upson*[1]*, J. Feary*[1]*, E. Duncan*[1]*, C. A. Bent*[4,5]*, R. Rankin*[1,5]*, C. Dissanayake*[3]*, K. Pye*[1] *and G. Vivanti*[6,7]*, (1)Victorian Autism Specific Early Learning and Care Center, La Trobe University, Melbourne, Australia, (2)Victorian Autism Specific Early Learning and Care Center, Olga Tennison Autism Research Centre, Melbourne, Australia, (3)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (4)Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, Australia, (5)Olga Tennison Autism Research Center, La Trobe University, Melbourne, Australia, (6)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (7)AJ Drexel Autism Institute, Philadelphia,*

PA

Background: A small body of empirical research has focused on the outcomes achieved by young children with ASD in inclusive and specialized settings, providing mixed results. Little experimental research addresses whether early intervention for pre-schoolers with ASD is feasibly delivered in inclusive settings (vs. established autism-specific settings) and whether such delivery would be acceptable to families and staff and not detrimental to the quality of classroom teaching for all children.
Objectives: In the context of a pilot randomised controlled trial, whereby we assigned pre-schoolers with ASD to receive the Group-Early Start Denver Model (G-ESDM; Vivanti et al., 2017) within either mainstream inclusive classrooms or specialised autism-specific classrooms, we took a number of measures to evaluate classroom- and teacher-level outcomes. These served to inform the feasibility and acceptability of delivering G-ESDM in inclusive setting.

Methods: Twenty-nine pre-schoolers with ASD (aged 18-36 months) were randomly assigned to receive G-ESDM intervention across the 2015 and 2016 school calendar years in an Autism-Specific classroom or an inclusive classroom with mostly typically-developing children. Educators in both settings were supported to implement the G-ESDM through participation in a three day ESDM skills training workshop and ongoing coaching delivered in the classrooms by Senior ESDM therapists (certified for more than 5 years) and ESDM Trainers. Feasibility, acceptability and effect on classroom teaching quality was measured by examining the degree of fidelity to the ESDM achieved by key staff implementing the intervention within each setting, and by comparing blind-rated Sustained Shared Thinking and Emotional Well-Being (SSTEW; Siraj, Kingston, & Melhuish, 2015) scores across each setting, and against the current local benchmark within Australia.

Results: Average ratings for ESDM fidelity in the Specialized Setting exceeded 80% in both calendar years and, in the Inclusive setting, exceeded 72% in 2015 and 76% in 2016. Results from the SSTEW indicated that teaching quality in the classrooms was classified as ‘good’ overall, across both the Inclusive and Specialized settings. Subscales scores varied from ‘adequate’ to ‘excellent’ with no substantive differences between Settings on any indicator. The overall ratings were well above the benchmark reported across 54 local Australian early childcare centres.

Conclusions: Data from this pilot RCT highlighted that delivery of G-ESDM to children with ASD within inclusive early childhood education settings is, 1) feasible, acceptable and not detrimental to the quality of the general classroom teaching and learning environment, and 2) able to be successfully adopted by inclusive early childhood educators with ongoing support from Senior Certified therapists and ESDM trainers. Further research on this topic should include measures of 1) staff and management attitudes to inclusive education and to working with children with ASD, 2) staff buy-in to the particular model of early intervention adopted and to the training program provided, , and 3) staff well-being in the work place. These would advance knowledge on the feasibility and considerations for the effective implementation of early intervention training for staff working with children with autism in inclusive settings.

146 **110.146** From Emotion Production to Emotion Comprehension: An Emotional Training Proposal for Children with ASD

N. Mazzoni[1]*, J. Rizzotto*[1]*, E. Tonelli*[1]*, A. Bentenuto*[1]*, T. Del Bianco*[1]*, I. Basadonne*[1]*, I. Landi*[2] *and P. Venuti*[1]*, (1)Psychology and Cognitive Science, University of Trento, Rovereto, Italy, (2)Bruno Kessler Foundation, Trento, Italy*

Background: According to the “direct-matching” hypothesis (Rizzolatti et al., 2001), there is a link between motion perception and execution and the comprehension of an observed action is underlay by the activation of the internal representation of the same action in the observer’s brain. Toddlers with ASD show signs of motor impairment - emotional expressions included - that often persists in adulthood. This atypical kinematic might lead to an abnormal perception of others’ actions. For instance, the motoric schema for expressing emotions in people with ASD could be different from the emotional expressions observed in other people and this mismatch could explaind the difficulties in comprehending other people's emotions.
Objectives: The aim of the present study was to investigate the link between motion perception and execution in ASD, by testing the effects of training the production of emotional expressions - both facial and bodily - on emotion comprehension. We hypothesized that training the emotion production would have favoured a reorganization of motoric schema for emotion expression and in turn improved the emotion recognition.

Methods: 17 children with ASD (age (M=5.38, SD=1.92); IQ (M=74.85, SD=18.9); ADOS (M=6.8, SD=2.18)) participated to one week of training. The daily sessions focused on joy and anger separately on alternate days. Children initially watched a cartoon clips with characters experiencing anger/joy; then they listened nursery rhymes about emotions and produced the corresponding expressions; finally, children imitated emotional expressions with the help of pictures.To assess the children’s comprehension of emotions, they underwent naming, comprehension, and match-to-sample tasks before and after the training, using pictures of facial and bodily expressions.

Results: Separated repeated measures ANOVAs were performed in each behavioural task. Results showed that the *naming* accuracy generally increased over time (F= 8.88; p=0.015; ges=0.079), and was greater for faces than for bodies (F=14.42; p=0.004; ges=0.278). Interestingly, only the naming accuracy for bodily expressions increased significantly (t=-2.447, p=0.037). *Comprehension* was higher for facial than bodily expressions (F=5.989; p=0.044; ges=0.022). The effect of Time on comprehension was marginally significant (F=3.595; p=0.1; ges=0.036), and the interaction between Time and emotion approached significance (F=4.395; p=0.074; ges=0.005), with increased accuracy for happiness over time. In the *match-to-sample* task, accuracy was higher for faces than for bodies (F=17.364; p=0.004; ges=0.199) and the effect of Time approached significance (F=4.276; p=0.077; ges=0.076).

Conclusions: The results show a tendency towards improvement in all the behavioural tasks after the training, suggesting that training the production of emotional expressions can foster the emotion comprehension. In general, emotion recognition resulted more accurate with facial than bodily expressions, suggesting that recognition of bodily expression is still developping in preschooler with ASD. In line with that, our results suggest a major effect of the proposed training on the recognition of bodily expressions. These finsings highlights the importance of including the body language in the emotional trainings for children with ASD.

147 **110.147** Integrated Naturalistic Developmental Behavioral Interventions for Toddlers with ASD: A Preliminary Analysis of Treatment Effectiveness within a Community Setting

B. Vibert[1]*, J. Winter*[2]*, C. Martin*[3]*, Y. B. Choi*[4]*, N. Benrey*[5]*, C. Lord*[6] *and* ***S. H. Kim***[7]*, (1)Psychiatry, Center for Autism and the Developing Brain, Weill Cornell Medical College, White Plains, NY, (2)Center for Autism & the Developing Brain, NYP, White Plains, NY, (3)Weill Cornell Medicine, White Plains, NY, (4)Psychiatry, Weill Cornell Medical College, White Plains, NY, (5)Weill Cornell Med School, New york, NY, (6)University of California Los Angeles,* *Los Angeles, CA, (7)Psychiatry, Center for Autism and the Developing Brain, White Plains, NY*

Background: Randomized Controlled Trials (RCTs) of Naturalistic Developmental Behavioral Intervention (NDBI) programs have demonstrated improved symptoms and functioning in toddlers with autism spectrum disorder (ASD). Yet, treatment effectiveness of these RCTs have mainly been demonstrated within university-based research contexts. Thus, examination of treatment efficacy of integrated NDBI implemented in community-based clinics is necessary to evaluate intervention feasibility.
Objectives: We aim to evaluate preliminary effectiveness of a short-term (6 month) NBDI program implemented in a community-based clinic for toddlers with ASD.

Methods: A total of 14 toddlers underwent a 6-month NDBI program that integrates multiple intervention modalities (see Table 1 for the details of the program). Child assessments and parent interviews were conducted at treatment entry (Time 1; mean age= 24.1 months, SD= 4.6) and treatment exit (Time 2; mean age= 32 months, SD=5.98) based on Autism Diagnostic Observation Schedule (ADOS), Mullen Scales of Early Learning-Second Edition (MSEL), Vineland Adaptive Behavior Scales-Second Edition (Vineland-II), and the Early Start Denver Model-Curriculum Checklist (ESDM-CC). Generalized Linear Mixed Models (GLMM) were used to examine the changes in autism symptom severity (ADOS), developmental skills (Mullen, ESDM-CC), adaptive functioning (Vineland) while controlling for baseline cognitive levels, symptom severity, language level, and age, and other demographic factors (i.e., race, gender, and maternal education).

Results: Despite the small sample size, significant improvements were found in these areas ($p<0.05$; see Table 2); 1) nonverbal and verbal domains measured by the MSEL, including visual reception, fine motor, receptive and expressive language as well as several areas of development measured by the ESDM-CC, including Expressive Communication, Social Skills, Imitation, Cognitive, Fine Motor, Joint Attention and Personal Independence; 2) autism symptom severity measured by the ADOS algorithm total scores; 3) adaptive expressive language and personal daily living skills measured by the Vineland-II. Effect sizes (Cohen's D ranged from .3-1.5). In addition, baseline symptom severity and language levels consistently predicted improvements across these domains.

Conclusions: Based on 14 toddlers who received a short-term NDBI program implemented in a state-funded, community-based setting, significant improvements across various developmental nonverbal and verbal domains, ASD symptom severity, and adaptive functioning were found using (non-treating) clinician ratings, parent report, and therapist ratings. Results indicate that baseline clinical features such as language and symptom severity may mediate the improvements in these skills over the course of treatment. Our research did not include a control group for treatment; therefore, based on these promising results for the potential feasibility of the community-implemented NDBI program, a randomized control trial is underway to examine the treatment efficacy and the mechanisms of treatment effects in toddlers with ASD.

148 **110.148** Mediation of Treatment Effect in Teacher-Implemented Social Communication Intervention for Young Children with Autism

Y. C. Chang[1], *S. Y. Shire*[2], *W. I. Shih*[3] *and C. Kasari*[3], *(1)Special Education and Counseling, California State University, Los Angeles, Los Angeles, CA, (2)University of Oregon, Eugene, OR, (3)University of California, Los Angeles, Los Angeles, CA*

Background:
Few studies have examined mediators of treatment outcomes for young children with autism (e.g., Gulsrud et al., 2015; Pickles et al., 2014), and none for teacher-implemented interventions. Previous studies have examined specific strategies, or active ingredients, within interventions; however, it is important to consider that interventions are often packaged for optimal effect. Thus, we have identified and grouped strategies within the intervention into three tiers of support (Basic, Foundational, and Advanced) to examine how these different sets of strategies mediate the outcome measure of joint engagement.

Objectives:

The current study is a secondary data analysis from two previously published teacher implemented intervention studies (Chang et al., 2016; Shire et al., 2016). The aim of this study is to examine whether sets of strategies mediate joint engagement.

Methods:

Participants. 179 children age 2-5 years (mean age=38 months; SD = 9.35) from two independent community intervention deployment studies (Chang et al., 2016 and Shire et al., 2016) were included in the study. Children in both studies were randomized to immediate JASPER (Joint Attention, Symbolic Play, Engagement, and Regulation) treatment (IT) or school as usual control (WL) for 3 months.

Intervention. Teachers and paraprofessionals received training and in-vivo coaching with the research team to learn the JASPER intervention. In the IT group, teachers implemented JASPER 30 minutes a day with their students for 3 months, while WL teachers continued with standard school curriculum.

Ten-minute Teacher-child play interactions (TCX). Teachers' accurate implementation of JASPER was coded at entry and exit. Seven main strategy subscales were coded. Each subscale was summarized in a percentage score where higher score indicates greater implementation accuracy. Three tiers of strategies were created: Tier 1 (Basic) included supporting regulation/engagement, environmental arrangement, and imitation/modeling. Tier 2 (Foundational) included play routines and language strategies. Tier 3 (Advanced) included play expansion and programing for social communication gestures. Children's time jointly engaged was coded as proportion of the play interaction that children were jointly engaged with their teachers (1 minute intervals).

Results:

Basic and Advanced strategies partially mediated the effect of treatment (% mediated: 36% and 28% respectively; p-values<0.01) while *Foundational* strategies had close to full mediation (50% mediation; $p<0.01$).

Conclusions:

All three sets of strategies mediated the effect of treatment on joint engagement. Joint engagement was most influenced by *Foundational* strategies. These results highlight the importance of *Foundational* strategies, which include establishing developmentally appropriate play routines and responding to and expanding children's communication. It may be that *Basic* strategies, such as setting up the environment, may not be enough support to engage children with autism, and *Advanced* strategies, such as expanding routines, may be more effective after *Foundational* strategies, such as having a solid play routine, are established to create a context for social communication.

149 **110.149** Overcoming Barriers to Mass Dissemination: A Pilot Online Pivotal Response Treatment Training Program for Parents of

Toddlers with Autism Spectrum Disorder

E. McGarry, *A. Baktha, A. Tharakan and T. W. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Despite advances in evidence-based treatment for autism spectrum disorders (ASD), disparities in service access remain a serious concern. The current delivery format of many interventions represents a critical roadblock to treatment access. Most models require parents to commute to a clinic or have a clinician visit their home many hours per week. This format may not be feasible for families who live in remote geographical regions, do not have the resources to travel or pay for weekly therapy services, and/or are headed by single parents with competing work obligations. To address this, recent studies have begun to explore parent-implemented interventions via an online or telehealth format (Nefdt et al., 2009; Vismara et al., 2012; Wainer & Ingersoll, 2013). These approaches are particularly beneficial as they improve access to training for families, can fit into busy family schedules, and lower the cost of expensive treatments (Nelson, Bui & Velasquez, 2011). The current pilot study examined a newly developed 5-week online course designed to help parents implement an evidence-based intervention, Pivotal Response Treatment (PRT), for their child with ASD.

Objectives: This study's objective was to investigate the impact of an online course to disseminate PRT strategies for parents of young children with ASD.

Methods: Participants were 20 families of toddlers with ASD, ages 24-48 months. PRT presentations consisting of informational slides, video examples, and brief quizzes were delivered through Qualtrics each week. Topics focused on core intervention strategies to elicit communication and social engagement through playful interactions, child-selected materials, and positive behavior principles. Parents submitted weekly videos capturing their use of these treatment strategies, which were coded for PRT fidelity of implementation (FOI). FOI was defined as the parent properly demonstrating all PRT components with competency at least 80% of the time. Fidelity summary scores were obtained at multiple time points (pre-intervention and once per weekly session). Social validity measures were also obtained.

Results: Data from families who have completed the course were analyzed. A paired samples t-test was conducted to compare parent treatment fidelity pre- and post-intervention. Analysis revealed that parent's treatment fidelity improved significantly from baseline (M= 2.5, SD= 1) to Week 5 (M= 4.5, SD= 1.29), *p*= .016. These results were supported by social validity data from families indicating high satisfaction with the course. On a 0-6 scale, (0= Strongly Disagree, 6= Strongly Agree) all families reported that their child's level of social engagement had improved over the course of intervention (M= 5.00). Additionally, all families indicated that they would recommend this course to a friend in need of intervention for their child (M= 5.33).

Conclusions: The data indicate that PRT implementation fidelity significantly improved following participation in the online course. These results suggest that an online intervention may be a feasible approach to disseminating PRT strategies. This innovative format has the potential to reduce disparities in access to evidence-based intervention.

150 **110.150** Parent Perspectives of a Parent-Teacher Communication App after Use in a Classroom for Preschoolers with ASD

M. Pizzano[1] *and C. Kasari*[2]*, (1)Education, University of California, Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA*

Background:

Communication between families of children with ASD and their school remains understudied. Parent participation in their child's education improves skill maintenance and generalization, but parents of children with ASD are more dissatisfied with the level of communication with their child's school versus parents of TD children (Moes and Frea, 2002; Zablotsky, 2012). Parent support remains the lowest level of implementation of the NRC recommendations for autism research (Tincani et al., 2013).

Telehealth approaches to intervention are a promising but remain nonexistent for parent communication (Vismara, 2013). An app was used to track positive behavior, but has not been examined for communication between parents of children with ASD and their child's service team (Jordan, 2016). Electronic communication is investigated in other health fields, but not in autism intervention (Eysenbach, 2004).

Objectives:

To explore how parents of children with ASD perceive using an app to communicate with their child's preschool team.

Methods:

Parents completed a questionnaire describing their experience using a cellphone communication app. The app, part of a 4-week long preschool program for 11 students aged 42-86 months with ASD, was used by the classroom team to communicate with parents.

1 teacher and 6 aides posted updates on the app. Updates appear like a social media feed, with accounts for each individual student and one account for the classroom as a whole. Each parent has access to the classroom's and their student's account. Posts give updates of the day and include videos, images, and written private messages. Over the course of the program, 608 posts were shared with parents, with an average total of 40.09 posts per student and an average of 2.22 posts per student per day. Posts per student ranged from an average of 1 to 4.7 per day.

12 parents of the 11 students were emailed, and 9 completed, a questionnaire at the end of the program. It consisted of six open-ended questions about how frequently parents used the app, whether they had previously used a similar method of communication, and their perceptions of using the app.

Results:

Parents rated their experience using the app favorably. All parents checked the app at least daily, with 44.4% checking it 1-2 times per day and 55.6% checking it over 3 times per day. None had used a communication app previously with their child's team. All 9 reported positive feelings toward using the app. All 9 parents reported feeling more connected to the classroom as a result of using the app. 8 of the 9 parents reported that their favorite part of the app was the picture updates, with others commenting that the app let them be part of their child's day and gave up-to-date information about the day's events.

Conclusions:

Parents checked their child's activities daily, reported enjoying the app, and feeling connected to their child's classroom, given a high frequency of app use. The next step is to incorporate the app as part of a controlled examination, with particular attention to the potential to reduce parent anxiety.

151 **110.151** Parent-Led Training for Motivating Eye Contact in Young, Low-Functioning Children with Autism

M. Muuvila[1]*, T. M. Helminen*[2]*, K. Eriksson*[3]*, T. Charman*[4] *and A. Kylliainen*[2]*, (1)Tampere University Hospital, Tampere, Finland, (2)Tampere University, Tampere, Finland, (3)Tampere University and Tampere University Hospital, Tampere, Finland, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Difficulties in the use of eye contact are widely reported in children with autism spectrum disorder (ASD). Following this, it may be important to motivate them to look towards other people's eyes and faces as early as possible to reduce further abnormalities in social development. Involving parents in interventions of early social communication skills has been shown to reduce autistic behaviour and improve parent-child interaction.

Objectives: The aim of the study was to pilot a parent-led training method targeted to improve eye contact in young children with ASD. The planned training method was in addition to treatment as usual (TAU) which also includes eye contact encouragement but not as systematically and explicitly as in this training method. It was predicted that children's motivation towards faces would increase if eye contact is reinforced by trying to make it rewarding. It was further assumed that children's interaction with their parents would improve.

Methods: Twenty young (age range: 2.5-5.5 years of age) and low-functioning children with severe ASD were randomly divided into an intervention group (N=10) and a control group (N=10). The parents of the intervention group were taught to do three kinds of daily activities with their child for 4 months. The activities included encouraging the child to use eye contact for requesting food, toys or physical play activity, and imitating the child's actions in a specific manner. The training was based on combining behavioural and developmental principles of early intervention. Baseline and outcome measures included observations, questionnaires and psychophysiological measures. There were short-term measurements 4-6 months and long-term measurements two years after the baseline measurements in both groups. Orientations toward the parent's face (indicative of eye contact) and the state of engagement were analysed from play sessions with the parent in the laboratory and at home. The number of eye contacts was analysed in addition to the information as to whether the eye contact was an overture or a response, and whether it was linked to other forms of social communication.

Results: The laboratory observation analyses showed that in the intervention group eye contacts, especially responsive eye contacts, increased in the short-term outcome ($Z = 2{,}61$; $p = 0.009$). Eye contact was also connected more often to other forms of social communication (e.g., gestures and facial expressions) in the intervention group ($Z = -2{,}51$; $p = 0.012$). The increase of eye contacts was not significant in the control group. Preliminary analysis of the long-term follow up indicated that these findings remained stable. The significant improvement of the joint engagement ($Z = -2{,}19$; $p = 0.028$) was evident only after the long-term follow-up and was shown in the intervention group only (Fig.1).

Conclusions: It seems beneficial to encourage eye contact initiation in young, low-functioning children with ASD. The parent-led eye contact focused training did not only increase the use of eye contact but, importantly, also the state of engagement seemed to improve in the long run.

152 **110.152** Parent-Mediated Intervention Increasing Parent-Child Engagement and Improving Cognitive and Behavioural Outcomes of Toddlers with Autism Spectrum Disorder

M. Couture[1]*, A. J. Beaudoin*[2] *and G. Sebire*[3]*, (1)Rehabilitation, Universite de Sherbrooke, Sherbrooke, QC, Canada, (2)Rehabilitation, Université de Sherbrooke, Sherbrooke, QC, Canada, (3)Pediatrics, McGill University, Montreal, QC, Canada*

Background:
Now that it is possible to identify a child with autism spectrum disorder (ASD) in the first two years of life, efforts are being made to develop early effective interventions for toddlers at high risk of ASD. Thus, age-specific strategies have to be used to offer effective early intervention to these toddlers with a diagnosis or a suspicion of ASD (Rogers & Wallace, 2011) including parent involvement. By participating in parent-mediated interventions, parents develop skills to promote their toddler's development. Parent-mediated interventions that focus on joint attention, imitation and play can capitalize on teachable moments as they occur, provide learning opportunities during daily routines, and facilitate the generalization of learned skills across environments.

Objectives: this study aims to evaluate the effects of parent-mediated intervention for toddlers with a suspicion or a diagnosis of ASD on quality of parent-child interactions and children developmental outcomes using a crossover randomized controlled trial.

Methods: The 12-week parent-mediated intervention was an adaptation of the parent delivery of the Early Start Denver Model (P-ESDM, Rogers, Dawson, & Vismara, 2012) and the Social Communication Emotion Regulation Transaction Support (SCERTS, Prizant, Wetherby, Rubin, & Laurent, 2003) Model. The intervention was delivered in the family's home (60 to 90 minutes). The 19 parent-child dyads were randomized either in the Intervention group or the Waitlist group (participants in this group had to wait three months before getting access to the intervention). The primary outcome was the quality of dyadic engagement between the child and his parent as measured by the total score of the *Engagement state, Child and Caregiver Behavior, and Shared Topic* (Adamson, Bakeman, Deckner, & Nelson, 2013). Based on Adamson's and colleagues protocol (Adamson et al., 2013), four cluster scores were also analyzed, which are 1) Child Joint Engagement, 2) Child Behavior, 3) Caregiver Behavior, and 4) Shared Topic. Secondary outcomes were related to children's development. These outcomes include cognitive abilities, motor skills, and adaptive behaviors all assessed via the *Bayley Scales of Infant Development – 3rd edition* (Bayley, 2006), a widely used tool for early childhood assessment

Results: This crossover randomized trial highlights the positive effect of the parent-mediated intervention on parent-child dyadic engagement ($p=.012$; effect size=.51). Also, the participation to the intervention stimulates the child development that is manifested by a mild-to-moderate normalization of toddlers' cognitive abilities ($p=.010$; effect size=.57) and motor skills ($p=.071$; effect size=.38) compared to typically developing peers.

Conclusions: Very promising effect sizes underline trends toward moderate-to-large improvement in parent-child dyadic engagement and a mild-to-moderate normalization of children's developmental outcomes after a 12-week parent-mediated intervention. These results also highlight greater benefits on proximal outcomes, specifically the way parent and child interact with one another in play compared to more distal child-related outcomes (Helm & Kozloff, 1986; Mahoney & Perales, 2003; Mahoney & Perales, 2005; Oono et al., 2013).

153 **110.153** Parenting Stress, Self-Efficacy and Empowerment in Primary Caregivers of Children with Autism Spectrum Disorder Receiving Ipad-Based Early Intervention: Outcomes from the Toby Trial

J. Granich[1]*, A. Clark*[2]*, M. Busacca*[3]*, D. Moore*[4]*, A. Anderson*[5]*, S. Venkatesh*[6]*, T. Duong*[6]*, P. Vellanki*[7]*, A. L. Richdale*[8,9]*, D. Trembath*[10]*, D. Cairns*[11]*, W.*

Marshall[12], T. Rodwell[13] and A. J. Whitehouse[14], (1)Telethon Kids Institute, Telethon Kids Institute, Subiaco, Australia, (2)Telethon Kids Institute, the University of Western Australia, Perth, Australia, (3)Krongold Centre, Faculty of Education, Monash University, Melbourne, Australia, (4)Krongold Centre Faculty of Education, Monash University, Melbourne, Australia, (5)Krongold Centre Faculty of Education, Melbourne, Australia, (6)Centre for Pattern Recognition and Data Analytics, Deakin University, Geelong, Australia, (7)Centre for Pattern Recognition adn Data Analytics, Deakin University, Geelong, Australia, (8)Olga Tennison Autism Research Centre, School of Psychology and Public Health, La Trobe University, Melbourne, Australia, (9)La Trobe University, Olga Tennison Autism Research Centre, Bundoora, Australia, (10)Menzies Health Institute, Griffith University, Australia, (11)The Charles Street Clinic, Perth, Australia, (12)Autsim West, Perth, Australia, (13)Autism West, Perth, Australia, (14)Telethon Kids Institute, University of Western Australia, Perth, Western Austalia, Australia

Background: A diagnosis of an autism spectrum disorder (ASD) and the start of a range of early and intensive behavioural interventions (EIBI) to ameliorate ASD symptoms in young children are significant life events and potential stressors that can impact on parental stress, satisfaction, self-efficacy, sense of competence and empowerment. The use of technology to complement EIBI may assist caregivers in delivering timely therapy at low cost. However, the impact of any EIBI on parents is limited, so we investigated parent attributes to better understand their needs during EIBI in a bid to develop interventions with parent focused components.

Objectives: As part of an iPad-based early intervention (Therapy Outcomes By You: TOBY) for young children with ASD, this study aimed to investigate the effects of TOBY on perceived parental factors such as 1) parenting stress 2) satisfaction 3) self-efficacy and 4) empowerment among primary caregivers whose children participated in the TOBY randomised controlled trial (RCT). Parental outcomes were assessed at 3 and 6 months post-baseline.

Methods: The TOBY app provides a learning curriculum within which a combination of solo on-screen, partner-on-screen and real world tasks are encouraged and implemented by parents. Children aged 51 months or younger with a clinical diagnosis of ASD (received in the past 12 months) and parents were randomised to the TOBY (>20 mins/day) plus therapy as usual group (TOBY, n = 41) or the control - therapy as usual only (TAU, n = 39) group for 6 months. In addition to children diagnostic, functional and developmental assessments, primary caregivers self-completed the Parenting Stress Index, Parenting Sense of Competence Scale and Family Empowerment Scale at baseline, 3 and 6 months post-intervention.

Results: Primary caregivers (mothers) were 34.38 (*SD* = 4.74) years of age at baseline. One quarter (23.4%) of all parents reported clinically significant stress scores at baseline. Non-parametric tests were used to examine differences between and within the TOBY and TAU groups due to non-normal distributions. No significant differences between the TOBY and TAU groups emerged. However, primary caregivers within the TOBY group perceived less parental stress at 3-months (*Mdn* = 86.5) compared to their baseline stress scores (*Mdn* = 95.5, *z* = -2.54, *p* = .011) but their stress scores did not differ significantly at 6 months post intervention (*Mdn* = 91.5, z = -1.24, *p* = .212). There were no significant differences within the TOBY group for parenting satisfaction, self-efficacy and empowerment at 3- or 6 month follow up.

Conclusions: Some parents of newly diagnosed children with ASD experience high levels of stress at the start of therapies. A reduction in parenting stress among TOBY parents in the first 3-months was observed but not at 6 months post-intervention. Although this requires exploration, the results suggest parent screenings to determine stress levels with a view to assess clinical needs and services aimed to support parents during early intervention. The findings have implications for future research in EIBI and the development of comprehensive early interventions for ASD with embedded parent support components.

154 **110.154** Pilot RCT of Early-Intervention Delivered in Inclusive Vs. Autism-Specific Settings: Blinded Proximal Outcomes from LENA Recordings and Classroom Footage

K. Hudry[1,2], *C. A. Bent[3,4], J. Maya[5], R. Rankin[4,5], C. Dissanayake[2], S. Upson[5], J. Feary[5], K. Capes[5], E. Duncan[5], G. Vivanti[6] and T. Victorian ASELCC Team[5], (1)Victorian Autism Specific Early Learning and Care Center, Olga Tennison Autism Research Centre, Melbourne, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (3)Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, Australia, (4)Olga Tennison Autism Research Center, La Trobe University, Melbourne, Australia, (5)Victorian Autism Specific Early Learning and Care Center, La Trobe University, Melbourne, Australia, (6)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA*

Background: Little experimental research addresses the relative benefits of different intervention approaches for children with autism or differential effects of specific delivery methods. Further, understanding relative benefits is complicated by a lack of outcome measures that are both meaningful and sensitive to change over time among young children with autism who may also present with substantial developmental delays.

Objectives: We examined growth in proximal outcome measures in toddlers and pre-schoolers with autism during receipt of a manualized early intervention. Children were randomly assigned to receive the Group-Early Start Denver Model (G-ESDM; Vivanti et al., 2017) within either mainstream inclusive classrooms or specialised autism-specific classrooms within a community childcare service. We hypothesised that children receiving their intervention within mainstream settings might make greater or more rapid gains in proximal outcome measures than those in the autism-specific setting, given the opportunity afforded for regular interaction with typically-developing peers, alongside the specialist input from classroom staff.

Methods: We randomly assigned 29 preschoolers with ASD (aged 18-36 months) to receive intervention across the school calendar year either in classrooms that included 1) only children with ASD (n=15; i.e., Autism-Specific Setting) or 2) mostly typically-developing children (n=14; i.e., Inclusive Setting). Two proximal measures were sampled at the start and end of the school year, and at three intermediate times. Language ENvironment Analysis (LENA) was used to record rates of spontaneous child vocalisation from 40-minute semi-structured interaction samples, with automated data extraction. Following Clifford et al. (2010) we collected footage of free-play and snack time sessions to sample spontaneous child intentional communication bids within classrooms, and coding by blinded researchers demonstrated excellent inter-rater agreement (ICC=.93).

Results: Children showed increased rates of spontaneous vocalisation and intentional communication bids – including both initiations and responses toward others – across the intervention year, particularly within the first half of the year. There was no differential effect of randomisation group. However, children randomised to the inclusive setting showed greater rates of intentional communication at the start of the year and maintained this advantage over time.

Conclusions: Spontaneous child vocalisations, recorded and extracted automatically via LENA, and intentional communication bids, coded from naturalistic 10-minute classroom behaviour samples, appear to be sensitive measures of growth in children's skills over time. Advantages of these methods include the ability for repeated sampling across an intervention period and automated extraction (LENA) and blinded coding (Classroom

Footage) with high inter-rater agreement. While we did not observe differential effects of randomisation, we may have been underpowered to do so with this relatively small pilot sample. Replication with a larger sample would also permit the use of more sophisticated method of growth analysis and allow examination of potential moderators and mediators of outcome.

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110.155 Pilot Research Prevents Anxiety Problems in Young Children with Autism

N. L. Bischof[1], R. M. Rapee[2], K. Hudry[3,4] and ***J. K. Bayer***[1,5,6]*, (1)School of Psychology and Public Health, La Trobe University, Melbourne, Australia, (2)Centre for Emotional Health, Macquarie University, Sydney, Australia, (3)Victorian Autism Specific Early Learning and Care Center, Olga Tennison Autism Research Centre, Melbourne, Australia, (4)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (5)Murdoch Children's Research Institute, Melbourne, Australia, (6)Psychology and Public Health, La Trobe University, Melbourne, Australia*

Background: Autism is highly comorbid with anxiety. Meta-analysis of studies of children and adolescents with autism report prevalence of anxiety disorders at 40% (Steensel, Bogels & Perrin, 2011). Research with school age children with autism finds that cognitive behavioural treatment reduces comorbid anxiety (Chalfant, Rapee & Carroll, 2007; Sukhodolsky, Bloch, Panza & Reichow, 2013). To date there have been no published early intervention studies for anxiety among preschool children with autism.

Objectives: This pilot study aimed to explore acceptability to parents and outcomes for young children with autism of a preventive intervention for anxiety problems. The study focused on children with autism who were participating in a wider population-based randomised trial of the Cool Little Kids parenting group program.

Methods: The population trial included 545 temperamentally inhibited preschool children recruited across eight economically diverse areas of Melbourne, Australia. Within this sample, 26 parents reported that their child had received an autism diagnosis. The trial measures included baseline inhibited temperament and developmental problems, post-intervention quantitative and qualitative feedback on the program, and child mental health outcomes (anxiety diagnoses and internalising symptoms) one and two years post baseline.

Results: The rate of autism cases in the sample of inhibited young children was 4.8%, or one in 20, compared to population prevalence estimates between 1 and 2%. Sample retention over two years for children with autism in the trial was strong (92%). At follow up, fewer intervention than control children with autism had anxiety disorders (25% *vs.* 77%, $p = .03$) and separation anxiety symptoms (*M (SD)* = 4.22 (2.68) *vs.* 9.38 (5.91), $p = .03$). Parents of children with autism in the trial intervention arm reported that Cool Little Kids was "quite useful" in relation to their child's anxiety but also gave feedback that they would appreciate some tailoring of program content to the context of autism.

Conclusions: These pilot findings suggest that Cool Little Kids may be helpful for reducing comorbid anxiety in young children with autism. This warrants further research to develop an autism-specific adaptation that can be trialed with a larger sample of children with corroborated autism diagnosis.

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110.156 Pivotal Response Treatment 2.0: Development and Evaluation of an Enhanced Model to Target Social Motivation and Engagement Using Microanalytic and RCT Methodologies

T. W. Vernon[1]*, A. Barrett[1], A. Navab[1], J. A. Ko[1], E. McGarry[1], J. Bradshaw[2], J. Gong[1], E. Horowitz[1] and T. German[1], (1)University of California Santa Barbara, Santa Barbara, CA, (2)Department of Psychology, University of South Carolina, Columbia, SC*

Background: Effective early intervention models have been a life-alternating development in the field of autism spectrum disorders, offering the hope of normalized developmental functioning and outcomes. Applied behavior analysis offered a transformative leap forward in intervention technology, offering a framework for systematically teaching children new behaviors through repetition and reinforcement. The introduction of Pivotal Response Treatment (PRT) and other Naturalistic Developmental Behavioral Interventions (NDBIs) constituted a paradigm shift of comparable magnitude, utilizing motivational and developmental elements within natural learning contexts to significantly increase skill acquisition. However, even with an ever-growing empirical foundation for PRT, the issue of differential response to intervention remains. Modification of the PRT model to directly target social motivation and engagement may further enhance developmental outcomes and eventually pave the way for third generation intervention paradigms.

Objectives: To use a series of studies to systematically develop and evaluate an enhanced PRT model's effect on child engagement, parent-child interactions, and developmental outcomes.

Methods: Across the three interrelated studies, the existing PRT framework was modified to embed engaging social components. Specifically, participants' preferred nonsocial activities were analyzed to identify the motivating sensory elements that yielded high levels of engagement. These elements were extracted and embedded into socially analogous activities to leverage this existing motivation and transfer it into dynamic exchanges with adults.

Study I was an ABAB design with three children aged 3:1-3:5. Clinician-delivered traditional PRT and an enhanced social PRT model were contrasted to examine within session effects on child social engagement and eye contact.

Study II was a multiple baseline design with three children aged 2:0-4:11 and their parents. During baseline, parents were taught traditional PRT procedures. During intervention, enhanced social PRT model strategies were introduced. Session data were gathered on parent and child social behaviors using moment-by-moment sequential analysis techniques.

Study III was a randomized controlled trial with 24 children aged 1:6-4:6 and their parents. Twelve were randomly assigned to the enhanced social PRT condition (10 hours a week) and twelve were assigned to a community treatment group for six months. Mullen, ADOS-2, PLS-5, Vineland-II, and SLO data were analyzed using mixed MANOVA procedures.

Results: Studies I & II yielded data confirming superior child social engagement in the enhanced PRT condition. Study II's lag sequential analyses revealed significant increases in the total number and transitional probability of parent-child social exchanges.

Study III yielded significant Group X Time effects across several measures, with the treatment enhanced PRT group experiencing superior improvements in developmental, autism symptom severity, language, and adaptive skill measures.

Conclusions: The results from this progression of studies demonstrate the potential of an enhanced social PRT framework. Specifically, Study I yielded a significant increase in child social initiations and responses at the micro level. Next, Study II demonstrated that increased child receptivity and parent-introduced motivational exchanges can generate crucial social momentum in the form of sustainable parent-child transactions and synchrony. Finally, Study III demonstrated that continued exposure to this enhanced PRT model has the potential to significantly alter the developmental trajectories of young children with ASD.

157 **110.157** Pivotal Response Treatment: Effectiveness of Group Versus Individual Parent Training on Pivotal and Collateral Skills

R. Verschuur[1,2] *and B. Huskens*[1]*, (1)Research, Development, & Innovation, Dr. Leo Kannerhuis, Doorwerth, Netherlands, (2)Behavioural Science Institute, Radboud University, Nijmegen, Netherlands*

Background: Effective and efficient parent training is essential to meet to the increased demands for treatment services for children with Autism Spectrum Disorder (ASD). Several studies have indicated that parent training in Pivotal Response Treatment (PRT) is effective to teach parents to implement PRT with their child (e.g., Coolican et al., 2010; Hardan et al., 2015; Minjarez et al., 2011; Symon, 2005), but research comparing the effectiveness of group versus individual of parent training in PRT is lacking.

Objectives: This study investigated the effectiveness of group versus individual parent training in PRT on parent-created opportunities and children's self-initiations, and explored collateral changes in parental stress and children's maladaptive behavior.

Methods: Participants were 26 parents and their children with ASD, aged between 3;0 and 14;9 years. Thirteen parent-child dyads participated in group parent training in PRT and thirteen parent-child dyads participated in individual parent training. Both group and individual parent training consisted of instruction in PRT-techniques, practice, and video-feedback, but individual training also included guided practice. One multiple baseline design across groups and two multiple baseline designs across participants were used to investigate the effectiveness of group and individual parent training on parent-created opportunities and children's self-initiations. To explore collateral changes parents completed two questionnaires during baseline and post-intervention. Data analysis included visual analysis (Lane & Gast, 2014) and statistical analyses (i.e., Tau and Reliabilty of Change Index [RCI]; Jacobson & Truax, 1991; Parker et al., 2011)

Results: Preliminary results of 21 parent-child dyads indicated that 5 parents participating in group training (N = 11) created significantly more opportunities during intervention (overall Tau = 0.53; $p < 0.001$). Reliable reductions in parental stress were observed in 7 parents (RCI < -1.96); one parent reported a reliable increase in stress (RCI > 1.96). Self-initiations increased significantly for 2 children (overall Tau = 0.35; $p < 0.001$). Maladaptive behavior reliably decreased in 5 children, but significantly increased in 3 other children. Nine parents participating in individual training (N = 10) created significantly more opportunities during intervention (overall Tau = 0.81; $p < 0.001$), but only for 2 parents reductions in stress were reliable; one parent reported a reliable increase in stress. Self-initiations significantly increased for 4 children (overall Tau = 0.54; $p < 0.001$). Maladaptive behavior reliably decreased in 5 children, but increased significantly in 2 other children.

Conclusions: These preliminary findings suggest that individual parent training in PRT is more effective in increasing parent-created opportunities than group training, but group training appears to be more effective in reducing parental stress. In both groups only a minority of children demonstrated significant improvements in self-initiations and for both groups results concerning maladaptive behavior were mixed. Explanations for findings and recommendations for future research will be discussed.

158 **110.158** Predictors of Treatment Response in the Social ABCs Parent-Mediated Intervention for Toddlers with ASD

J. A. Brian[1]*, S. E. Bryson*[2]*, L. Zwaigenbaum*[3] *and I. M. Smith*[4]*, (1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Dalhousie University, Halifax, NS, Canada, (3)University of Alberta, Edmonton, AB, Canada, (4)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA*

Background: The *Social ABCs* is a parent-mediated intervention for toddlers with, or at-risk for, autism spectrum disorder (ASD). Following pilot evidence of efficacy (Brian et al., 2016), a recent RCT demonstrated that toddlers who received the *Social ABCs* made significant gains, relative to controls, in functional vocal responsivity to parent prompts, vocal initiations, positive affect, and social orienting; parents learned the techniques (achieved implementation fidelity) and reported increased empowerment (Brian et al., 2017). As with most behavioural/ developmental interventions, outcomes varied across individuals in both studies, raising the question of what factors were associated with degrees of responses. Identification of moderators and mediators of treatment response has been identified as an urgent research priority (Vivanti et al., 2014; IMFAR SIG, 2017), with potential to inform personalized intervention pathways and resource allocation.
Objectives: To explore factors associated with response to *Social ABCs* treatment.

Methods: Demographics, video-coded indices, and standardized assessment data from 50 parent-child dyads, all of whom had received the *Social ABCs* intervention, were included (mean child age = 24.0 months; SD = 4.5; range: 12-32 months). Putative predictors were examined using univariate ANOVA and linear regression, with child vocal responsivity (baseline to post-training change; z-transformed) as the primary outcome.

Results: The vast majority (98%) of parents achieved implementation fidelity, and 92% of toddlers demonstrated some improvement, but with individual variability. Regression analyses revealed two significant child-level baseline predictors, with small-to-medium effects (f^2): Expressive language (Mullen age equivalent; $R^2 = .12$, $p = .016$; $f^2 = .14$), and rate of spontaneous initiations ($R^2 = .09$, $p = .035$; $f^2 = .10$), with a negative association for both. Notably, parent fidelity of implementation post-training, but not at baseline, significantly predicted outcome ($R^2 = .14$, $p = .008$) with a medium effect ($f^2 = .16$). The following baseline variables were explored but not associated with treatment response: ASD symptoms (ADOS-2 calibrated severity score; $p = .40$), toddler age ($p = .38$), parental education ($p = .06$), sibling status ($p = .19$), number of words used ($p = .56$). However, a significant effect was found for child sex ($p < .001$), wherein boys in our sample demonstrated a greater response. This is likely related to lower baseline expressive language in boys (Mullen t-score; $p = .04$), and the negative association between baseline language (age equivalent) and response. These relations need further examination.

Conclusions: Preliminary investigation of factors associated with treatment response revealed the importance of baseline language/communication abilities, with greater gains for toddlers who began the program with relatively lower verbal proficiency. This may be explained by a ceiling effect in some, but not all, cases. Parental implementation fidelity following training was the greatest single predictor of children's progress, supporting the efficacy of the program. Severity of ASD symptoms and age were not associated with treatment response, indicating that this intervention is appropriate for a range of high-risk toddlers. Findings will guide development of a combined moderator/mediator model including interactions between factors, and examination of other key outcomes (e.g., positive affect, social orienting).

159 **110.159** Preschool Peer Social Intervention: Study Outcome and Integrative Summary

N. B. Bauminger-Zviely[1], *S. Hoshmand*[2], *O. Rajwan, Ben - Shlomo*[2] *and D. Eytan*[1], *(1)School of Education, Bar Ilan University, Ramat Gan, Israel, (2)School of Education, Bar - Ilan University, Ramat Gan, Israel*

Background: Peer relations in typical development are cardinal for children's development of ample cognitive, linguistic, and social skills (e.g., Hay, et al., 2009). Longitudinal evidence shows that individual variations in behavior and in responding to peers' behavior as well as in playing and conversing with peers at early ages predict later social competence (e.g., Coplan & Arbeau, 2009). These areas do not develop typically in children with ASD, thus limiting peer relationship experiences in young children with ASD and forming the basis for reduced peer engagement across development (Manning & Wainwright, 2010). Yet, relevant manualized evidenced-based social curriculum to enhance peer-interaction that are developmentally-based, ecological-school-based for preschoolers with ASD are scarce.
Objectives: To provide an integrative view on learning goals related to peer- social intervention through the summary of the *Preschool Peer Social Intervention (PPSI*) – Evidenced-based school social curriculum to promote Peer Play Conversation and Interaction for preschoolers with ASD. The objective of this talk is to present comparative results between treatment modalities (play, conversation, and interaction) and to teach us about the links between play, language, interaction and overall social competence in ASD. These young children's ability to generalize from a treated social domain to an untreated one will be reviewed (e.g., from play to conversation and vice versa). Furthermore, we aimed to provide a critical overview of current literature.

Methods: The PPSI project included 65 children with high-functioning ASD (HFASD) randomly divided between four main groups: three intervention groups (play, conversation and interaction) and a waitlisted no-treatment control group. PPSI manualized curriculum is holistic, integrating CBT as well as developmental and ecological orientations, targeting three major areas of children's social deficiency in ASD: splay, conversation and interaction with typical age-mates. Multi-method assessment procedures included pre-post behavioral measures of children's social competence completed by parents and teachers, and observations of children's play, conversation and interaction with their peers. Post-treatment gains in untreated domains will identify generalizability of the groups' treatments.

Results: Overall, as expected, children in each treatment modality showed higher improvement in their learned skills compared to the other groups. For example, the play group improved play capabilities more than the conversation group that improved their quality of speech better than the interaction group. However, we also found two levels of important generalizations: 1.From one modality to the other (e.g., 20% of the children in the conversation group improved their social play complexity, and children in the interaction group improved their paralinguistic capabilities on the pragmatic scale) 2. Of the learned skills to the child's natural free-play situation in the preschool according to the blind teacher's report.

Conclusions: The PPSI outcome can help the future design of more individualized approaches to the treatment of core deficit in peer interaction, resulting in mitigation of the social withdrawal and isolation in older ages. Furthermore, the ecological nature of the PPSI can teach us about the implementation of social intervention within the child's natural social environment-his preschool, involving his natural peers. These issues will be further discussed.

160 **110.160** Randomized Comparison of Two Instructional Sequences for Imitation Intervention for Children with Autism Spectrum Disorder

E. Espanola[1], *A. Gutierrez*[2] *and M. N. Hale*[1], *(1)University of Miami, Coral Gables, FL, (2)University of Miami, Miami, FL*

Background:
Children as young as 24 months of age diagnosed with Autism Spectrum Disorder exhibit poor imitation skills. Amongst the many skills often targeted during early intervention, imitation is particularly important because of the integral role it plays in the development of communication and social skills. However, the published curricula provide a sequence for selecting imitation targets for intervention that has never been directly tested and are not empirically validated. This lack of information is a potential pitfall, because it is impossible to know whether the sequence of skills in these curricula accurately represent a continuum of complexity. A shortfall, that could result in less responding, more trials to mastery and less skill acquisition. The use of an empirically validated protocol may result in more faster and more efficient learning.
Objectives:
The aim of this study was to determine differences in effectiveness and rate of skill acquisition between a recently developed and empirically validated instructional sequence, Motor and Vocal Imitation Assessment (MVIA), and a commonly used instructional sequence in a curriculum guide, Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP).
Methods:
Children with ASD were randomly assigned to two treatment groups to determine difference in imitation performance. The treatment group followed the instructional sequence proposed in the MVIA. The comparison group followed the instructional sequence proposed in the VB-MAPP. Initial levels of imitation were assessed via the MVIA. The intervention consisted of discrete trial training (DTT). A trained therapist presented a fixed number of stimuli in massed trial format. Prompted and unprompted imitative responses were reinforced using edibles. A most-to-least with a progressive time delay prompting strategy was used to help the learner engage in the target response.
Results:
Participants in the MVIA treatment group had significantly more skill acquisition than participants in the VB-MAPP comparison group. Participants in the MVIA treatment group also acquired these skills more efficiently, spent less time on skills that never reached mastery and demonstrated higher levels of responding. Additionally, pre-treatment imitation was found to predict autism severity and expressive language.
Conclusions:
These results indicate that the MVIA protocol provides an appropriate sequence ordered from simple to complex for selecting targets for intervention. These findings suggest that organizing and sequencing skills in increasing difficulty, as with the MVIA protocol, leads to more appropriate target selection. Targeting skills that are appropriate for the child's current skill level, in turn leads to more effective and efficient intervention. Results also replicate previous findings that demonstrate that imitation performance plays a critical role in other areas of development.

161 **110.161** Short-Term Parent-Mediated PRT: Teaching Social Initiation to Children with Autism Spectrum Disorder through Question

Asking

S. Popovic[1] *and E. M. Starr*[2]*, (1)University of Windsor, Windsor, ON, Canada, (2)Faculty of Education, University of Windsor, Windsor, ON, CANADA*

Background: Parents of children with ASD report high wait times between diagnosis and service referral (between 22-39 months (Gordon, 2015)). In addition, the financial cost of many early intervention programs can be prohibitive and are difficult to continue at home. Pivotal Response Treatment (PRT) is a naturalistic evidence-based intervention based on principles of Applied Behaviour Analysis that may occur at home, can be taught to parents, and targets a number of pivotal behaviours including social initiation. Social initiations are imperative for development; however, many children are only taught to request. Teaching social initiations allows children to advance from requesting to engaging in self-learning. There is support for the idea that parents can be taught to implement evidence-based practices, such as PRT, in the natural environment after engaging in short-term training. By increasing parents' skills through short training, continual opportunities for learning may emerge beyond intervention.

Objectives: Investigate whether caregivers can be taught to implement PRT procedures for question-asking in the home after participating in a brief training in PRT. The study also investigated whether children increased their frequency of social initiation through question asking (specifically "What's that?") and whether these results maintained and generalized beyond intervention.

Methods: Participants included three mother-sons dyads. The children ranged in age from 45 to 56 months; all had a confirmed diagnosis of ASD. Prior to the study, the researcher obtained full certification as a trainer in PRT from the Koegel Autism Center. A single-subject multiple baseline design was used. After a stable baseline was obtained, training was introduced to each mother in a one-week staggered manner. Each mother completed 12 hours of training in PRT across three weeks (i.e., two hours twice a week) after which intervention was initiated. Each mother implemented the intervention with their child three times a day in 10-minute sessions with one session video-recorded daily by the researcher**.** Immediately succeeding intervention, the mother conducted generalization probes every day for one week. Follow-up occurred after one month.

Results: Results of visual analysis showed that all three mothers were able to successfully implement PRT procedures for question asking and achieved fidelity during intervention, with one mother attaining fidelity at follow-up. All three children showed an increase in their frequency of asking, "What's that?" These results generalized to various novel items, family members, and environments. Follow-up data showed that all three children continued asking, "What's that?" but at a lower rate than during the intervention.

Conclusions: Results of the study demonstrate that parents are able to learn, and effectively implement PRT procedures for question asking after completing a short training. Furthermore, all three children increased their frequency of asking "What's that?" Short-term parental training thus offers a viable option to reduce both wait-times and costs of early intervention experienced by parents of children with ASD.

162 **110.162** Speech Language Pathologists' (SLPs) Knowledge and Use of Factors Found in Research to Predict, Moderate, and Mediate Response to Augmentative and Alternative Communication (AAC) Intervention for Children with Autism

S. B. Sievers[1]*, D. Trembath*[2] *and M. Westerveld*[3]*, (1)Allied Health, Griffith University, West End, Australia, (2)Menzies Health Institute, Griffith University, Australia, (3)Allied Health, Griffith University, Southport, Australia*

Background:

Individuals with Autism Spectrum Disorder (ASD) may experience a wide range of communication difficulties, with as many as 30% of children receiving comprehensive early intervention programs commencing school unable to speak in sentences (Rose, Trembath, Keen, Paynter, 2016). Augmentative and alternative communication (AAC) interventions have the potential to enhance communication skills. However, implementing AAC interventions is challenging due to the heterogeneous population, limited AAC training for speech-language pathologists (SLPs), a lack of research evidence regarding what works for whom and why, and the research to clinic gap. Research has identified factors that predict, moderate, and mediate AAC intervention outcomes for children with ASD, however, it is unknown is if SLPs have knowledge of these factors and if these factors are used in their clinical practice.

Objectives:

The aims of this study were to (a) investigate SLPs knowledge and use of factors that predict, moderate, and mediate AAC intervention outcomes for children with ASD and (b) to identify additional factors that SLPs believe warrant further research.

Methods:

A mixed methods survey using close and open-ended questions was distributed internationally to certified SLPs who have experience working with children with ASD and AAC interventions. SLPs were recruited through professional organizations in Australia, the United States, Canada, and the United Kingdom; online communities (e.g., AAC for SLPs); and through the research team's professional network. Survey questions were based on a systematic review of factors that predict, moderate, and mediate outcomes to AAC for ASD. Questions investigated SLPs' knowledge and use of these factors as well as their views on where future research should be focused and barriers to implementing best practice in AAC interventions.

Results:

The survey, which opened in September 2017, yielded 176 responses within the first two weeks. The survey will close in November 2017, and the results will be presented. Preliminary data analysis indicates that SLPs had knowledge of the 18 factors presented, with an average clinician rating for "great extent/very familiar" and "some knowledge" was 35.76% and 40.65% respectively. High rating included *communication competence, joint attention,* and *frequency of AAC Exposure* and low rating included *duration of therapy session, motor skills,* and *duration of therapy session.* Preliminary data also indicated that clinicians consider these 18 factors found in research when making decisions in clinical practice. Of the 18 factors, the average clinician rating for "frequently consider" was 56.69% and "sometimes consider" 26.76%. High ratings for frequently consider were *AAC input at school, motor skills,* and *frequency of AAC exposure* and low ratings were *duration of therapy session, age of therapy onset,* and *chronological age.* Additional factors clinicians indicated were important included motivation of AAC user and communication partner.

Conclusions:

Based on preliminary data collected to date, the majority SLPs were familiar, and took into consideration factors identified in research that may predict, moderate, and mediate AAC intervention outcomes when working with children with ASD. However, further research is needed to examine clinician-identified factors which to date have not been investigated in research.

163 **110.163** Strategies to Engage Underrepresented Parents in Child Intervention Services: A Review of Effectiveness and Use

M. Pellecchia[1], H. J. Nuske[2], D. Straiton[3], E. McGhee Hassrick[4], A. Gulsrud[5], S. Iadarola[6], S. F. Vejnoska[7], B. Bullen[8], R. Haine-Schlagel[9], C. Kasari[10], D. S. Mandell[2], T. Smith[6] and ***A. C. Stahmer***[11]*, (1)University of Pennsylvania, Philadelphia, PA, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (3)Psychology, Michigan State University, East Lansing, MI, (4)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (5)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (6)University of Rochester Medical Center, Rochester, NY, (7)University of California, Davis, Sacramento, CA, (8)University of Rochester, Rochester, NY, (9)Child and Adolescent Services Research Center, San Diego, CA, (10)University of California, Los Angeles, Los Angeles, CA, (11)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA*

Background: Parent involvement is considered to be a key ingredient in successful interventions for children with autism spectrum disorders (Benson, et al., 2008). Effectively engaging parents in their child's treatment contributes to improvements in the child's symptoms, parent-child interactions, and family functioning (Dowell & Ogles, 2010; Haine-Schlagel & Walsh, 2015). Engaging parents from traditionally underrepresented families is particularly important, as children and families from ethnic minority backgrounds are less likely to engage in services (Dickson, et al., 2017), and retention in parent training programs is lower among parents from ethnic minority and low income households (Chacko et al., 2016; Kazdin & Whitley, 2003). Little is known about which strategies are most effective in engaging underrepresented families, many of whom are at high risk for poor treatment outcomes. Information about how strategies are routinely combined to support parent engagement is still emerging (Michie, Fixsen, Grinshaw & Eccles, 2009), but could provide valuable insight into how engagement strategies can be delivered in combination to enhance parent engagement.

Objectives: To estimate the impact of parent engagement strategies in improving engagement among underrepresented (i.e., minority race or ethnicity and/or low income) families of children with ASD and related social, emotional, or behavioral disorders, and to describe the combinations in which these strategies are commonly used together.

Methods: A systematic literature review of parent engagement strategies with underrepresented families of children with ASD and related disorders was conducted. The PracticeWise Engagement Coding System was used to identify which strategies had the strongest empirical support for engaging underrepresented families receiving psychosocial services for their children. Linear regression was used to estimate the impact of each strategy on parent engagement, using attrition as a proxy for non-engagement. Social network analyses were used to identify the frequency of strategy use and how strategies were combined to engage underrepresented families.

Results: Thirty-five studies met inclusion criteria for the review. Less parent attrition was predicted by interventions that were based in the community or home (vs. in a clinic), less therapist monitoring/positive reinforcement from therapists, and more pairing of parents with peers for guidance and support. Social network analyses found that more effective strategies were more frequently implemented alone and less effective strategies were commonly combined with each other.

Conclusions: Findings point to the need for more community-based intervention trials for children with ASD that explicitly report on measures of parent engagement, development of implementation measures to better characterize the quality of engagement strategies, and the need to better understand how income and education level may interact with the use of engagement strategies and outcomes. Multiple aspects of parent engagement (e.g., participation, attendance, retention) should be examined as potential mediators and moderators of treatment outcome. As parent-mediated intervention techniques become more common, there is an urgent need to explicitly measure and discuss the contributions of combining parent engagement strategies and practices.

164 **110.164** Targeting Joint Engagement in Toddlers with ASD: What Predicts Sustained Engagement at Study Follow-up?

A. J. Schlink[1]*, L. M. Baczewski[2], K. Sterrett[3], C. Kasari[4] and A. Gulsrud[5], (1)UCLA Semel Institute for Neuroscience and Human Behavior, Los Angeles, CA, (2)Education, UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)University of California Los Angeles, Los Angeles, CA, (4)University of California, Los Angeles, Los Angeles, CA, (5)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA*

Background:

Parent-mediated interventions for toddlers with autism spectrum disorder (ASD) can improve core social communication deficits such as joint engagement, and these improvements are maintained over time (Green et al., 2010; Kasari et al., 2015). Toddlers with ASD may receive intensive therapist-mediated behavioral intervention (BI), however, these approaches may not prioritize targeting specific core deficits of autism, like joint attention (Kasari et al., 2008). Given that toddlers often receive both parent-mediated intervention and BI concurrently, it is unclear whether one approach can better predict toddler outcomes of joint engagement after a research study is terminated.

Objectives:

The present study aimed to assess whether parent mediated intervention fidelity (JASPER) or behavioral intervention hours (treatment as usual) was more predictive of increased joint engagement in a group of young children with ASD at the study's 6-month follow up.

Methods:

The present study included 86 toddlers (range 22 – 36 months) with ASD and their primary caregiver. These dyads participated in an intervention trial comparing the effects of a parent-mediated JASPER intervention and a parent education counterpart on social communication outcomes. The primary outcome was time spent in joint engagement at the 6-month follow up coded from an unstructured parent child play interaction. Upon exiting study, toddlers returned to receiving behavioral intervention hours as usual. A multiple linear regression was calculated to predict child's time joint engaged with the parent based on parent implementation fidelity and hours of behavioral intervention. This analysis controlled for autism severity (as measured by ADOS Clinical Severity Scores), IQ (Mullen developmental quotient), and time spent in the joint engagement state at exit. Insignificant predictors were excluded from presented analyses.

Results:

Parents' implementation fidelity uniquely predicted toddler's time spent in joint engagement. Parents' successful adherence to JASPER principles significantly predicted their toddlers' increased time jointly engaged ($t(61)=3.62$, $p<.005$), while toddlers' total hours of behavioral intervention during the follow-up period did not ($t(61)=-0.59$, $p = .56$). Additionally, ADOS severity and Mullen developmental quotient scores were not significant predictors of joint engagement outcomes. Toddlers' time spent jointly engaged at exit predicted time spent jointly engaged at follow up ($t(61)=3.56$, $p<.005$), indicating maintenance of joint engagement outcomes across a 6-month span.

Conclusions:

Parent's use of JASPER strategies emerged as a significant predictor of toddler joint engagement at follow-up above and beyond the effect of hours of behavioral intervention received during the follow-up period. This suggests that merely more hours accrued across numerous community based behavioral interventions do not translate to better joint engagement. Parents' implementation fidelity strongly predicted toddler's time spent in joint engagement states, further supporting the benefit of brief, specific, parent-mediated interventions. The further use of targeted parent-mediated interventions has implications to greatly reduce time and money otherwise spent on other BI resources. These findings may have practical implications for clinicians who seek to recommend interventions that successfully predict gains in the skills most impacted by ASD. Future research should investigate feasibility and effects of other parent-mediated interventions targeting core deficits of autism.

165 **110.165** Teaching Object Labeling during Play to Children with Autism Spectrum Disorders

A. D. Duenas[1,2] *and J. B. Plavnick*[1], *(1)Counseling, Educational Psychology, and Special Education, Michigan State University, East Lansing, MI, (2)Michigan State University, Okemos, MI*

Background:

Language impairment is a significant area of delay for many children with autism spectrum disorder (ASD). Children with ASD do not engage in early play interactions with adults or frequently label objects as a means to share information with others and learn about the environment. This limits their opportunities to engage in social interaction related to objects of interest (Paul, 2008). Although interventions have been developed to teach object labeling to children with ASD, these protocols are administered in highly structured arrangements separate from the naturally occurring conditions typically known to occasion language (Reichow, Barton, Boyd, & Hume, 2014).

Natural language interventions combine a behavior analytic and developmental approach to language in which an adult embeds opportunities for learning in socially relevant contexts throughout the child's daily routine (Lane, Lieberman-Betz & Gast, 2016). Despite the effectiveness of natural language training procedures for teaching requests to children with ASD, few researchers have applied a similar approach to other types of functional responses, such as object labeling. Procedures that teach object labeling within a naturalistic context need to be developed and empirically tested to offer additional instructional strategies to service providers.

Objectives:

The purpose of the present investigation was to test the efficacy of a procedure that incorporated strategies used within natural behavioral interventions for teaching requests and imitation while embedding repeated object labeling trials within a play-based routine for children with ASD.

Methods:

Three 4-year-old children diagnosed with ASD attending an Early Intensive Behavior Intervention (EIBI) program housed within a child development laboratory preschool participated. A multiple-probe across behaviors design (Gast & Ledford, 2014) was used to evaluate the effectiveness of the play-based procedure on acquisition of targeted object labels. Experimental sessions involved a play routine consisting of three distinct subroutines (e.g. pulling toys out of a box, playing with toys, and cleaning up toys). The play routine was centered on a thematic set in order to create an environment similar to those observed when children play in early childhood environments. Subroutines were developed to contrive opportunities for participants to label target stimuli three times within a session, creating a total of nine object labeling trials per session.

Results:

Participants demonstrated rapid acquisition of object labeling during the training procedure and maintained responses during a two-week follow-up probe. The results demonstrate play-based intervention procedures that mimic the conditions and environment in which language occurs may be beneficial for children with ASD.

Conclusions:

In addition to rapid acquisition of all targets, two participants for whom we administered transfer of training assessments both labeled objects in novel contexts (i.e., transfer of training). Early childhood providers rated the procedures as highly acceptable. The procedures and outcomes of the present investigation extends naturalistic interventions to teach object labeling to children with ASD.

166 **110.166** The Effect of Parental Involvement in Preschool-Based Intervention on Parent-Teacher Agreement Regarding the Adaptive Skills of Children with ASD

ABSTRACT WITHDRAWN

Background: Multi-informants' ratings of developmental and adaptive functioning form an essential tool in assessing children with autism spectrum disorder (ASD). Together, they provide an updated developmental profile of the child, essential for classification and treatment planning (McDonald et al., 2015; Klin et al., 2006). However, previous studies adressing parent-teacher agreement on children's adaptive skills, have revealed significant discrepancies between raters, when teachers' ratings were usually higher than parents' (Murray et al., 2009; Achenbach, 2011; McDonald, et al., 2016). Such disagreement between parent and teacher ratings on the functioning of children with ASD may present a challenge to both assessment and intevention planning.

Objectives: In the current study we examined whether parent-teacher agreement on the child's adaptive functioning improves when parents join a preschool-based intervention program for children with ASD. The Early Start Denver Model (ESDM) was integrated into the therapeutic program of Israeli preschools for children with ASD. Since parents play a key role in the ESDM (Rogers et al., 2012) and in order to facilitate generalization, parents joined the preschool-based program for weekly parent-child therapy sessions. Since research on the ESDM has shown strong working alliance between parents and therapists (Rogers et al., 2012), we hypothesized that the agreement between parents' and teachers' reports on child adaptive functioning will improve following this intervention.

Methods: Thirty-two children (7 girls), aged 34-58 months, from four ASD preschools in which ESDM was integrated, participated in the current study. All children received 40 hours of intervention from educators and para-professionals. Parents attended weekly parent-child therapy sessions. Teachers and parents reported on children's adaptive functioning using the Vineland Adaptive Behavior Scales (VABS-II) pre- and post- 8 months of intervention (at the beginning and end of the school year). Parent-Teacher discrepancies were assessed by comparing the standard scores.

Results: Before the intervention, significant parent-teacher discrepancies have been found, with parents rating their child higher on areas of receptive language, expressive language, and community and coping skills. Post-intervention, parent-teacher discrepancies on those areas became non-significant. However, in the area of interpersonal relationships, parents rated their children significantly higher than teachers in both pre- and post- intervention assessmants, elbait with smaller discrepancy post-intervention. In the area of play and leisure time skills parents also rated their child significanly higher than teachers, however, their reports were even higher post-intervention and the inter-rater discrepancy increased.

Conclusions: Results indicate that parental involvement in preschool-based ESDM intervention impacted on descrepencies between parents and teachers perceptions of the childs' adaptive functioning. Whereas teacher-parent agreement improved in areas of language, daily living skills and social skills, discrepancies in the area of play and leisure increased. This difference may be attributed to the new play skills provided to parents in the ESDM program, gaining increased play and leisure functioning at home that may have yielded new experiences bewtween parents and their children and higher parent ratings of their child's play skills post treatment.

167 **110.167** The Effects of Prospectively Following High-Risk Infant Siblings with ASD: Observation Positively Alters Outcome

M. Micheletti[1]*, W. Jones*[2]*, S. Shultz*[2]*, A. Klin*[2]*, S. Hoffenberg*[1]*, C. A. Saulnier*[2] *and C. Klaiman*[2]*, (1)Marcus Autism Center, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: The past 10 years have seen a substantial increase in prospective studies of the infant siblings of children with autism spectrum disorder (ASD), whose risk of also having the condition is approximately 20%. Direct observation of this population from the first months and years of life provides a unique window into the early emergence of ASD. Despite the large number of infant siblings enrolled in prospective longitudinal research, few studies have examined how this early developmental surveillance may, in and of itself, influence development. Drawing on the concept of 'the observer effect' in physics—that the act of observing a phenomenon necessarily changes that phenomenon—this study investigates how prospective longitudinal surveillance may impact the course of a child's development.
Objectives: Measure the effects of prospectively following infants later diagnosed with ASD on parent-reported first concerns, clinical presentation, and service utilization.

Methods: Children were selected to form two groups: 1) a *prospectively-followed cohort* (children who completed a prospective infant sibling study that included 10 visits from birth to 36 months); and 2) a *community-referred cohort* (children referred to the center for clinical assessment at a single time point). All children in each cohort: 1) received a clinical best-estimate diagnosis of ASD at 24-36 months; 2) had an older sibling already diagnosed with ASD; and 3) had completed measures of child demographics, development, and service use patterns. Cohorts were then matched on sex, race, cognitive ability, maternal age, maternal history of infertility, pregnancy complications, and gestational age (all factors known to impact parent-reported age of first concern), to yield final samples of n=18 prospectively-followed and n=18 community-referred.

Results: *Parent-Reported First Concerns:* Age of first concern was significantly earlier in the prospectively-followed cohort (11.7 months) than the community-referred cohort (15.5 months), $p = .039$. Furthermore, domains of first concern were more diverse in the prospectively-followed cohort (Figure 1). *Clinical Presentation:* The prospectively-followed cohort had lower ADOS severity scores ($p = .027$), and higher receptive ($p = .013$) and expressive ($p = .011$) language abilities relative to the community-referred cohort. *Service Utilization:* Although there were no differences in age at therapy onset, community-referred children were often enrolled in speech and occupational therapy, whereas prospectively-followed children were more often enrolled in comprehensive early intervention ($p = .026$). See Table 1b for all between-group comparisons.

Conclusions: Compared to a community-referred cohort, matched on age of diagnosis, sibling status, and other factors known to influence parent-reported first concerns (Table 1a), children enrolled in the longitudinal study had earlier and more diverse parent concerns, a higher enrollment rate into early intervention, and a less severe clinical presentation of autism symptom severity and language ability. These differences were observed despite similarities in nonverbal cognitive levels and parents' experience with a child on the spectrum. These findings support early developmental surveillance as a framework in which to aid parents in early identification of a broad range of ASD symptoms, and to aid in accessing early intervention services for their children, likely to have profound positive cascading effects on future development.

168 **110.168** The Stability of ASD Symptoms after One Year of Applied Behaviour Analysis

F. Rad[1]*, I. Mihailescu*[2]*, A. Buica*[3]*, M. C. Nedelcu*[4]*, C. Anghel*[3] *and I. Dobrescu*[1]*, (1)Child and Adolescent Psychiatry Department, Carol Davila University of Medicine and Pharmacy, Psychiatry Clinical Hospital Alexandru Obregia, Bucharest, Romania, (2)Child and Adolescent Psychiatry Department, Prof. Dr. Alex Obregia Psychiatry Hospital, Bucharest, Romania, (3)Child and Adolescent Psychiatry Department, University of Medicine and Pharmacy Carol Davila, Bucharest, Romania, (4)Cabinet Individual de Psihologie Maria Cristina Nedelcu, Bucuresti, ROMANIA*

Background:
To establish a diagnosis of certainty at younger ages implies certain uncertainties, especially when such a heterogeneous disorder as Autistic Spectrum Disorder is involved, all the more so as the clinical aspect is complicated with characteristic elements of ADHD. In the process of development, the symptoms may change - some manifestations become more obvious, others pass in the secondary plane. Behaviour therapy improves the characteristic deficits of the comorbidity between Autism Spectrum Disorder and ADHD (based on theoretical hypotheses and clinical observations).

Objectives:

This paper aims to analyse the evolution of children diagnosed with Autism Spectrum Disorder (ASD) comorbid with ADHD type symptoms involved in an Applied Behaviour Analysis program with the identification of potential evolutionary models.

Methods:

We conducted an observational study on a group of 52 subjects (2-5 years old) diagnosed with Autism Spectrum Disorder (according to DSM IV-TR diagnostic criteria) comorbid with ADHD-specific symptoms, without significant comorbid disorders (psychiatric and somatic). Each of the subjects included in the clinical group followed a psychotherapist-conducted applied behaviour analysis program for one year, which was structured as such: 2 hours / day, 5 days / week. To standardize behaviour intervention among subjects, supervision of the intervention programs was performed by the same psychologist for all subjects.

Data collection involves a longitudinal direction by assessing the main symptomatology domains of ASD (using ADOS scores) and ADHD (using

ADHD - RSboth at moment of inclusion in the study (T0) and after one year of applied behaviour analysis program (T1).

Results:

In our group, after one year of applied behaviour analysis (T1), only 27% of children still met the DSM IV-TR criteria for Autism (compared to 63% at T0), 50% meet criteria for PDD-NOS (compared to 35% at T0) and 23% of children no longer met the diagnostic criteria for Autism Spectrum Disorder. In other words, after therapy, the evolution was favourable for a significant number of children, with the diminishing and even disappearance of the clinical elements suggestive for ASD.

The favourable evolution of ASD symptoms after 1 year of therapy also results from the statistically significant differences between ADOS scores averages from T0 and T1 moments. Differences are established both in the total ADOS-C+Is domain and separately in each of the two domains. Also, there are statistically significant positive correlations between T0 and T1 scores. The average total score difference between the two moments is 2.44±2.72.

The results of the study show that 71% of the subjects had a favourable evolution of the ADOS-C+Is score, whereas only 32% of the subjects had a favourable evolution of total ADHD-RS score.

Conclusions:

Applied behaviour analysis significantly improves the ASD-specific symptomatology among children with ASD-ADHD polymorphic clinical features.

Behaviour therapy improves ADHD-specific symptomatology among children with polymorphic ASD-ADHD clinical features, but the observed differences are smaller than those highlighted for ASD symptomatology. The most frequent evolutionary pattern after one year of behaviour therapy is represented by the association between a favourable evolution of ADOS-G score and a stagnation of ADHD-RS scores.

169 **110.169** The Therapeutic Relationship As Outcome Predictor in Music Therapy with Children with Autism

W. Schmid[1], *C. Gold*[2] *and K. Mössler*[2], *(1)The Grieg Academy - Department of Music, University of Bergen, Bergen, Norway, (2)GAMUT, Uni Research Health, Uni Research, Bergen, Norway*

Background: Shaping sensory perceptions, regulating affective dynamics, or joining attention are abilities that enable human beings to relate. Children with an autism spectrum condition (ASC) can face challenges in all of these areas. However, their bodily and emotional expressions form and inform relational abilities. By creating music that is embodied and attuned to the child's relational resources, therapists might effectively strengthen the child's social skills on a generalized level.

Objectives: The aim of the present study was to examine whether a therapeutic relationship, in which the therapist is attuned to the child's expression and behavior, predicts generalized changes in social skills in children with ASC.

Methods: This predictor study included music therapy sessions from 48 children from 7 countries worldwide who were between 4 and 7 years of age and diagnosed with ASC. Improvisational music therapy was provided weekly over a period of 5 months. Generalized interaction skills were measured using the Autism Diagnostic Observation Schedule (ADOS) and the Social Responsiveness Scale (SRS) questionnaire at baseline, 5 and 12 months. The therapeutic relationship was assessed using the evaluation tool for Assessing the Quality of Relationship (AQR). Associations between the therapeutic relationship and generalized outcomes have been analyzed using a linear mixed effect model.

Results: This study found significant interaction effects between the therapeutic relationship and generalized changes in social skills in children with ASC. A symptom reduction as measured with the Autism Diagnostic Observation Schedule (ADOS) was found after 12 months (B = -3.89; CI = -7.51, - 0.26; p = 0.0399), if a relationship was developed in which the therapist was emotionally and musically attuned to the child's affective and relational needs. ADOS subgroup analysis showed a significant decrease of symptoms especially in the area of language and communication (B = -1.79; CI = -3.46, -0.12; p = 0.0402). Also problems in social responsiveness decreased more over the course of 5 months as measured with the SRS (B = -23.46; CI = -45.63, -1.29; p = 0.0426). However, this effect waned after 12 months.

Conclusions: These results emphasize a therapeutic relationship, in which the therapist attunes to the child's expressions musically and emotionally, as important mechanism of change. These results might challenge a behavioristic paradigm in autism treatment focusing on training strategies rather than relational factors such as affect attunement as intervention strategy to improve social skills.

170 **110.170** Types of Parent Responsiveness: Longitudinal Changes Associated with a Parent-Mediated Intervention for Children at-Risk for ASD

A. A. Alzamel[1], *D. Garrido*[2], *L. R. Watson*[3], *M. DuBay*[4], *E. Crais*[3], *G. Baranek*[5], *G. Carballo*[2], *R. Garcia-Retamero*[2] *and L. Turner-Brown*[6], *(1)Department of Allied Health Sciences, University of North Carolina - Chapel Hill, Chapel Hill, NC, (2)University of Granada, Granada, Spain, (3)Department of Allied Health Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)University of North Carolina, Chapel Hill, NC, (5)Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (6)UNC TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background:

Early interventions have effectively increased parent responsiveness (PR) to children at-risk for ASD. Few studies have examined these effects longitudinally, and little is known about the impact of interventions targeting PR on changes in parental nonverbal and verbal responses.

Objectives:

Examine longitudinal effects of a PR intervention, Adaptive Responsive Teaching (ART), on PR in parents of young children at-risk for ASD.

Methods:

Two groups of community-recruited infants at-risk of ASD and their parents were randomized to ART or to "referral to early intervention and monitoring" (REIM). Data were collected at pre-treatment (mean age:13.8 months, ART [n=45], REIM [n=42]), post-treatment (mean age: 22.5 months, ART [n=44], REIM [n= 39]), and follow-up (mean age: 53.91 months, ART [n=27], REIM [n=18]). The *Parent Responsiveness Coding System* measured PR using 5-second intervals in a 10-minute video of unstructured play. General linear mixed models examined a range of PR behaviors. Due to variance in children's chronological age (CA) at follow-up, CA was used as the metric of time for estimating outcome trajectories.

Results:

Significant group by time interaction for *total responses,* F(1, 203.097) = 5.717, *p* = .018, and *total nonverbal responses, F*(1, 205) = 4.373, *p* = .038, indicated more responses in ART compared to REIM at post-treatment, *p* = <.001, but not follow-up, *p* = >.05. For *nonverbal expansion responses,* the interaction was nonsignificant, but comparisons of predicted values suggested a similar marginal linear trend in both groups *F* (1, 207) = 3.521, *p* = .062. A marginal group by time interaction emerged for *nonverbal non-expansions, F* (1, 205) = 3.314, *p* = .070, and simple comparisons showed more ART group responses at post-treatment, *p* = <.001, but more REIM group responses at follow-up, *p* = <.001. The *total follow-in verbalizations* interaction was nonsignificant, but there was an effect of time *F*(1, 137.013) = 45.365, *p* = <.001. Similarly, only a significant effect of time was found in *follow-in directive verbalizations F*(1, 142.641) = 27.187, *p* = < .001, suggesting an increase of follow-in directive verbalizations in both groups over time. The *follow-in non-directive verbalizations* interaction was significant, *F*(1, 200.945) = 5.744, *p* = .017, and simple comparisons showed more ART responses only at post-treatment.

Conclusions:

ART was effective in increasing overall PR, nonverbal responses, and non-directive verbalizations at post-treatment, but these effects were not maintained at follow-up. Because our measure of PR heavily focused on contingency, it might not have tapped into other important aspects of PR for preschoolers. That is, contingency in PR is associated with positive outcomes for infants and toddlers, but may be less important for preschoolers, who have attained greater cognitive and linguistic competency. Future longitudinal research should examine broader dimensions of PR to determine if parents who increase their contingent responses to at-risk infants/toddlers differ in other dimensions of PR with their preschool children, such as the syntactic complexity and semantic richness of verbal responses.

171 **110.171** Using the VABS-II Item Sets As Predictors of Outcome in Preschool-Based Esdm Vs. Preschool-Based Eclectic Intervention

ABSTRACT WITHDRAWN

Background: Identification of child related factors that may serve as predictors of outcome in early intervention plays a key role in the personalization of treatments in ASD (Sherer, Schreibman & Cunningham, 2011).

Objectives: The current study aimed to identify these differential factors while comparing two types of preschool-based intervention models: The Early Start Denver Model (ESDM), a manualized early intervention, integrated into ASD community preschools in Israel, and an eclectic intervention commonly implemented in the country. Child factors were assessed utilizing content analysis of specific Vineland Adaptive Behavior Scales (VABS-II) item-sets related to play and communication skills.

Methods: Fifty-eight children, aged 35-57 months, from eight ASD preschools, participated in the current study. Thirty-three children attended preschools in which ESDM was integrated, and twenty-five children attended eclectic preschools. Groups were matched on age, developmental level and autism severity, both receiving equal numbers of therapy hours per week. Changes in children's adaptive behaviors (teacher reported VABS-II) and cognitive ability (MSEL) were measured pre- and post- 8 months of intervention. Four item-sets reflecting early behaviors that may affect treatment outcome (Vivanti et al., 2013) and may be impaired in children with ASD (Balboni et al., 2015) were chosen as predictive variables to intervention related changes in child MSEL scores. These item-sets include 'beginning to talk', 'following instructions', 'playing' and 'imitation'.

Results: The 'following instructions' item-set predicted developmental gains in the areas of expressive language, visual reception and fine motor across intervention groups. The 'imitation' item set predicted improvement for both groups in receptive language and was also found to predict greater gains in fine motor scores in the ESDM group, but not in the group receiving the eclectic intervention. However, the 'play' item-set yielded an opposite trend, predicting higher fine motor scores in the eclectic intervention group in contrast to the ESDM group. Finally, the 'beginning to talk' item-set predicted significantly higher gains in expressive language scores in the ESDM group but not in the eclectic intervention group. A similar trend was marginally significant in predicting receptive language scores (*p=0.058).*

Conclusions: Results indicate that both imitation and following instructions skills are important learning mechanisms that underlie children's ability to gain from both interventions. However, differential gains in fine motor and expressive language abilities reflect the notion that different children might gain more from different intervention models. In the ESDM model, imitation and spoken language abilities are marked as central early social learning abilities. Put together, these results further broaden current knowledge regarding child-related intervention outcome predictors. The current study also offers a possible use of the VABS-II item-sets in community settings, in order to identify children who might benefit more from the ESDM.

172 **110.172** Video Modeling Intervention for Toddlers with ASD

***M. N. Hale**[1], E. Espanola[1], A. Gutierrez[2], M. Sanchez[3], I. Deveaux[1] and N. V. Roman[1], (1)University of Miami, Coral Gables, FL, (2)University of Miami, Miami, FL, (3)Florida International University, Miami, FL*

Background: Video modeling (VM) is an empirically-supported therapeutic technique for individuals with ASD, which serves to remediate behavioral deficits and foster improvements of desirable behavior. The VM technique generally involves having an individual watch and then mimic a video model engaging in specific desirable behavior or act. The VM technique is robust in that it has been used successfully to improve behavior across a variety of skill domains including communication, perspective taking, self-care skills and play skills. VM has additional benefits of being portable, cost-effective and easily transferable. Interestingly, for some individuals with ASD, VM serves as a more effective and efficient therapeutic technique that other more traditional therapeutic strategies. However, several researchers have noted a subset of individuals with ASD for whom the VM technique appears minimally- or non-effective. Lack of responsiveness, unfortunately, serves to limit the range of potential treatment options and strategies for those individuals.

Objectives: The goal of this study was to identify toddlers with ASD who showed minimal- to no -responsiveness to the VM technique and then expose them to a systematic instructional intervention designed to improve their ability to mimic video models. Efficacy of the instructional intervention for improving responsiveness to VM technique was systematically evaluated.

Methods: Three toddlers (ages 2-4) with ASD who demonstrated limited responsiveness to VM interventions were selected to participate. Each received direct one-on-one instruction whereby they were taught to mimic a series of progressively more complex acts depicted on video. Instruction involved applied behavior analytic (ABA), discrete trial teaching technique. Efficacy and generality of the intervention was evaluated using a single-subject research design, and a multiple-baseline across individuals.

Results: Throughout the instructional intervention, all three participants demonstrated improvements in their ability to mimic actions of video models. Furthermore, post-intervention, improvements generalized to similar and more complex novel (un-trained) behavioral acts depicted via video model.

Conclusions: VM is an effective, non-invasive and robust intervention technique for individuals with ASD. However, little to no attention has been given toward the subset of individuals with ASD who do not readily respond to the VM technique. Results of this study indicate that toddlers with ASD, can be successfully taught to imitate video models and subsequently demonstrate increased responsiveness to the VM. Given the utility of VM, early intervention programs may benefit from incorporating systematic instruction on the imitation of video models as part of the curriculum.

173 **110.173** Videogame Based on Full-Body Interaction Used As a Tool to Foster Social Conducts in Children with Autism Spectrum Disorders: A Feasibility Study on Pico's Adventure

M. A. Mairena[1], *J. Mora*[2], *L. Malinverni*[3], *V. Padillo*[4], *L. Valero*[5], *A. Hervás*[5,6] *and N. Pares*[7], *(1)Hospital Sant Joan de Déu, Barcelona, Spain, (2)InflightVR Software GmbH, Barcelona, Spain, (3)Pompeu Fabra University, Barcelona, Spain, (4)Ayuntamiento de Montornès de Vallès, Barcelona, Spain, (5)Instituto Global de Atención al Neurodesarrollo (IGAIN), Barcelona, Spain, (6)Mutua Terrassa Universitary Hospital, Barcelona, Spain, (7)ICT, Pompeu Fabra University, Barcelona, Spain*

Background: Game-based interventions have shown to facilitate motivation and learning processes in Autism Spectrum Disorders (ASD). Moreover, interventions that use Information and Communication Technologies are attractive for children with ASD and have demonstrated to be useful to increase social behaviors.
Objectives: The main purpose of this project was to conduct a feasibility study to compare the amount of social initiation conducts performed during a full-body interaction videogame versus the amount of social initiation conducts occurred during a free-play activity in children with ASD. We hypothesized that the videogame could elicit a higher number of these conducts and therefore could be proposed as a tool to promote social initiation skills.

Methods: A total of 15 children (ages 4 to 6) were recruited. Diagnoses were confirmed using the Autism Diagnostic Observation Schedule (ADOS) and the Autism Diagnostic Interview-Revised (ADI-R). In order to be included in the study, subjects had to obtain cognitive capacity above 70. Children participated in four consecutive weekly sessions with two sections: a section where they played with the videogame Pico's Adventure (a Kinect-based game developed for high functioning children with ASD) and a section that just involved free play time. Sessions involved different conditions; playing alone, with a parent, and with a peer the subject did not know before. Social skills conducts were codified according to an observational scale.

Results: Results show that the videogame elicited more social initiation conducts than free play in children with ASD when playing alone [t(11)= 2,438, p= 0,033] or playing with a peer [t(13)= 3,60, p=0,003]. Furthermore, it showed to be as effective as free play in promoting social initiation while playing with parents. In addition, results indicate that repetitive behaviors were less frequent during the videogame (Mdn = 0) than during free play (Mdn = 2), Z = 2.05, p = 0.040. Along with social initiation we calculated the number of spontaneous gestures performed by the children in both Pico's Adventure and free play. Results show significant differences in emotional gestures during the two situations where the child was playing with a parent [t (12) = 2,420; p = ,032; t (12) = 2,360; p = ,036] and during a situation where the child was playing with the peer [t (13) = 2,879; p = ,013]. In the three aforementioned cases more emotional gestures were reported in Pico's Adventure than in free play. Similarly, a significant difference in the amount of pointing gestures was found between the videogame and free play.

Conclusions: The videogame Pico's Adventure elicited more social initiation behaviors than free play in children with ASD when they were playing alone or playing with a peer. The videogame was also effective in reducing repetitive behaviors and increasing both emotional and pointing gestures. Therefore, the game could be useful as a tool to increase social behaviors. Future work is needed to obtain further data that supports this hypothesis.

Poster Session
111 - Social Cognition and Social Behavior
11:30 AM - 1:30 PM - Hall Grote Zaal

174 **111.174** Celebrating in Your Success, Suffering in Your Defeat: Self-Conscious Emotion Understanding in Adolescents with Autism

K. Jankowski *and J. H. Pfeifer, University of Oregon, Eugene, OR*

Background:
A two hit model of autism argues that adolescents with ASD experience a critical secondary wave of impairments in social cognition and peer interactions, enhanced by neural maturation and socioaffective changes related to puberty. Self-conscious emotions (SCEs), such as embarrassment and pride, are complex emotions representing self-awareness, perspective-taking, and social conceptual knowledge processing. SCEs are critical for supporting/maintaining interpersonal relationships; thus, atypical SCE understanding may underlie social difficulties in ASD.

Objectives:

We investigated the subjective experience and neural correlates of SCE understanding in adolescent males with high-functioning ASD and age-matched neurotypical (NT) males.

Methods:

Study I investigated group differences in SCE attributions (the ability to recognize SCEs) and empathic SCEs (the ability/tendency to feel SCEs for others) in 56 adolescents (ASD=30, NT=26). It also explored associations with a triad of social cognitive abilities (self-awareness, perspective-taking, empathy) and autistic traits. Study II investigated the neural correlates of SCE processing in 52 adolescents (ASD=27, NT=25).

During an MRI scan, participants completed the novel Self-Conscious Emotions Task, which included 24 salient, ecologically-valid videos of adolescents in a singing competition. Videos represented two factors: emotion (embarrassment, pride) and perspective-taking (PT) demands (low, high). In low PT clips, singers' emotions matched their performance (sing poorly, act embarrassed); in high PT clips, they did not (sing well, act embarrassed). Participants rated how intensely embarrassed and proud singers felt. They made congruent ratings, which matched the conveyed emotions (rating how embarrassed an embarrassed singer felt), and incongruent ratings, which did not match the conveyed emotions (rating how proud an embarrassed singer felt). Outside the scanner, participants rated how empathically embarrassed and proud they felt for the singers and completed social cognition tasks/questionnaires.

We conducted 2(group) x 2(emotion) x 2(PT) repeated measures ANOVAs investigating inferred and empathic SCE ratings. We also conducted 2x2x2 repeated measures ANOVAs investigating neural activity across the whole brain and in regions of interest.

Results:

Groups made similarly intense inferred congruent SCE ratings; however, the ASD group made more intense inferred *incongruent* SCE ratings during high PT demands. Inferred incongruent SCE ratings correlated negatively with PT abilities and positively with autistic traits. Groups made similarly intense empathic SCE ratings, which correlated positively with self-reported empathy.

Groups recruited broadly similar neural patterns during SCE processing. However, there were group differences within social cognition regions (medial prefrontal cortex, temporal pole), modulated by PT demands, and salience (anterior insula, anterior cingulate cortex) and sensorimotor regions, modulated by the situational context (singing quality).

Conclusions:

Results reveal that adolescents with ASD can recognize SCEs and feel empathic SCEs. However, more intense incongruent SCE ratings during high PT demands suggest that emotion attributions may be more strongly impacted by the situational context. An over-reliance on contextual cues may reflect a strict adherence to rule-following and serve as a compensatory strategy for attenuated reflexive mentalizing. Additionally, adolescents with ASD broadly recruit similar neural patterns during SCE processing; however, atypicalities within social cognition, salience, and sensorimotor regions may reflect an over-reliance on abstract social conceptual knowledge. Implications for intervention are discussed.

175 **111.175** Atypical Conjunctive Visual Processing in ASD: Domain General or Face Specific?

F. Shafai[1], *M. D. Barense*[2], *S. Ferber*[2] *and R. A. Stevenson*[3], *(1)The University of Western Ontario, London, ON, Canada, (2)Department of Psychology, University of Toronto, Toronto, ON, Canada, (3)Western University, London, ON, Canada*

Background: The human face is arguably the most socially-informative visual stimulus available, conveying relevant social information such as identity and emotional expressions. Individuals with autism spectrum disorder (ASD) have demonstrated difficulties with identifying faces in a variety of studies. Eye-tracking studies have suggested that individuals with ASD may process faces atypically, but it is still an open question as to whether these differences are with faces processing per se, or with conjunctive visual processing more generally.

Objectives:

1) Determine whether conjunctive processing in ASD varies across face and object stimulus types similarly to TD.

2) Determine if atypical conjunctive processing in ASD is face specific, or is more broadly observed, in this case across stimulus ambiguity.

Methods: We used eye-tracking to assess visual conjunctive processing in a 2x2 design, varying between face and object stimuli, and high- and low-ambiguity. Pairs of face and object stimuli were presented, while individuals reported whether faces/objects were the same or different. Stimuli were either high or low ambiguity. High-ambiguity objects shared 2/3 features, while low-ambiguity shared 0/3 features. Face identities were morphed, so that low-ambiguity pairs differed by 60%, and high-ambiguity pairs by 10% (Figure 1). Eye-gaze data was analyzed based on within-item saccades relative to between-item saccades. Higher proportions of within-item saccades are representative of greater conjunctive processing (Figure 1).

The paradigm was first conducted in TD individuals (n=20), with data related to autistic traits. Following a significant finding relating ASD traits and visual conjunctive processing, we recruited an additional 33 TD (n=53 total) and 10 ASD individuals (diagnosis confirmed via ADOS, data collection ongoing) ranging in ages from children to young adults to measure between-group differences in patterns of visual conjunctive processing.

Results: The initial study of TD adults (n = 20) showed that visual conjunctive processing was significantly correlated with autism traits severity (r = -0.38, p = 0.05) – the higher the level of autistic traits, the lower the level of conjunctive processing (Figure 2A). In the primary experiment, comparing conjunctive processing with low- and high-ambiguity faces and objects across TD and ASD, we observed a significant 3-way, group-by-stimulus-by- ambiguity interaction (Figure 2B-D; $F_{(1,61)} = 4.33$, $p = 0.04$, $\eta_p^2 = 0.07$). A greater impact of ambiguity level was found for the TD group compared to individuals with ASD ($F_{(1,61)} = 3.88$, $p = 0.05$, $\eta_p^2 = 0.06$). TD participants showed greater conjunctive processing with high- relative to low-ambiguity objects (t = 8.20, p < 0.001, d = 0.89) but showed no difference for faces, as predicted (Figure 2B). Autistic individuals, however, showed no differences across any of the four conditions (Figure 2C).

Conclusions: Results from this on-going study suggest gaze patterns during visual conjunctive processing are being influenced by autism traits. As face and object stimuli were processed similarly, our results indicate that individuals with ASD are employing a more general-purpose visual processing strategy. Together, the results suggest that further investigation is warranted to characterize the relationship between autism traits and visual conjunctive processing for low- and high-ambiguity stimuli.

176 **111.176** Atypical Connectivity in Adults with Autism Spectrum Disorder during Complex Facial Emotion Recognition: An EEG Imaginary Coherence Study

M. H. Black[1,2], *T. Almabruk*[3,4], *M. A. Albrecht*[5], *O. V. Lipp*[6], *S. Bolte*[7,8,9], *T. Tan*[2,10] *and S. J. Girdler*[1,2], *(1)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)Department of Computing, Curtin University, Perth, Western Australia, Australia, (4)Computer Science Department, Omar Almukhtar University, Elbeida, Libya, (5)Curtin Health Innovation Research Institute, School of Public Health, Curtin University, Perth, Western Australia, Australia, (6)School of Psychology and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (7)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (8)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (9)Child and Adolescent Psychiatry, Center for Psychiatry Research, Stockholm County Council, Sweden, (10)School of Mechanical Engineering, Curtin University, Perth, Western Australia, Australia*

Background:

Atypical cortical connectivity is commonly associated with individuals diagnosed with Autism Spectrum Disorder (ASD). However, there is a paucity of research measuring cortical connectivity in autistic people during cognitive tasks, such as facial emotion recognition (FER). While FER is considered impaired in autistic people, the contributing mechanisms remain inconclusive. Here, electroencephalography (EEG) coherency measures were used to provide an indication of the functional communication between cortical regions during FER.

Objectives:

We examined the alpha (8-15 Hertz), theta (4-8 Hertz) and beta (16-30 Hertz) EEG imaginary coherency of autistic adults during a complex, dynamic FER task to provide insights into the mechanisms underlying altered FER.

Methods:

Twenty-two autistic adults and 24 non-autistic typically developing (TD) age, gender, and IQ matched control participants were included. They completed a complex emotion recognition task utilising stimuli selected from the Cambridge Mind Reading Face-Voice Battery (CAMs), a battery consisting of videos of male and female actors displaying positive and negative complex emotions. EEG was simultaneously recorded during the FER tasks and the imaginary part of the coherency was used as our measure of connectivity. The imaginary part of coherency is able to resolve some of the limitations associated with the regular coherence, in particular the spurious connectivity driven by volume conduction and the use of a common reference.

Results:

During positive and negative FER, autistic adults showed reduced coherency between short and long range interhemispheric electrodes and reduced long range anterior-posterior connectivity. In response to positive emotion (figure 1), this reduction in coherency was most notable in the beta band, while reduced coherency in the theta and alpha bands was most commonly observed in response to negative emotion (figure 2). These reductions in coherency were paired with an increase in short range intrahemispheric connectivity restricted to frontal and occipital regions in autistic adults.

Conclusions:

These findings suggest that altered network functioning involved in FER may contribute to FER impairments in autistic people. The fact that coherency differences between autistic and non-autistic participants differed in accordance with the emotional valence may indicate that divergent processes contribute to ASD-linked impairment during negative and positive FER. Reduced beta coherency during positive FER may indicate inadequate recruitment of task-relevant networks and reduced saliency of social information, while reduced connectivity in theta and alpha bands may indicate reduced integration of sensory systems with higher order cognitive functions (such as top-down attention allocation) during negative FER.

177 **111.177** Complex Emotion Processing in Adults with Autism: Evidence of Atypical Brain Response Modulation

M. H. Black[1,2], *K. Iyer*[3,4], *M. A. Albrecht*[5], *O. V. Lipp*[6], *S. Bolte*[7,8,9], *T. Tan*[2,3] *and S. J. Girdler*[1,2], *(1)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)School of Mechanical Engineering, Curtin University, Perth, Western Australia, Australia, (4)School of Biological Sciences, University of Western Australia, Perth, Western Australia, Australia, (5)Curtin Health Innovation Research Institute, School of Public Health, Curtin University, Perth, Western Australia, Australia, (6)School of Psychology and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (7)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (8)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (9)Child and Adolescent Psychiatry, Center for Psychiatry Research, Stockholm County Council, Sweden*

Background:

The processing of facial emotion in adults diagnosed with Autism Spectrum Disorder (ASD) is poorly understood and it is possible that past studies may not adequately reflect facial emotion recognition (FER) functioning of autistic adults. Using more socially relevant and complex stimuli may provide greater insights into the mechanisms underlying FER impairment in ASD. Electroencephalography (EEG) measures are capable of dynamically capturing electrical activity of neural networks and may provide further insights into the nature of FER impairment in adults with ASD during a complex and dynamic FER task.

Objectives:

We investigated the neural oscillations of autistic adults and non-autistic adults to provide insights into the mechanisms underlying ASD-linked FER impairment.

Methods:

Behavioural performance (accuracy) and neural oscillations of 22 autistic adults and 24 non-autistic typically developing (TD) age, gender and IQ matched controls were examined during a complex FER task. Participants were required to actively recognize positively and negatively valenced complex, dynamic facial emotion stimuli taken from the Cambridge Mind Reading Face-Voice Battery (CAMS).

Alpha (8-15 Hertz), theta (4-8 Hertz), beta (16-30 Hertz) and mu (8-12 Hertz) rhythms were extracted from the EEG data collected during the FER task. Median power values for positive and negative emotions were extracted for each frequency and electrode. EEG data were examined according to region (frontal, central, temporal, parietal, and occipital) and hemisphere (left, right) to examine potential differences in the distribution of power in the frequency bands.

Results:

Autistic adults were less accurate during facial emotion recognition, particularly in response to positive emotions. A reduction in accuracy was present concomitant with increased power primarily in the theta band in the left occipital hemisphere during positive FER. A global increase in theta activity was seen in response to negative emotions. Autistic adults also showed altered differentiation of mu rhythm activity. Mu suppression was reduced to positive emotion relative to negative emotion in autistic adults, with the opposite being true for TD adults.

Conclusions:

Increased theta power for autistic adults may represent hyper-reactivity to emotional stimuli and greater requirements for top-down cognitive control during the processing of negative emotion. Altered differentiation of the mu rhythm to emotional stimuli suggests atypical functioning of the mirror neuron system that may also contribute to ASD-linked FER impairments.

178 **111.178** Examining Complex Facial Emotion Processing in Typical Development and Autistic Traits: An Investigation of Dimensional Models of Emotion

M. H. Black[1,2], *N. T. Chen*[1,2,3,4], *O. V. Lipp*[4], *S. Bolte*[5,6,7], *M. Falkmer*[8,9] *and S. J. Girdler*[1,6], *(1)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)School of Psychological Sciences, University of Western Australia, Perth, Australia, (4)School of Psychology and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (5)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (6)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (7)Child and Adolescent Psychiatry, Center for Psychiatry Research, Stockholm County Council, Sweden, (8)Curtin University, Bentley, Australia, (9)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia*

Background:

Impairments in facial emotion recognition (FER) are commonly associated with Autism Spectrum Disorders (ASD). While longstanding research has typically shown this in clinical ASD, emerging evidence suggests that FER impairment may also extend to the broader autism phenotype including non-clinical populations with high autistic-like traits. However, the precise nature of this impairment remains equivocal. It is possible that past investigation of FER in ASD is clouded by the conceptualizations of emotion used in these studies, which rely on discrete conceptualizations or the categorization of emotions based on the valence alone. A dimensional approach, which considers emotions to arise from the intersection of independent neural systems, may provide insights into the mechanisms underlying ASD-linked FER impairment.

Objectives:

To explore the effect of autistic traits on the perception of complex facial emotions to determine what dimensions of processing may drive ASD-linked impairment in emotion processing.

Methods:

A total of 100 typically developing individuals completed the Autism Quotient (AQ) and viewed 52 complex facial emotion stimuli from the Cambridge Mind Reading Face-Voice Battery (CAMs). Participants were required to rate each stimulus based on "How you think the person is feeling" on 9-point Likert scales relating to the valence, arousal, dominance and approach dimensions. To observe the effect of autistic traits on the perception of the stimuli, correlations between AQ score and ratings on each of the four dimensions were examined. As correlations can be conducted only one dimension at a time, further analysis was subsequently conducted to calculate the absolute difference between high and low autistic trait groups within the four dimensional space whereby larger values indicated a greater degree of distance between low and high AQ groups. Individual dimensions were also examined to investigate which dimensions contributed the greatest to this difference.

Results:

Autistic traits were shown to influence the perception of emotion on all four dimensions. Correlation analysis showed that higher autistic traits were associated with more positive valence ratings for emotions labelled as 'guarded' and greater approachability ratings for 'insincere', 'confronted' and 'appalled emotions'. Higher autistic traits were also associated with lower arousal ratings for emotions labelled as 'lured'. When examining the absolute difference between high and low AQ groups within the four dimensional space, valence and arousal ratings appeared to contribute to only half of the difference between high and low autistic traits. Differences on dominance and approach dimensions appeared to account for larger differences between high and low autistic trait groups for many of the complex emotions.

Conclusions:

These findings suggest that under-examined dimensions of emotions such as dominance and approach may also underlie ASD-linked FER impairment. There is a need to consider these other underlying dimensions when examining FER impairment in clinical ASD samples to accurately capture potential underlying mechanisms.

179 **111.179** Autism Severity, Social Identity and Well-Being in Autistic Young People

K. Cooper[1] *and A. Russell*[2], *(1)University of Bath, Bath, United Kingdom, (2)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom*

Background: Autistic people are more likely to struggle with mental health problems than the general population, and autistic traits are also associated with poor psychological well-being. Individuals who strongly identify as an autistic person (referred to as autism identity) and feel positively about this identity (autism collective self-esteem) have been found to have improved mental health compared to individuals who feel negatively about their autism identity. This is consistent with findings from other stigmatised groups in the social identity literature. However there has been no research to date investigating the relationship between autism traits and autism identity in autistic people, despite the importance of these two factors for psychological well-being. Developing and maintaining a sense of affiliation with in-group members, i.e. other autistic people, may be a particular challenge for individuals high in autistic traits, due to the social communication deficits characteristic of this group.

Objectives: This study aimed to investigate the impact of self-reported autism severity on autism identity and psychological well-being in autistic young people aged 17 and 18, using well validated measures. It was hypothesised that individuals with higher self-reported autism severity would have a lower sense of autism identity and collective self-esteem, lower well-being and higher social anxiety scores.

Methods: Participants (n=49) were young people with a clinical diagnosis of an Autism Spectrum Disorder (ASD). The Social Responsiveness Scale-Short was used to divide participants into high and low severity groups, based on whether they scored above or below the average score across participants. Participants also completed two self-report measures of psychological wellbeing; the Social Anxiety Scale for Adolescents and the Warwick-Edinburgh Mental Well-being Scale. Finally, participants completed measures of their autism identity and autism collective self-esteem.

Results: A one-way ANOVA with the factor group (high vs low autism severity) was conducted with the dependent variables autism identity, autism collective self-esteem, mental well-being and social anxiety. There was no significant effect of group on autism identification or autism collective self-esteem. There was a significant effect of autism severity on mental well-being $F(1,47)=4.24$, $p=.045$, with higher well-being in the low severity group (Mean=45.7, SD=1.28) compared to the high severity group (Mean = 41.67, SD=1.47). There was also a significant effect of autism severity on social anxiety *F*(1,47)=10.69), *p*=.002, with higher social anxiety in the high severity group (Mean=68.33, SD = 2.55) compared to the low severity group (Mean = 57.28, SD = 2.21).

Conclusions: In line with the hypothesis, high autism severity was associated with lower mental well-being and higher social anxiety scores. This fits with the well-established link between autism and poor mental health. We predicted that higher autism severity would decrease sense of autism identity, however it seems that autism severity does not impact on sense of identity as an autistic person. This means that autistic individuals from all parts of the spectrum are equally likely to identify (or not identify) as autistic, suggesting that severe autistic traits are not a barrier to a sense of affiliation with other autistic people.

180 **111.180** Autistic Person or Person with Autism? the Effect of Diagnostic Terminology on First Impressions

K. M. DeBrabander, *K. E. Morrison and N. J. Sasson, University of Texas at Dallas, Richardson, TX*

Background:

The terms people use to describe autism can vary widely. Professionals continue to favor person-first language (e.g., “person with autism”), whereas members of the autism community increasingly prefer identify-first language (e.g., “autistic person”) (Kenny et al., 2016). We previously reported that first impressions of autistic adults made by their typically-developing (TD) peers improve when their diagnosis is known relative to when it is withheld (Sasson and Morrison, in press), but it is unclear whether these impressions differ depending upon how their diagnosis is described.

Objectives:

This study examined whether different diagnostic terms for autism affect how TD people form first impressions of autistic adults, and whether these patterns differ depending upon the observer’s level of knowledge and familiarity with autism.

Methods:

203 TD undergraduate raters (171 female; mean age=21.30) viewed 10 second videos of 20 autistic adults (17 male; mean age=24.5; mean full-scale IQ=106.4) performing a mock audition for a television program (see Sasson et al., 2017 for details). Individuals in the videos were labeled either as having “no diagnosis”, “has autism”, “is autistic”, “is on the autism spectrum”, “has Asperger’s”, or “has a disability”. Raters provided impressions on ten items for each video using a four point scale: six trait items (attractiveness, awkwardness, intelligence, likeability, trustworthiness, and dominance) and four intentions to interact items (e.g., likelihood of hanging out with the person; see Sasson et al., 2017). Raters also completed the Autism Awareness Scale (Gillespie-Lynch et al., 2015) and the Level of Contact Report (Holmes et al., 1999).

Results:

Using multi-level modeling, providing any label yielded more favorable impressions compared to a “no diagnosis” label (p‘s<.002). Specific comparisons of labels revealed participants labeled as autistic were rated higher on attractiveness and hanging out with compared to all other labels (p’s<.01) except has autism (p=.053), and higher on likeability compared to has a disability and on the autism spectrum (p’s<.03). The autistic label also resulted in higher ratings on intelligent compared to all other labels (p’s<.01) except for on the autism spectrum. Level of contact with autism predicted higher first impressions for participants labeled as autistic (p=.001), but lower impressions for the autism, on the autism spectrum, and Asperger’s labels (p’s<.048). Autism knowledge predicted higher first impressions when any label was provided relative to when presented as having “no diagnosis” (p=.001), but individually autism knowledge was only positively associated with the autistic label (p=<.01).

Conclusions:

Results suggest the identifying an individual as autistic evokes more favorable first impressions by unfamiliar TD observers relative to other common terms used to describe autism. The benefit of using the term autistic was particularly beneficial for those with higher autism knowledge and with personal connections to autism. Taken together, these findings indicate that the identify-first language preferred by many autistic adults results in more favorable first impressions, which in turn may increase the quantity and quality of their social experiences (Sasson et al., 2017).

181 **111.181** Can Neurotypical Adults Identify Autism Based on Brief Samples of Behaviour?

E. Sheppard[1] *and J. Macgillivray*[2]*, (1)University of Nottingham, Nottingham, United Kingdom of Great Britain and Northern Ireland, (2)University of Nottingham, Nottingham, United Kingdom*

Background:

In recent years, considerable resources have been spent on raising public awareness of autism. Autism awareness within the general population is frequently tested using questionnaires, where knowledge and understanding of autism is assessed by self-report. Recent studies have suggested that the general public has relatively good understanding of the features of autism (Dillenberger et al., 2013; Stewart et al., 2008). However, it is not known whether people bring such knowledge to bear when they encounter people with autism in everyday circumstances.

Objectives:

This study aimed to determine whether neurotypical adults could identify who does or does not have an autism diagnosis based on brief samples of behaviour. The study also aimed to determine the relationship between people’s ability to recognise autism, their knowledge of autism features, and the amount of contact thay have had with autistic individuals.

Methods:

Neurotypical adults (perceivers) watched videoclips of 20 male autistic adolescents and adults and 20 male neurotypical comparison individuals (targets), created by Sheppard et al. (2016). Each muted video showed the target’s reaction to one of four events enacted by the researcher. Targets were either told a joke, paid several compliments, told about the researcher’s unfortunate day, or kept waiting while the researcher carried out irrelevant activities.

Perceivers were told which event the target had experienced prior to each video and were asked to indicate whether or not they believed the target was autistic. They were then asked to verbally state the reason for their choice. Perceivers also completed questionnaires that tested their understanding of core features of autism and asked about the amount of contact they had had with autistic individuals.

Results:

Overall, perceivers were able to judge whether or not targets were autistic at above chance levels. However, further analysis revealed that for the waiting scenario performance was not above chance. Perceivers' ability to jduge whether or not targets were autistic correlated with the amount of contact they reported having had with autistic individuals, but not with knowledge of autism features. Perceivers' most frequently stated reasons for their choices included aspects of facial expression, references to eye movements or eye contact, comments on rapport with the (off camera) experimenter, and whether the reaction was 'normal' for the context.

Conclusions:

Neurotypical individuals are capable of judging who does or does not have an autism diagnosis based on very brief samples of behaviour. They were above chance for three of the four scenarios included in the study, suggesting that differences between those with and without autism may be more apparent in some situations than others. Along with studies that have used more implicit measures (Sasson et al., 2017; Sheppard et al., 2016), these results suggest that autistic people can be perceived differently from neurotypical individuals based on just a few seconds of their behaviour. More prior experience of autism was associated with better task performance, suggesting that neurotypical individuals can develop expertise in recognising autism through exposure, in the absence of explicit diagnostic training.

182 **111.182** Autism Spectrum Disorders in Girls and Women with Turner Syndrome

***J. Wolstencroft**[1], W. Mandy[2] and D. H. Skuse[3], (1)UCL GOS ICH, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background:

Turner Syndrome (45,X; TS) is one of the most common sex chromosome aneuploidies. It is associated with physical morbidities affecting nearly every body system, but the research into the psychological wellbeing of girls with TS is scarce and seldom systematic. Girls with TS experience social skills difficulties but the previously reported association between TS and Autism Spectrum Disorders (ASD) is controversial.

Objectives:

This study aims to determine the prevalence of autism spectrum disorders in girls and women with TS using structured psychiatric assessments and examine the profile of the social skills deficit.

Methods:

Participants (N=70) were recruited through the IMAGINE ID (national UK study of behavioural adjustment) and SOAR (social skills and relationships in Turner Syndrome) research studies. Assessments were administered online to the caregivers of girls and women with TS aged 4-20. To date a structured psychiatric interview called the Development and Wellbeing Assessment (DAWBA) has been completed by 58 families and the Social Responsiveness Scale (SRS) has been completed by 40 families. The DAWBA responses are reviewed by a psychiatrist to generate clinical diagnoses and the SRS measures autistic traits. Both instruments are widely used and validated.

Results:

21% of the girls with TS met criteria for a diagnosis of an ASD, which is substantially higher than the UK national rates of ASD in females (0.3%). Of these, on the total SRS standardised score 29% of participants scored within the 'moderate' range and 71% scored in the 'severe' range. When looking at the SRS subscales, participants meeting criteria for diagnosis scored in the 'severe' range for all subscales.

Of the girls that did not meet criteria for a clinical diagnosis of ASD, on the SRS standardised total score 18% scored in the 'normal range', 21% scored in the 'mild' range, 55% scored in the 'moderate' range and 6% scored in the 'severe' range. When looking at the SRS subscales, all participants that did not meet clinical criteria scored in the 'moderate' range for the communication as well as the restrictive interests and repetitive behaviours subscales. However, they scored in the 'mild' range for the awareness, cognition and motivation subscales.

Overall, regardless of clinical diagnosis girls with TS were the least impaired in the social motivation subscale on the SRS, where they obtained their lowest subscale scores.

Conclusions:

TS is associated with higher rates of autism compared to the UK national population. Substantial sub-diagnostic social skills difficulties were identified in the girls and women with TS who did not meet criteria for a diagnosis of an ASD, specifically in domains of social communication, as well as restrictive interests and repetitive behaviours. These difficulties warrant further research as they are likely to have a significant impact on everyday social interactions. Overall, girls with TS were the least impaired in the social motivation domain of the SRS, which may be indicative of a desire for social interactions and suggests that delivering social skills interventions may be appropriate for this group.

183 **111.183** Can You Spot a Liar? Lie Detection and Mindreading Abilities in Adults with Autism Spectrum Disorder

***C. Grainger**[1], T. Nicholson[2], S. E. Lind[3], P. Carruthers[4] and D. M. Williams[5], (1)University of Stirling, Stirling, United Kingdom, (2)University of Kent, Canterbury, England, United Kingdom, (3)Psychology, City, University of London, London, United Kingdom, (4)University of Maryland, College Park, MD, (5)University of Kent, Canterbury, United Kingdom*

Background: Detection of deception is of fundamental importance for everyday social life. Intuitively, the abilities to lie and detect lies are an aspect of mindreading – the ability to explain and predict behaviour in terms of underlying mental states (beliefs, desires, intentions etc.). People with diminished mindreading, such as those with autism spectrum disorder (ASD), might be at risk of manipulation and exploitation as a result of lie detection difficulties. However, surprisingly, no study to date has explored lie detection abilities in ASD.

Objectives: Given the important role accurate lie detection plays in everyday social interactions, it is important to establish lie detection abilities in individuals ASD. As such this research aimed to assess whether a) lie detection abilities relate to ASD traits/mindreading abilities in the general population, and b) whether lie detection abilities are impaired in adults with ASD.

Methods: In Experiment 1, performance among 216 neurotypical adults was assessed on a realistic lie detection paradigm. During this task, participants were shown interviews of individuals being questioned about whether they had cheated during a game they previously played. In all videos, the interviewee reports that they had not cheated. However, crucially, only half of the videos included individuals who had not cheated (truth-tellers) and the other half included individuals who had cheated and who lied about this in the interview (liars). Participants watched each video once and made a categorical judgement about whether the person being interviewed was lying or telling the truth about whether they cheated during the experiment. Participants also completed two classic test of mindreading ability (The 'Reading the Mind in the Eyes' task; Baron-Cohen et al., 2001, and the 'Animations Task'; Abell et al., 2000) and a measure of autistic traits (the Autism-Spectrum Quotient; AQ, Baron-Cohen et al., 2000). In experiment 2, the same battery of tasks was completed by 27 adults with a diagnosis of ASD and 27 age-, sex-, and IQ-matched comparison participants.

Results: In Experiment 1, performance among neurotypical adults on the lie detection paradigm was significantly negatively associated with number of ASD traits, but not with mindreading ability. Moreover, in Experiment 2, lie detection was significantly impaired in adults with a diagnosis of ASD relative to comparison participants. Of particular note was the finding that participants with ASD failed to distinguish truth-tellers from liars even when "transparent" behavioural cues were emitted (i.e., when judging individuals who were "bad" liars) that allowed neurotypical participants to make highly accurate judgements.

Conclusions: The results of both experiments suggest that that people with ASD (or sub-clinical ASD traits) are poorer at detecting when someone is lying. This may leave individuals with ASD open to manipulation and future research should explore the benefits of lie detection training, to help individuals with ASD recognise signs of deception.

184 **111.184** Capture the Face: Motion-Capture Patterns of Dynamic Facial Expressions in ASD

E. Zane[1]*, L. Pozzan*[2]*, Z. Yang*[3]*, T. Guha*[3]*, S. Narayanan*[3] *and R. Grossman*[4]*, (1)FACE Lab, Emerson College, FACE Lab, Boston, MA, (2)Amazon, Cambridge, MA, (3)University of Southern California, Los Angeles, CA, (4)CSD, Emerson College, Boston, MA*

Background:

Neurotypical (NT) individuals struggle to interpret emotional facial expressions of people with Autism Spectrum Disorder (ASD) (Brewer et al., 2016). Research attempting to determine why this is so has reported different findings. Some describe expressions as atypically flat in ASD (Kasari et al., 1993; Stagg et al., 2014; Yirmiya et al., 1989), while others report expressions that are less "natural" than NT individuals (Faso et al., 2015; Grossman et al., 2013).

Much of this research uses human observation to assess facial-expression quality in ASD. However, this type of subjective coding cannot elucidate underlying differences in facial movement that might lead to facial-expression ambiguity.

Objectives:

Use facial motion-capture (mocap) to objectively quantify the facial movements that make expressions of individuals with ASD difficult for NT individuals to interpret

Methods:

We presented 18 videos of actors making emotional facial expressions to 19 children and adolescents with ASD and 18 NT individuals (Age *M* = 12;8 and 12;11, respectively). Groups did not differ significantly on age, gender, IQ and language. We asked participants to mimic facial expressions they saw while wearing 32 reflective markers on their face. The movement of markers was recorded using mocap technology.

Mocap data were grouped by the Valence (positive vs. negative) and Intensity (high vs. low) of the expression being mimicked. We used Growth Curve Analysis (GCA) (Mirman, 2008; 2014) to test whether facial movement patterns were predictable by the valence and intensity of the expressed emotion and by participant group.

Results:

Facial movement patterns were significantly predicted by an interaction between group (ASD vs. TD), the Valence of the expression being mimicked (Positive vs. Negative), and the Intensity of expression (High vs. Low). This result reflects differences in facial expressions between the diagnostic groups, which vary as a function of the Intensity and Valence of the expression. Post-hoc tests within group show that Valence significantly predicts movement in the NT group, but not the ASD group. Both group's movement patterns are predicted by Intensity.

Conclusions:

For NT individuals, Intensity and Valence significantly predict facial expressions movements. For individuals with ASD, facial movement is predicted by Intensity, but not Valence. This demonstrates a lack of quantifiable differentiation between positive vs. negative expressions in the ASD group, which could provide an objective explanation for why NT individuals struggle to interpret the facial expressions of their ASD peers.

185 **111.185** Classic Social Psychological Phenomena across the Autism Spectrum: Three Empirical Tests of the Integrated Self-Categorization Model of Autism

D. Skorich*, K. Bertschy, S. A. Haslam, K. S. Karimi and C. J. Santos, University of Queensland, Brisbane, Australia*

Background: Skorich and colleagues (2016; 2017) have proposed a model of autism that integrates the theory of mind (ToM) and weak central coherence (WCC) features of the disorder, which they term the Integrated Self-Categorization Model of Autism (ISCA). This model leads to a number of novel hypotheses, in particular predicting that people with autism should be less susceptible to classic social psychological phenomena, such as ingroup favoritism, cooperative social interdependence, and outgroup homogeneity. The current paper reports 3 experiments exploring the degree to which participants show each of these effects as a function of their autistic tendencies.

Objectives: The research reported in the current paper aims to test the ISCA model, by way of 3 empirical studies investigating some of the novel hypotheses of the model. The first experiment explores the degree to which autistic tendencies relate to ingroup favoritism, the second explores the degree to which autistic tendencies relate to social interdependence, and the third explores the degree to which autistic tendencies relate to outgroup homogeneity.

Methods: All three studies were conducted online, with the Autism Quotient (AQ) used as a measure of autistic tendencies in the general population samples recruited. In the first study, participants were asked to complete the minimal group paradigm, in which participants are randomly placed into made-up groups and then asked to allocate resources to ingroup and outgroup members, as a measure of ingroup favoritism. In the second study, participants were asked to complete the prisoners' dilemma, in which participants are paired with another player and then asked to decide between mutually beneficial and individually beneficial outcomes, as a measure of their tendencies toward cooperative social interdependence. In the final study, participants were asked to rate either their own national (in)group or another national (out)group on a number of traits, as a measure of the degree to which they perceive the outgroup as more or less homogenous than their ingroup.

Results: The first study revealed a negative relationship between AQ and ingroup favoritism, such that high AQ participants showed less ingroup favoritism than low AQ participants. The second study revealed a negative relationship between AQ and cooperative, socially interdependent decisions, such that high AQ participants showed less cooperation and more competition than low AQ participants. The final study revealed that high AQ participants perceived both their ingroup and their outgroup as less homogenous than low AQ participants.

Conclusions: These results suggest that autistic tendencies are associated with decreased susceptibility to classic social psychological phenomena. Taken together, they provide strong evidence for the ISCA model, and for its contention that people with autism have a decreased tendency to self-categorize, which is related to WCC, and which results in the ToM and associated social-communication problems on which diagnosis is based.

186 **111.186** Contribution of the Social Cognition Evaluation Battery "Clacos"

E. Houy-Durand[1], *S. Morel-Kohlmeyer*[2], *A. Thillay*[3], *M. Barbier*[4], *I. Amado*[5], *L. Brenugat-Herne*[5], *I. Carteau-Martin*[6], *C. Danset-Alexandre*[5], *B. Gaudelus*[7], *J. Graux*[2], *E. Peyroux*[8], *Z. Prost*[8] *and F. Bonnet-Brilhault*[9], *(1)UMR930 Inserm, Université François-Rabelais de Tours, Tours, France, (2)UMR Inserm U930 Imagerie et Cerveau, Université François-Rabelais de Tours, CHRU de Tours, TOURS, France, (3)UMR INSERM U930, Tours Cedex 9, France, (4)UMR Inserm U930 Imagerie et Cerveau, Université François-Rabelais de Tours, TOURS, France, (5)SHU Centre Hospitalier Sainte Anne, PARIS, France, (6)groupe de travail « Cognition » - Institut de Psychiatrie - GDR 3557, TOURS, France, (7)Centre référent de réhabilitation psychosociale et remédiation cognitive CL3R-SUR, Le Vinatier Hospital, Lyon, France, (8)Le Vinatier Hospital, LYON, France, (9)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France*

Background: Autism Spectrum Disorders (ASD) is a range of neurodevelopmental disorders characterized by impairments in social communication and interaction and limited interests and repetitive behaviour according to DSM-5 (American Psychiatric Association, 2013). Although social communication impairments are probably shared across several psychiatric disorders including autism, schizophrenia, anxiety disorders and ADHD, they are not well characterized, due to a lack of standardized evaluation tools, especially in adult populations. Our multicentric research group in psychiatry GDR3557 developed since 2011 a new battery for social cognition evaluation named "ClaCoS", in order to discriminate specific profiles of social cognition disorders that could be common or specific, respectively to autism and schizophrenia (Pinkham et al., 2008). Thus, clinical evaluation of social cognition impairments is still controversial and remains poorly documented. Moreover, we considered social cognition as a multidimensional process (Pinkham et al., 2014), and examined different components some of which are known to be impaired in ASD.

Objectives: Our aim is to assess the sensibility of the 'ClaCoS' battery in the evaluation of social cognition impairments in autism. This battery examines multiple domains of social cognition, namely: subjective perception of social impairments, empathy, emotional facial expression recognition, theory of mind, attribution style (i.e. the interpretation of other people's behaviour), social perception and knowledge of social rules.

Methods: We compared the social cognition abilities of 18 autism spectrum disorders adult patients without intellectual disability and 18 neurotypically developed peers using ClaCoS.

Results: The ASD group showed deficits in facial expression recognition, empathy, theory of mind adjustment as well as social perception and convention knowledge. Furthermore, ASD adults reported subjective complains regarding their social abilities. We also showed correlations between these different components of social cognition, which suggest the relevance of our battery and its interest to discriminate possible ASD sub-group phenotypes.

Conclusions: A larger sample would be of great value to discriminate specific profiles that could be common to autism and schizophrenia. Shared social cognition profiles could help us to apply social cognitive remediation programs more adjusted to a "transnosographic" impairment following a clinical neurodevelopmental approach.

187 **111.187** Correlates of Social Functioning in Autism Spectrum Disorder and Typical Development: A Systematic Review and Meta-Regression Analysis

K. Bottema-Beutel[1], *S. Y. Kim*[1], *S. Crowley*[1] *and J. Cuda*[2], *(1)Lynch School of Education, Boston College, Chestnut Hill, MA, (2)Boston College, Chestnut Hill, MA*

Background: Differences in social functioning are a core feature of autism spectrum disorder (ASD). Several psychological constructs have been put forth as correlates of social functioning, in order to provide developmental and/or theoretical explanations for the social phenotype in ASD, as well as in typical development (Carter et al., 2013).

Objectives: The goal of this study is to synthesize literature reporting Pearson's *r* effect sizes between social functioning and 8 putative correlates, including (a) central coherence, (b) executive functioning, (c) initiating joint attention (IJA), (d) responding to joint attention (RJA), (e) theory of mind (ToM), (f) imitation, (g) symbolic play, and (h) visual attention patterns to faces. Using a meta-regression framework, we generated summary effect sizes for correlations between social functioning and each construct, for children with ASD and for children who are TD. Further, we determined if summary effect sizes differ between populations with ASD and TD.

Methods: We conducted a structured search using ERC, ERIC, Medline, PsychINFO, and ProQuest Dissertations and Theses databases. To generate summary effect sizes and to conducted meta-regressions, we used a robust standard error approach to account for the nesting of effect sizes within studies.

Results: Currently, 100 studies (nearly half from grey literature) comprising a total of 725 effect sizes have been located. Effect sizes were calculated on a total of 9,906 participants. Average chronological ages of participants was 6 years 8 months for TD children, and 16 years 5 months for children with ASD. Summary effect sizes were weak (range = .05 - .48) across all constructs for both ASD and TD groups. In the TD group, summary effect sizes were significant and positive for Pearson's *r* correlations calculated on social functioning and (a) executive function, (b) IJA, (c) RJA, and (d) ToM. The effect size for Play was positive, but not significantly different from zero. There were too few effect sizes available to calculate summary effects for central coherence and visual fixation in this group. In the ASD group, summary effect sizes were significant and positive for Pearson's *r* correlations calculated on social functioning and (a) executive function, (b) imitation, and (c) ToM. The effect sizes for central coherence, IJA, and visual fixation were positive, but not significantly different from zero. There were too few effect sizes available to calculate summary effects for RJA and symbolic play in this group. An illustration of these results can be found in Figure 1. Across all constructs, effect sizes were larger in the ASD group as compared to the TD group, even after controlling for age ($p = 0.02$). We did not find any evidence of publication bias.

Conclusions: The results of this study indicate there are only modest associations between the several psychological correlates proposed to undergird social functioning, but that associations are generally stronger in ASD. Future studies should be conducted to further investigate these associations so that summary effects can be calculated, to better understand potential moderators of these associations, and to propose novel constructs that may better explain social functioning.

188 **111.188** Does Gender Affect Mood in Children and Adolescents with Autism Spectrum Disorder?

***J. L. Lillis**[1] and M. A. Stokes[2], (1)Deakin University Australia, Melbourne, Australia, (2)Deakin University, Burwood, Australia*

Background: This study follows on from findings of high levels of anxiety, depression, suicide, bullying and loneliness in adolescents with Autism Spectrum Disorders (ASD).

Objectives: The present study investigated differences in mood between adolescents with ASD and their typically developing (TD) peers. The study also examined gender differences in the mood of adolescents with ASD. We hypothesised that adolescents with ASD would have more negative affect and less positive affect than TD adolescents. We also hypothesised females with ASD will have more negative affect than males with ASD and males with ASD will have lower positive affect than females with ASD.

Methods: We recruited 69 participants aged 10-20 years, comprising of 35 TD participants and 34 individuals independently assessed as having ASD. The study utilised the Positive and Negative Affect Schedule (PANAS) to measure mood as positive and negative affect.

Results: Independent bootstrapped *t*-tests found no differences in affect between TD participants and those with ASD, or for positive affect across gender within ASD. Importantly though, despite the hypothesis, the study found that males with ASD had significantly more negative affect than females with ASD (Cohen's $d=0.85$, $p<.01$).

Conclusions: An understanding of these gender differences in mood is needed to provide appropriate mental health services to those with ASD, and to understand what strengths may be present to better capitalize upon for those with ASD. This study recommends a focus on the communication challenges of males with ASD and how their friendship behaviours and coping strategies impact upon their negative affect levels in future research.

189 **111.189** Dyadic Physiological Interdependence and Social Reciprocity in ASD

***O. Saunders Wilder**[1], J. Sullivan[2], K. T. Johnson[1], R. V. Palumbo[2], C. Cumpanasiou[2], R. W. Picard[3] and M. S. Goodwin[2], (1)MIT Media Lab, Cambridge, MA, (2)Northeastern University, Boston, MA, (3)MIT, Cambridge, MA*

Background: Converging evidence in the social and affective neuroscience literature suggests that the same brain regions activated while experiencing emotion are also recruited when observing or inferring affective experiences in another person. This offers a potential process by which inferring another's affective state automatically influences one's own affective state. Understanding how this underlying process of *interpersonal interoceptive inference* may be impacted in individuals with social reciprocity impairment is an important step towards developing an etiological understanding of socio-affective impairment in Autism Spectrum Disorder (ASD). Interpersonal physiology may ultimately help further scientific understanding of the underlying etiology of socio-affective impairment in ASD by providing a feasible, sensitive, and interpretable means of measuring these underlying neurophysiological processes in a variety of contexts.

Objectives: In order to investigate the relationship between interpersonal physiology and social reciprocity impairment, we engaged child-parent dyads in semi-structured social-emotion regulation tasks while collecting ambulatory physiology data and a standard informant report measure of social reciprocity. In addition to simultaneous parent-child physiology, we also collected and analyzed physiological data from a researcher and the child in which they interacted with the child independent of the parent while administering several relevant presses from the ADOS-2. This allowed us to examine interpersonal physiological dynamics when a child is interacting with an unfamiliar adult, as is commonly the case in many diagnostic and assessment settings such as the ADOS-2.

Methods: Using ambulatory electrodermal activity (EDA) sensors, we collected interpersonal physiology data from 30 young children who were either typically developing (TD; N=22) or had an ASD diagnosis (N=8), their parent, and a researcher during semi-structured social interaction and emotion regulation tasks (ADOS-2; LABTAB) adapted from social presses in existing validated paradigms for assessing socio-affective functioning in young children. In addition, parents completed the Social Responsiveness Scale 2nd Edition (SRS-2) about their child, a well-validated 65-item informant-report measure of social reciprocity impairments in autism.

Results: To assess dyadic physiological interdependence, we fit a series of hierarchical linear models following the procedure used by Baker et al. (2015) with the child's EDA as the dependent variable and child movement, time, and adult EDA (either parent or researcher depending on the task being analyzed) and an interaction term consisting of adult EDA × SRS-2 Total Score as independent variables. Our results for both ASD and TD indicated a statistically significant dependence of child EDA on both adult EDA and adult EDA × SRS-2 Total Score, suggesting that physiological interdependence between adult and child was partially moderated by the child's social reciprocity impairment as measured by the SRS-2. Furthermore, a simple slopes decomposition indicated that physiological interdependence diverged significantly for children with different levels of social reciprocity impairment and varied depending on whether the child was interacting with the parent or the researcher.

Conclusions: Our findings suggest that physiological interdependence between a child and parent or unfamiliar adult is related to standard measures of social reciprocity in young children with and without ASD and may differ depending on dyad familiarity.

190 **111.190** Emotion Regulation, Emotionality, and Expression of Emotions: A Link between Social Functioning and ASD Symptoms in Children with ASD and Their Peers

N. Reyes[1]*, R. S. Factor*[2] *and A. Scarpa*[3]*, (1)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO, (2)Virginia Polytechnic Institute and State University, Blacksburg, VA, (3)Virginia Polytechnic Institute & State University, Blacksburg, VA*

Background: It is well documented that children with Autism Spectrum Disorders (ASD) experience profound social problems (American Psychiatric Association, 2013; Bauminger, 2013; Kanner, 1943), and demonstrate difficulties in emotional competence (Begeer, Koot, Rieffe, Terwogt, & Stegge, 2007; Hepburn & Wolf, 2013; White et al., 2013). To date, the link between emotional competence and social skills remains unexplored in young children with ASD.

Objectives: The goals of this study were (1) to investigate differences between emotion regulation (ER), emotionality, and expression of emotions in children with ASD and their typically developing (TD) peers; and (2) to examine the potential link between these areas of development and social skills and ASD symptoms.

Methods: Forty-six children with ASD (n=22) and their TD peers (n=24) were included in this study. The mean age for the ASD group was 69.36 months and for the TD group was 60.25 months. Parents reported information about their children's social and emotional skills on the Emotion Regulation Checklist (ER), Social Communication Questionnaire (SCQ), the Emotion Reaction Questionnaire (ERQ), Vineland Adaptive Behavior Scales–2nd Edition (VABS-2), and the Social Responsiveness Scale (SRS). Children also completed the Autism Diagnostic Observation Scheduled (ADOS).

Results: *Differences in Emotion Regulation, Emotionality, and Expression of Emotions between Groups.* Results indicated decreased ER skills, $F(1, 41) = 56.69$, $p < .001$, increased emotionality $F(1, 41) = 27.11$, $p < .001$, and decreased expression of emotions (anger, $F(1, 41) = 6.58$, $p = .014$, fear, $F(1, 41) = 4.69$, $p =.036$, and positive affect, $F(1, 41) = 13.93$, $p = .001$) in children with ASD compared to TD children.

Associations between Emotion Regulation, Emotionality, Social Skills, and Autism Symptoms. While better social skills were associated with decreased emotionality and increased expression of emotions in both groups (all p-values <0.05), better social skills in the VABS-2, r(20) = .67, $p<.05$, and the SRS-T, r(20) = -.47, $p<.05$, were linked to enhanced ER in the ASD group only. Also, enhanced ER, r(20) = -.53, $p<.05$, and increased expression of emotions, such as positive affect, r(20) = -.40, $p<.05$, and sadness, r(20) = -.50, $p<.05$, were also correlated with decreased ASD symptoms in the ASD group.

Conclusions: These results support differences in emotional competence between children with and without ASD and shed light on a potential link between social-emotional development in children with ASD. Consistent with previous research, children with ASD demonstrate decreased ER skills, increased emotionality, and decreased expression of emotions in comparison to TD peers. Further, we generally found a strong relationship between social skills and ER, emotionality, and expression of emotions in the ASD group. Thus, treatment packages that target both ER and social skills could improve the utility of these interventions (Bauminger, 2002; Scarpa & Reyes, 2011; Prizant, Wetherby, Rubin, & Laurent, 2003; Sofronoff, Attwood, & Hinton, 2005; Sofronoff, Attwood, Hinton, & Levin, 2007). Given that these specific difficulties tend to be present across the lifespan, addressing them in early childhood could ultimately improve the quality of life for individuals with ASD.

191 **111.191** Emotional Language Use in Descriptions of Social and/or Emotional Pictures By Younger and Older Children with ASD

E. J. Teh[1]*, M. J. Yap*[1] *and S. J. Rickard Liow*[2]*, (1)Psychology, National University of Singapore, Singapore, Singapore, (2)Otolaryngology, National University of Singapore, Singapore, Singapore*

Background: Compared to typically developing children, children with autism spectrum disorders (ASD) reportedly show deficits in recognizing and describing emotions in others, and may have difficulty deriving meaning in social contexts. One method used to study emotion-processing in children with ASD is indexing their emotional language production in story-telling tasks using picture-books. However, a limitation of existing studies is that experimental stimuli tend to conflate emotional and social information, making it difficult to separate deficits in the two domains. Moreover, while social and emotional processing skills improve with age in typical development, little is currently known about their development in children with ASD.

Objectives: First, we aimed to systematically investigate the effects of emotional valence and social information on the production of emotional terms in picture descriptions by children with and without ASD. Second, we aimed to examine developmental changes in these effects across younger (preschool) and older (school-age) groups.

Methods: Participants were 10 younger (5-6 years old) and 10 older (8-12 years old) children with ASD, and 20 typically developing children matched-pairwise to the participants with ASD on age, gender, non-verbal IQ (all >70), and socioeconomic status. The experimental stimuli were 48 pictures varying on valence (positive/negative/neutral) and social engagement levels (high or low). All pictures depicted one or more person(s) in common everyday situations (see example in Figure 1). Participants were asked the task prompt, *"What is happening in this picture?"*, and allowed to respond freely with their descriptions. The frequency of emotional terms produced by each group was compared across valence and social engagement conditions using mixed ANOVA.

Results: While children with ASD generally produced fewer emotional terms than the control children in all negatively- and positively-valenced conditions, we found two significant three-way interactions. First, valence effects were moderated by social engagement information differently in ASD and control groups. Children with ASD produced fewer emotional terms in high-social than low-social emotional conditions; whereas typically developing children produced most emotional terms under high-social and negatively-valenced conditions. Second, age effects were moderated by group and social engagement information. For children with ASD, emotional terms increased with age and lower social engagement; whereas for typically developing children, higher social engagement increased emotional terms in the older group only.

Conclusions: Children with ASD showed deficits in emotional language use compared to typically developing children, which remained evident despite age-based increases in production. Our results are consistent with existing studies reporting reduced use of emotional language by children with ASD, and extend them by showing that increased social information may adversely impact emotional language production in ASD. The combination of emotional and social cues appears to create a cognitive-processing overload in children with ASD. Our findings also provide preliminary support for a model of separable components of social-cognitive processing in ASD, which contrasts with integrated processing of social and emotional information in the neurotypical brain. Future research directions for social cognition and emotion-processing in ASD are suggested, as well as practical applications for researchers and clinicians in the field.

192 **111.192** Evaluations of Social Interactions By Adolescents with and without ASD

L. V. Usher[1]*, C. A. Burrows*[2]*, D. S. Messinger*[2] *and H. A. Henderson*[3]*, (1)University of Wisconsin-Madison Waisman Center, Madison, WI, (2)University of*

Miami, Coral Gables, FL, (3)University of Waterloo, Waterloo, ON, Canada

Background:

Engaging in social interactions with unfamiliar peers requires adolescents with and without autism spectrum disorder (ASD) to coordinate multiple abilities, such as managing social anxiety and employing social cognitive abilities (Aiken et al., 2014; Usher et al., 2015; Usher et al., in press). However, less is known about how adolescents evaluate their own interactions with unfamiliar peers. This study aimed to quantify adolescents' global evaluations of the first few minutes of a social interaction, and to examine dyadic associations between those evaluations and observed behavior.

Objectives:

1. Evaluate how adolescents with and without ASD evaluate brief dyadic social interactions with unfamiliar peers in terms of how well the interaction went overall and how likely they would be to continue a friendship with the peer.
2. Examine the association between adolescents' evaluations of how well the interaction went and their likelihood to continue a friendship with the unfamiliar peer.
3. Examine dyadic associations between evaluations of the interaction and likelihood to continue a friendship with observed social reciprocity and social initiative during the social interaction.

Methods:

Fifty adolescents interacted in pairs consisting of one adolescent with ASD (M_{age}=14.66, SD=1.43; $M_{VerbalIQ}$=105.00, SD=14.79) and a gender-, age-, and verbal IQ-matched unfamiliar typically developing (TD) adolescent (M_{age}=14.21, SD=1.34; $M_{VerbalIQ}$=108.48, SD=13.83). Dyads were instructed to get to know each other for five minutes. During the interaction, participants were coded for social reciprocity (seeking, eye contact, conversational efficacy, social ease) and social initiative (proportion of time talking, reversed latency to first utterance, reversed latency to first spontaneous utterance, sharing). Immediately following the interaction, each participant responded to two questions on a 5-point scale from 1 (not at all) to 5 (the most): "How well did your interaction with____ go overall?" and "How much would you want to continue a friendship with _____ after today?"

Results:

Adolescents with and without ASD comparably reported that social interactions went well, ASD M=3.80(1.04), TD M=4.00(.96) and that they would continue a friendship with the peer, ASD M=3.24(.93), TD M=3.08(1.19). Ratings of the interaction and likelihood to continue a friendship were significantly associated within person, ASD *r*(25)=.44, *p*=.027, TD *r*(25)=.62, *p*=.001. Neither rating was significantly associated with age, IQ, or ASD symptoms for either group, *p*s>.05.

Across both diagnostic groups, adolescents who displayed higher reciprocity rated the interaction as having gone well overall, b=.64, t(33)=2.95, p=.006. Adolescents with higher social initiative rated the interaction as having gone well overall, b=.57, t(41)=2.82, p=.007, and were likely to want to continue a friendship with the peer, b=.71, t(33)=3.17, p=.003.

Adolescents whose peers displayed more reciprocity were likely to want to continue a friendship with the peer, b=.48, t(39)=2.09, p=.043. Those whose peers displayed more social initiative rated the interaction as having gone well overall, b=.46, t(36)=2.22, p=.033.

Conclusions:

Findings reveal comparable associations between positive evaluations of social interactions and observed social behavior for adolescents with and without ASD. Future research investigating how specific aspects of the interaction impact adolescents' evaluations over time would provide a fuller picture of social dynamics during this developmental stage.

193 **111.193** Examining Reciprocal and Predictive Relations Among Social, Language and Emotion Regulation Skills across Early Childhood in a Longitudinal Sample of Children with ASD.

V. P. Reinhardt[1], *J. B. McCauley*[2], *C. W. Nordahl*[3], *D. G. Amaral*[3] *and M. Solomon*[4], *(1)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (2)UC Davis MIND Institute, Sacramento, CA, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (4)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA*

Background:

Developmental science draws on transactional models to understand stability and change across the lifespan (Sameroff & Mackenzie, 2003; Gottlieb, 2001). Phenotypic presentations of Autism Spectrum Disorder (ASD) are dynamic across development, and variability in individual symptom presentation is well documented across the lifespan. Early social and language skills predict later language, developmental, and social outcomes in ASD (Landa & Kalb, 2012; Smith, Mirenda & Zaidman-Zait, 2007), and emotion regulation (ER) skills have been identified as a key predictor of social and academic development within typically developing (TD) samples (McClelland & Cameron, 2011). Understanding how social, language, and ER skills interact to influence development may provide insight into the mechanisms and processes underlying developmental heterogeneity in ASD.

Objectives:

(1) To examine the stability of and reciprocal relations between social and language skills across early childhood, and (2) To model predictive relations between early ER and later social and language skills during this period.

Methods:

Participants were 277 children with ASD (26% female) drawn from the Autism Phenome Project (APP) at UC Davis MIND Institute. The APP is an ongoing longitudinal investigation of young children with ASD and TD. Participants completed comprehensive behavioral evaluations at study visits 1 (M_{age} = 35.67 months; SD = 5.68) and 3 (M_{age}=66.77 months; SD= 10.23). ASD diagnoses were confirmed using the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R).

Models were developed to represent social, language, and ER latent variables using parent ratings (Vineland Adaptive Behavior Scales; Child Behavior Checklist; Social Responsiveness Scale) and clinician administered measures (ADI-R; ADOS; PPVT-III; Mullen Scales of Early Learning;

Differential Ability Scales-II). Measurement models at visits 1 and 3 evidenced good fit (CFI/TLI > 0.93; SRMR <.08; RMSEA < 0.08). Latent variables allow for the estimation of specific constructs using multiple sources of information, while taking the contributions of measurement error into account, providing a more robust estimate of the hypothesized construct (Kline, 2016). Predictive and reciprocal relations between ER, and social and language skills were examined using structural equation modelling, controlling for the influence of early nonverbal IQ.

Results:

Models were estimated using MPlus software 7.4. Results documented stability in language ($\beta = 0.80$; $p < 0.001$) and social skills ($\beta = 0.63$; $p < 0.001$). Early language skills predicted later social skills ($\beta = 0.23$, $p < 0.001$), while early social skills did not account for unique variance in later language ($\beta = 0.06$, $p = 0.47$). Predictive associations were observed between early ER and later social skills ($\beta = 0.19$, $p < 0.05$), with fewer ER difficulties predicting better social skills. ER was not associated with later language.

Conclusions:

These findings suggest that early ER and language skills contribute to variation in social development in ASD. Social and language abilities were relatively stable across early childhood. Further investigation into the mechanisms by which early ER and language skills impact social development is necessary. Illuminating these pathways contributes to increased understanding of the developmental heterogeneity in ASD, and may inform assessment and intervention practices.

194 **111.194** Examining the Intertwined Development of Prosocial Skills and ASD Symptoms in Adolescence

A. M. Sluiter-Oerlemans[1], *N. N. J. Rommelse*[2,3], *J. K. Buitelaar*[4,5] *and C. A. Hartman*[1], *(1)Department of Psychiatry, Interdisciplinary Center Psychopathology and Emotion Regulation (ICPE), University Medical Center Groningen, Groningen, Netherlands, (2)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (3)Department of Psychiatry, Donders Institute for Brain, Cognition and Behaviour, Radboud university medical center, Nijmegen, Netherlands, (4)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (5)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands*

Background:

Autism Spectrum Disorder (ASD) and reduced prosocial behaviour are strongly intertwined. However, social interactions with peers may be increasingly practiced over the course of development and may instigate a reduction in ASD symptoms and vice versa. This may particularly hold during adolescence, a crucial phase for developing long term social relationships.

Objectives:

The current study set out to examine if, during adolescence, possible improvements in prosocial behaviors and ASD symptoms may benefit one another over time.

Methods:

Participants were 2,773 adolescents from the Tracking Adolescents' Individual Lives Survey (TRAILS) cohorts. Measurements took place over three waves (mean ages: 11.1y, 13.4y, and 16.2y). Parent-reported ASD symptoms were measured using the Child Social Behavior Questionnaire (CSBQ). Prosocial skills were teacher-rated, representing real life prosocial behaviors towards peers in a classroom setting, an important developmental context in adolescence. Longitudinal associations between prosocial skills and ASD symptoms were examined using the random intercept cross-lagged panel model (RI-CLPM). In addition to estimating the stable, between-person associations, the dynamical effects between prosocial skills and ASD symptoms over time were estimated at the within-person level. We tested whether the model fitted equally well across gender (male, female), cohort (population, clinically referred), and diagnostic status (ASD cases versus non-cases). In addition, we reran the model separately for social and communication behaviors and for stereotypic interests and repetitive behaviors to test whether the association between prosocial skills in the classroom and ASD depended on type of ASD symptoms.

Results:

At the between-person level, prosocial skills and ASD symptoms were substantially negatively correlated. At the within-person level, a small and unexpected positive cross-lagged effect from wave 1 ASD symptoms on wave 2 prosocial skills was observed, see Figure 1. For prosocial skills, no associations were found at the within-person level. Fixing across gender, cohort and for ASD versus non-ASD did not significantly impair model fit. The parameter estimates for social and communication symptoms were highly similar to the parameter estimates of the full model. The cross-lagged effect from wave 1 stereotypic and repetitive behaviors to wave 2 prosocial skills was not significant.

Conclusions:

We added to the existing literature by showing that, in addition to replicating the already firmly established between-person association between low prosocial skills and ASD, we found no evidence that improvements in ASD symptoms and in prosocial skills over time during adolescence do not appear to influence each other for the better.

195 **111.195** Examining the Relationship between Level of Autistic Traits, Social Anxiety, and Social Network Size Among First Year University Students

J. Lei[1], *A. Russell*[2], *C. Ashwin*[3] *and M. Brosnan*[4], *(1)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (3)University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (4)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background: Students transitioning to first year of university encounter significant changes in their social network size (SNS) and composition, which have been associated with perceived social support (PSS) and transition outcome. Factors known to affect social communication such as autistic traits and social anxiety may play a role in these relationships but have not yet been examined. High rates of social anxiety co-occur in individuals with Autism Spectrum Disorder. Investigating the role of such factors will help stakeholders better understand student vulnerabilities relevant to planning transitional support services, to ultimately improve educational outcomes.

Objectives: Evaluate the relationship between level of autistic traits, social anxiety, SNS, network composition, and PSS among typically developing (TD) first-year university students. We hypothesised that: 1) higher levels of autistic traits will be related to smaller SNS; 2) this relationship will be mediated by co-occurring level of social anxiety; 3) bigger SNS will be related to higher levels of PSS; 4) networks of individuals with higher autistic traits will contain lower proportion of friends and higher proportion of family members.

Methods: First-year TD university students (N=92; 79F/13M; Age M = 18.21) completed online questionnaires during the first week of autumn semester. For SNS, participants named up to 20 individuals they considered important to them and with whom they had been in contact with over the past 3 months. Social network composition was indexed by type of relationship between self and the named individual (i.e., family, friends, teachers etc). Participants completed self-reported measures of autism traits (Autism Quotient-Short version (AQ-S)), social anxiety (Social Anxiety Scale –Adolescent version (SAS-A)), and PSS (Multidimensional Scale for Perceived Social Support (MSPSS)). Controlling for age and sex, we conducted partial correlation to assess the relationship between level of autistic traits, social anxiety, SNS, network composition, and PSS, and a mediation analysis to examine social anxiety as a mediator between level of autistic traits and SNS.

Results: Participants reported a large range of autistic traits, social anxiety, SNS, and PSS (Table 1). Consistent with hypotheses 1,2, and 3, a smaller SNS was associated with higher levels of autistic traits (r = -.212, p = .045), higher social anxiety (r = -.415, p = .000), and lower PSS (r =.233, p = .027). Higher level of autistic traits significantly correlated with higher social anxiety (r = .571, p = .000). Social anxiety fully mediated the relationship between level of autistic traits and SNS (Sobel's Z = -3.169, p =. 002; Figure 1). Hypothesis 4 was not supported, no significant relationship between autistic traits and proportion of family/friends in social network were observed.

Conclusions: Findings show that autistic traits in first-year university students are negatively associated with SNS, and this association is mediated by social anxiety. SNS is positively related to how supportive students viewed networks. Higher level of autistic traits may be related to having fewer relationships in general, but not disproportionately fewer friends. Implications of the findings include recommendation that transitional interventions should aim to support students in overcoming anxiety about social situations.

196 **111.196** Measuring Social Networks and Perceived Social Support in Autism Spectrum Disorder: Development and Feasibility Pilot Study of an Online Tool

J. Lei[1]*, A. Russell*[2]*, C. Ashwin*[3] *and M. Brosnan*[4]*, (1)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (3)University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (4)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

Social networks are complex, multi-dimensional, and difficult to measure. Adolescents with Autism Spectrum Disorder (ASD) receive support from their social network members to meet different academic, daily-living, and social demands. Understanding individual differences in adolescents with ASD's social network structure (SNS) and how they perceive support provided by network members, offer a valuable perspective to help stakeholders plan more focused and effective support.

Objectives:

1) Develop an online questionnaire to characterise differences in SNS and perceived social support (PSS)

2) Explore the relationship between SNS and autism symptom severity

Methods:

Previous research informed generation of items in a novel online questionnaire (delivered via Qualtrics) relating to SNS and PSS, which was tested in a feasibility pilot with 10 high-functioning adolescents with ASD (8M/2F) aged 17-19 years old (M;SD = 17.90;0.74). For SNS (i.e., size, composition, density), participants: 1) named up to 20 individuals they considered to be important to them and have been in contact with over the past three months (size); 2) stated their relationships with self (composition, i.e., family, friends, or "other": teachers/support workers etc); 3) reported whether each pair of individuals they named knew and were in contact with each other (density). For PSS, participants reported the types, frequency, and perceived quality of support provided by each network member across academic, daily-living, and social domains (5 items/domain). Parent-reported Social Communication Questionnaire (SCQ) measured autism symptom severity. Verbal and written feedback about the questionnaire was gathered. Preliminary analysis used Pearson's correlations, though is constrained by the small sample size.

Results:

Participants found items to have good face validity, and took ~20 minutes to complete. A wide range of social network size (M(SD) = 11.2(6.49) people) and density (M(SD) =0.55(0.28)) were reported, and can be presented visually using Gephi (Figure 1). On average, participants named 3.8 family members, 5.9 friends/acquaintances, and 1.5 "other" members. Social network size was not associated with autism symptom severity (r = .127, p = .726). Networks of participants with higher autism symptom severity were associated with lower proportion of friends (r = -.689, p = .028), and higher proportion of "other" members (r = .760, p = .011). Higher network density was associated with smaller size (r =-.867, p = .001), and a higher proportion of family members (r = .69, p = .027). Of the network members reported to provide support for each participant, differences in frequency and quality of PSS were observed (Figure 2).

Conclusions:

Participants reported good acceptability and feasibility of this novel online questionnaire that characterised individual differences in SNS and PSS. Participants perceived family members to provide better daily-living support, friends better social support, and "other" members better academic support, findings consistent with intuitive hypothesis suggesting that the online tool can help discriminate different social network dimensions. Feedback about item phrasing and streamlining have been incorporated for the next stage of the research. Stakeholders can benefit from considering individual differences in both SNS and PSS, and help social network members provide more focused support for adolescents with ASD.

197 **111.197** Examining the Relationship between Social Anxiety and Quality of Social Skills Among Adolescents with ASD Following the UCLA PEERS® Intervention

J. Wu[1]*, P. Johnson*[2]*, N. E. Rosen*[3]*, M. Jolliffe*[3] *and E. A. Laugeson*[3]*, (1)PEERS lab: UCLA PEERS Clinic, Los Angeles, CA, (2)UCLA PEERS Clinic, Los Angeles, CA, (3)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background: Deficits in social skills, such as poor reciprocal social communication, restricted interests, and repetitive behavior are hallmarks of those with Autism Spectrum Disorder (ASD; Murphy et al. 2016). As a result of these deficits, adolescents with ASD often experience less successful implementation of social skills and integration into social settings (Little et al. 2014). These difficulties in social integration often contribute to the development of anxiety, which tends to worsen during the adolescent years (White et al. 2009). Previous research on the UCLA Program for the Education and Enrichment of Relational Skills (PEERS®), an evidence-based social skills intervention for adolescents with ASD, demonstrates improved social skills following treatment (Laugeson et al. 2012). However, the extent to which social anxiety at baseline predicts social skills outcomes has yet to be examined.
Objectives: The present study examines the relationship between social anxiety and improved social skills among adolescents with ASD following a 16-week social skills intervention.

Methods: Participants from two cohorts included 98 adolescents (males=84, females=14) with ASD ranging from 11-17 years of age (M=13.86; SD=1.68) and their parents, who participated in a parent-assisted intervention, and a separate group of 73 adolescents (males=59; females=14) with ASD ranging from 12-18 years of age (M=15.05; SD=1.71), who participated in a school-based intervention. Adolescent participants had clinically-elevated ASD symptoms as determined by the Social Responsiveness Scale-2 (SRS-2; Constantino, 2012) and clinically-elevated social anxiety as determined by the Social Anxiety Scale (SAS; La Greca, 1999). Baseline social anxiety was measured using adolescent- and parent-reported SAS scores prior to intervention. Participants then completed a 16-week parent-assisted or school-based PEERS® social skills intervention. Treatment outcome was assessed by examining parent-reported change in social skills using the Social Skills Improvement System (SSIS; Gresham and Elliot, 2008) and change in social responsiveness on the SRS-2 pre- and post-intervention.

Results: Simple linear regressions revealed that baseline adolescent- and parent-reported social anxiety scores were not significantly related to change in social responsiveness on the SRS-2 in the parent-assisted sample (F=.213, p>.10, R^2=.002; F=.116, p>.10, R^2=.001). Likewise, social anxiety was not predictive of change in social skills (F=.352, p>.10, R^2=.004; F=.169, p>.10, R^2=.002) or problem behaviors (F=.084 p>.10, R^2=.001; F=1.743, p=.190, R^2=.019) on the SSIS in the same sample. In the school-based sample, simple linear regressions also revealed that baseline adolescent- and parent-reported social anxiety scores were not significantly related to change in social responsiveness (F=2.201, p=.143, R^2=.031; F=.009, p>.10, R^2=.000), social skills (F=.490, p>.10, R^2=.007; F=.828, p=.366, R^2=.012), or problem behaviors (F=.087, p>.10, R^2=.001; F(1.72)=.005, p=.945, R^2=.000).

Conclusions: Findings reveal that adolescent baseline social anxiety, though a common comorbid symptom of ASD, is not predictive of improvement in social responsiveness or social skills behavior among adolescents with ASD following the PEERS® intervention in parent-assisted and school-based settings. These findings are encouraging in that they suggest that adolescent anxiety does not appear to impact treatment outcome following PEERS®.

198 **111.198** For Better or for Worse? Social Camouflaging, Mental Health and Wellbeing in Autistic Adults.

L. Levy[1], *L. Hull*[2], *M. C. Lai*[3,4,5,6], *S. Baron-Cohen*[4], *C. Allison*[4], *P. Smith*[7] *and W. Mandy*[2], *(1)University College London, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan, (4)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (5)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (6)Centre for Addiction and Mental Health, Toronto, ON, Canada, (7)University of Cambridge, Cambridge, United Kingdom*

Background: Social camouflaging is the name given to the social coping strategies used by autistic people to cover up their autism in order to 'pass' as neurotypical (Tierney, Burns & Kilbey, 2016). Previous work on this phenomenon has been predominantly qualitative and focused on the experiences of autistic adults. In such studies, participants report benefits of social camouflaging, for example as a way of fitting in, 'feeling normal' and making connections. However, they also identify costs, stating that social camouflaging can be draining, stressful and can feel inauthentic (Hull et al., 2017). To date, only one published study has examined social camouflaging using quantitative methods (Lai et al., 2016), finding that higher levels of social camouflaging predicted higher levels of depression in men, but not women. Thus, whilst social camouflaging is common amongst autistic people, little is known about its associated costs and benefits.
Objectives: To investigate the costs and benefits of social camouflaging by investigating its links to internalizing disorders (social anxiety, generalized anxiety and depression) and wellbeing amongst autistic adults.

Methods: Participants (315 autistic adults aged 18-75; 177 female) were recruited online and via autism networks, and completed a series of well-validated self-report questionnaires measuring internalizing problems (social anxiety, generalized anxiety and depression) and wellbeing. A recently-developed, validated quantitative measure of social camouflaging, the Social Camouflaging in Autism Questionnaire (SCAQ) was used (Hull et al., 2017). In addition, demographic characteristics and autism severity were assessed.

Results: Females (mean=169) had higher average SCAQ scores than males (mean=102; p<.001, d=.56), though social camouflaging was common in both males and females. For males and females, SCAQ scores did not significantly differ based on either occupation status (in education, training or employment vs not in education, training or employment) or relationship status. In analyses controlling for autism symptom severity, higher SCAQ scores predicted higher scores on all measures of internalizing psychopathology; for social anxiety (p <.05; β=.298), generalized anxiety (p <.001; β=.331) and depression (p <.05; β=.214). None of these effects were moderated by gender; they were observed in males and females. There was no significant association between SCAQ score and wellbeing score.

Conclusions: This is the most comprehensive quantitative study to date on mental health difficulties associated with social camouflaging. Preliminary findings suggest that on average, females engage in higher levels of camouflaging than males as measured by the SCAQ. Nevertheless, in this sample social camouflaging was widespread in both genders, challenging the idea that camouflaging is primarily a female phenomenon. Further, our findings accord with reports in the qualitative literature (Bargiela et al., 2016; Hull et al., 2017), that social camouflaging is a risk factor amongst autistic people for the development of internalizing problems. Further longitudinal work is needed to investigate whether social camouflaging really is a causal risk factor for internalizing problems of autistic people

199 **111.199** Higher Tonic Alerting and Lower Reactivity to Exogenous Stimuli Predict Social Cognition in Autism: A Pupillometry Marker of Sensory Processing

N. Mueller[1,2], *L. Poustka*[3] *and C. M. Freitag*[4], *(1)Department of Child and Adolescent Psychiatry and Psychotherapy, University Hospital Frankfurt, Frankfurt, Germany, (2)none, none, Germany, (3)Medical University of Goettingen, Goettingen, Germany, (4)Autism Research and Intervention Center* *of Excellence Frankfurt, University Hospital Frankfurt, Frankfurt am Main, Germany*

Background: Aberrant attentional function in autism spectrum disorder (ASD) was proposed to explain impaired social cognition, although empirical evidence is sparse. Previous findings indicated elevated tonic alerting and attenuated orienting as aberrant attentional functions in ASD. Deviant activity of the locus coeruleus – norepinephrine (LC-NE) system was assumed as underlying mechanism, which can be captured by pupillometry. Here, we investigated the effect of attentional function represented in pupil dilation (PD) during sensory processing of social stimuli on social cognition performance.

Objectives: (1) We hypothesize a distinct PD time course in ASD characterized by the metrics of elevated tonic dilation and delayed pupillary reactivity. (2) We assume principal components within the PD time course to represent attentional functions of alerting and orienting, which correlate with the time course metrics of the PD time course. (3) These principal components are hypothesized to predict social cognition performance, with a negative effect of elevated early alerting and a positive effect of intermediate orienting moderated by ASD group affiliation.

Methods: 23 adolescents with ASD and 23 neurotypical controls (TD) matched for age, gender, and verbal IQ were included. Pupillometry was carried out while participants worked on a validated social cognition test (MASC) consisting of dynamic social stimuli. Video stimuli are each followed by a related social cognition question. Between-group variation of PD time course was estimated by linear mixed models (LMMs) controlling for random effects of participant. PD time course was segmented to attentional-function components by principal component analysis. Factors indicating differential attention functions were correlated with time course metrics derived from previous studies and applied to predict social cognition performance.

Results: A distinct pupil-dilation time course in autism was indicated by the best-fit LMM with a significant interaction of group x time course on PD. The distinct time course was characterized by increased relative tonic dilation and elevated dilation latency compared to TD (d = .50 - .54). Three attentional-function components were extracted from the PD time course. An early alerting/pupillary-light-reflex (PLR) component positively correlated with relative tonic dilation, and an intermediate orienting component negatively correlated with dilation latency. We also extracted a late attentional control component. The three attentional-function components and group affiliation substantially predicted social cognition performance with $F(15, 30) = 2.32$, $p = .02$, R^2 *adj.* = .31. Significant interactions indicated an enhanced negative effect of early alerting/PLR (ASD: $\beta = -.36$, TD: $\beta = -.27$, *partial* $\eta^2 = .17$), and a positive effect of intermediate orienting specific to the ASD group (ASD: $\beta = .45$, TD: $\beta = -.04$, *partial* $\eta^2 = .16$).

Conclusions: A distinct pupil-dilation time course in ASD predicted impaired social cognition performance. Higher relative tonic dilation suggested increased tonic LC-NE activity as underlying mechanism of elevated tonic alerting. Elevated tonic LC-NE activity may attenuate reactivity to exogenous stimuli as represented by elevated dilation latency in ASD. This likely impairs sensory processing of dynamic and complex environments as indicated by lower social cognition performance. Pupil-dilation time course is outlined as promising biomarker for future ASD research.

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111.200 Imagination Matters: Effects of Autistic Traits on Stereotyping and Stereotype Reduction in Non-Clinical Population

L. S. Iao *and E. Jones, Department of Psychology, Nottingham Trent University, Nottingham, United Kingdom*

Background: Stereotyping heuristically provides perceivers with information that are necessary in social contexts. As an energy-saving device, stereotyping may be useful for individuals with Autism Spectrum Conditions (ASC) who find social situations taxing although recent studies suggested reduced implicit stereotyping in ASC. Recent research also showed that elaborated imagined contact (EIC) reduces stereotypes, suggesting a relationship between imagination and stereotyping. Given that individuals with ASC also tend to have difficulties in spontaneous imagination, this study investigated stereotyping and stereotype reduction in ASC, focusing on the traits related to social and imagination skills.

Objectives: This study investigated whether ASC traits were related to stereotyping on one recent prominent target of stereotyping (i.e., Muslims) and whether ASC traits had an effect on the effectiveness of EIC in reducing stereotypes.

Methods: Sixty-one native English-speakers (53 females; mean age = 21.41 years, *SD* = 3.31 years, range = 18 – 38 years) who were not Muslims first completed the Autism Spectrum Quotient questionnaire (AQ; Baron-Cohen et al., 2001) and the stereotype endorsement scale (SES; Feret, Conway & Austin, 2006), which was adapted to assess stereotypes on Muslims. They then participate in an EIC task and completed the SES for a second time.

Results: The total AQ score and the Imagination subscale score (ISS), but not the Social Skills subscale score, were correlated with the first SES score. A 2x2 mixed ANOVA with group (low vs. high AQ score) and time (before vs. after EIC) showed a main effect of time, $F(1, 59) = 35.92$, $p < .001$, suggesting that the SES scores after EIC ($M = 61.48$, $SD = 5.39$ for the low AQ group and $M = 62.72$, $SD = 3.81$ for the high AQ group) were significantly lower than those before EIC ($M = 66.72$, $SD = 5.58$ for the low AQ group and $M = 67.34$, $SD = 5.82$ for the high AQ group). There was no other main effect or interaction. Another 2x2 mixed ANOVA with group (low vs. high ISS) and time showed a main effect of time, $F(1, 59) = 34.64$, $p < .001$, and a significant interaction, $F(1, 59) = 8.27$, $p < .01$. There was no other main effect. Post hoc tests indicated that EIC significantly reduced the SES score from 64.73 ($SD = 4.99$) to 62.38 ($SD = 4.70$) for the low ISS group ($p = .05$) and from 68.77 ($SD = 5.59$) to 61.94 ($SD = 4.64$) for the high ISS group ($p < .001$). Moreover, the high ISS group had a higher SES score than the low ISS group before EIC ($p < .01$) but not after EIC ($p = .72$). These findings suggested that EIC was more effective for the high ISS group due to a higher SES score before EIC.

Conclusions: Individuals with higher ASC traits, particularly traits related to imagination, were more likely to show enhanced explicit stereotyping on Muslims. Moreover, EIC was effective in reducing stereotypes across the autism spectrum in a non-clinical population.

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111.201 Impairments in Cognitive Empathy and Alexithymia Occur Independently of Executive Functioning in College Students with Autism

T. Ziermans[1]*, Y. de Bruijn*[2]*, R. Dijkhuis*[3]*, W. G. Staal*[4,5,6] *and H. Swaab*[2]*, (1)University of Amsterdam, Amsterdam, Netherlands, (2)Leiden University, Leiden, Netherlands, (3)University of Leiden, Leiden, Netherlands, (4)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (5)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (6)Institute for Brain and Cognition, Leiden University, Leiden, Netherlands*

Background: Impairments in the cognitive domains of empathy and alexithymia are commonly reported across the autism spectrum and are associated with social dysfunction. Such cognitive impairments in autism may arise as the result of underlying differences in executive functioning (EF), although previous findings are inconclusive about their relative contribution. Furthermore, it is unknown whether such cognitive domains are relatively spared in intellectually advanced individuals with autism spectrum disorder (ASD).
Objectives: To examine whether college students with ASD experience difficulties in empathy and alexithymia, and whether this can be partially explained by their cognitive levels of EF.

Methods: The ASD sample consisted of 51 college students, aged 18.3 to 28.1 years old, 72% male. This group was compared to an age- and gender-matched group of typically developing students (n = 29) on empathy and alexithymia, as measured with well-validated parent- and self-report questionnaires. Furthermore, a broadly used cognitive test battery was used to measure EF. For the ASD group, associations between the relevant constructs were further investigated with analyses of covariance and regression analyses.

Results: The ASD group scored significantly higher on cognitive alexithymia (d = 0.70) and lower on cognitive empathy (d = 0.84), while no group differences on the affective components appeared. The difference in cognitive empathy remained significant after controlling for the potential influence of (cognitive) alexithymia. No significant relations between executive functioning and cognitive alexithymia or empathy were detected.

Conclusions: Intellectually advanced individuals with ASD experience serious impairments in the cognitive processing of social-emotional information. However, these impairments cannot be attributed to individual levels of EF. This suggests that interventions aimed predominantly at enhancing EF skills are likely to have limited benefits for social-emotional information processing in ASD individuals with intact intellectual functioning.

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111.202 Implicit Versus Explicit Metacognition in ASD

D. M. Williams[1], *T. Nicholson*[2], *C. Grainger*[3], *P. Carruthers*[4] *and S. E. Lind*[5], *(1)University of Kent, Canterbury, United Kingdom, (2)University of Kent, Canterbury, England, United Kingdom, (3)University of Stirling, Stirling, United Kingdom, (4)University of Maryland, College Park, MD, (5)Psychology, City, University of London, London, United Kingdom*

Background: The few existing studies of metacognitive monitoring (awareness of one's own mental states/cognition) in ASD have employed tests that require participants to make explicit judgements about the state of their own knowledge. The closer the correspondence between *judgements* of one's knowledge and *actual* (objectively-measured) knowledge, the more accurate metacognitive monitoring is. Findings using such explicit tasks have been mixed. In the current investigation, we employed not only a standard test of explicit metacognitive monitoring, but also a paradigm adapted from one used in comparative psychology to assess metacognitive monitoring non-verbally/implicitly.
Objectives: The aim of the present study was to investigate implicit *and* explicit metacognition, and their relations to mentalizing ability, in ASD.

Methods: 21 participants with ASD and 21 age- and IQ-matched comparison participants completed an "uncertainty monitoring" paradigm based on that used among non-human primates. This involved a visual discrimination task (e.g., judging the most pixelated of two squares). On each trial (see Figure 1), two squares and a red ("opt out") arrow appeared. If participants chose the most pixilated square, they gained money, whereas if they chose the least pixilated square they lost money. Choosing the arrow moved on to the next trial without penalty or loss. Adaptive performance would be indicated by use of the opt-out arrow on difficult trials that the participant would likely have got incorrect.

In a second session, participants completed the same monitoring task, but requiring different visual discriminations and without the presence of the opt-out arrow (see Figure 2). This time, after each discrimination trial, participants were asked to choose between the options "confident" or "not confident". Accurate metacognitive monitoring was indicated by a greater tendency to choose "confident" on successful visual discrimination trials than on unsuccessful trials and, vice versa, to choose "not confident" more on unsuccessful than successful trials.

Results: In the implicit task, discrimination difficulty was significantly higher on trials that were opted out of than trials that were opted into, reflecting adaptive performance. There was no difference between the groups in this respect, p = .33, d = 0.31. However, in the explicit task, the judgements of confidence (JOC) were significantly less accurate (i.e., less in line with actual performance) among ASD than comparison participants, reflecting diminished explicit metacognitive monitoring, p = .04, d = 0.66. Importantly, mentalizing ability (measured using the Animations and Reading the Mind in the Eyes tasks) accounted for a significant 14% of the variance in explicit task performance, but only a non-significant 2% of the variance in implicit task performance.

Conclusions: These results show an impairment in explicit metacognition that is related to established mentalizing impairments in ASD, which supports the "one-system" theory of the relation between mentalizing and metacognition (e.g., Carruthers, 2009). However, they also suggest that decision-making can be adaptive in people with ASD. Nonetheless, the extent to which such decision-making is truly metacognitive/metarepresentational will be discussed.

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111.203 It's All Good: Contextual Emotional Incongruity in Spontaneous Facial Expressions of Children with ASD

R. Grossman[1,2], *M. Sager*[2], *H. Ventresca*[2], *K. Gallery*[2], *J. Mertens*[1] *and E. Zane*[3], *(1)FACE Lab, Emerson College, Boston, MA, (2)CSD, Emerson College, Boston, MA, (3)FACE Lab, Emerson College, FACE Lab, Boston, MA*

Background: Facial expressions of children with ASD are often perceived as awkward (Grossman, 2015) or ambiguous (Yirmiya, Kasari, Sigman, & Mundy, 1989), and are more difficult to recognize (Brewer et al. 2016). Young children with ASD show emotional facial expressions that aren't always congruent with social context (McGee, Feldman, & Chernin 1991), particularly when positive expressions are paired with negative behaviors (Costa, Steffgen, & Samson 2017). Most previous data into expression incongruity rely on posed or mimicked facial expressions, which may not be representative of spontaneous expressiveness. On the other hand, it can be difficult to determine the contextual valence of social interactions.
Objectives: Analyze facial expressions produced spontaneously by children with and without ASD in response to brief video clips whose emotional content was well defined.

Methods: We presented a pseudo-randomized sequence of funny and disgusting YouTube clips to neurotypical (NT) and autistic children. Participants' mean age was 13:8 (ASD) and 13:1 (NT). Groups were not significantly different in age, sex, IQ, and language ability. Participants with ASD had significant higher scores (p < .0001) on the Social Communication Questionnaire Lifetime form (SCQ), indicating greater social communication impairment.

We videotaped participants' facial responses to the videos and coded the durations (in ms) of positive/negative/flat expressive valence during the most evocative six seconds of each video. All coders were blind to diagnosis and all videos were independently double coded. When coders disagreed, a third coder was involved and final disagreements were resolved via discussion (Ventresca et al. 2017).

We calculated the percentage of positive, negative, and flat expressive duration relative to the duration of each 6,000ms clip. We then grouped responses to four happy video clips (funny kitten videos and laughing babies) and four disgusting video clips (people eating grubs, brains, and spiders, disgusting things being pulled out of a nose) and calculated the percentage of positive, negative, and flat responses to those composites.

Results: Neurotypical (NT) children were significantly more likely to have flat responses (Disgusting videos: F (1, 34) = 6.59, p = .015, Happy videos: F (1, 34) = 6.86, p = .013), while ASD children were significantly more likely to show positive responses (Disgusting videos: F (1, 34) = 7.03, p = .012, Happy videos: F (1, 34) = 7.42, p = .01). There were no group differences for negative expressions. There was a significant positive correlation between the SCQ and positive expressions in response to videos (disgusting videos: r = .47, p = .007; funny videos: r = .4, p = .028).

Conclusions: Children with ASD are more expressive overall in response to video stimuli and make more positive expressions regardless of stimulus valence. For disgusting stimuli this results in a mismatch between the emotional quality of the content they are watching and the facial expression they produce. This bias toward positive expressions and resulting expressive incongruity for stimuli with negative content seems to be related to greater social communication impairment and could lead to misunderstandings in social context.

204 **111.204** Joint Attention Behavior for Children with Autism Spectrum Disorder (ASD) Interacted with Social Robots

W. Cao[1], *W. Song*[2], *X. Li*[3], *S. Zheng*[4], *G. Zhang*[5], *Y. Wu*[3], *S. He*[2], *H. Zhu*[2,6] *and J. Chen*[1,7], *(1)South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (2)Centre for Optical and Electromagnetic Research, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (3)School of Psychology, South China Normal University, Guangzhou, China, (4)School of Physics and Telecommunication Engineering, South China Normal University, Guangzhou, China, (5)Caihongqiao children rehabilitation and service center of Panyu district, Guangzhou, China, (6)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, Guangzhou, China, (7)School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden*

Background: Joint attention has been the target of interventions of the autism spectrum disorder (ASD). Researches, however, did not yet find consistent evidence to support a joint attention deficit in the ASD population (Guillon, Hadjikhani, Baduel, & Rogé, 2014). Recently, social robots have been involved in the diagnosis and intervention of the ASD in social behaviors, language, imitation, and stereotyped behaviors, but robots seemed to reduce the joint attention behaviors when interacting with ASD population compared to the human agent. To address the problem whether interaction with social robots could improve joint attention of the autism spectrum disorder (ASD), we introduced a novel algorithm based on longest common subsequence (LCS) to quantify how the participant's gaze dynamically follow the given logic of the videos, in order to further capture the dynamic feature of eye movement data collected from the joint attention tasks.

Objectives:

By utilizing a commercial humanoid robot NAO, this study compared the difference of joint attention behaviors induced by both the human and robot stimuli. Based on the analysis of fixation time, gaze transitions and LCS algorithm, the study could reveal both the static and dynamic process underlying the joint attention ability and compare the difference between the ASD and typically developing (TD) children.

Methods:

15 ASD (mean age: 4.96±1.10) and 15 age-matched TD children (4.53±0.90) participated in this eye- tracking study. Video stimuli were used to induce joint attention behaviors of participants. Each video consisted of an agent (human or robot) sitting behind the table together with three objects on the left, middle and right side of the table. The agent would turn the head to one of the three truck toys, and the eye movement was recorded by the Tobii X3-120 eye-tracker system. Besides the traditional fixation time and gaze transition analysis, we introduced an LCS algorithm to measure the complexity of transition distributions between area of interests (AOIs).

Results:

Data analysis showed that the TD group fixated longer on the agent face (p=0.002) than the ASD group, and the ASD group gazed on the frame (p=0.045) and non-target (p=0.036) longer than the TD group. All participants spent more time on face area in the "Robot" condition (p=0.038), and more on target (p=0.004) and non-target in the "Human" condition (p=0.045). However, we did not found any significant difference in gaze transition analysis between the ASD and TD group. The LCS analysis revealed a significant effect of group (F(1, 28)=11.18, p=0.002, partial η^2=0.898), indicating that the TD participants have significantly higher LCS scores than the ASD. It implied the TD could better follow the logic of the video.

Conclusions:

This research showed a complex joint attention profile of the participants with ASD. Compared to the human agent, the robot attracted more interests of all participants, but was not able to facilitate the gaze transitions towards the targets or following the stimuli's logic. It implies a negative impact on joint attention behavior when children were interacted with social robots.

205 **111.205** Moral Identity and Perceptions of Moral Exemplars in Young Adults with Autism Spectrum Disorder

A. K. Senland, *Psychology, Trinity College, Hartford, CT*

Background: The popular press and social media often contribute toward a stereotype of individuals with autism spectrum disorder (ASD) as lacking empathy and morality ("Myth of the Autistic Shooter," 2015). While individuals with ASD can distinguish moral from conventional transgressions (Shulman et al., 2012), compared to their typically developing (TD) peers, they experience subtle difficulties on more advanced moral tasks requiring the interpretation of others' intentions (Mathersul et al., 2013), and have less advanced moral reasoning (Senland & Higgins-D'Alessandro, 2016). However, little is known about whether individuals with ASD and their TD peers differ in the degree to which they hold moral concerns such as caring and justice as central to their sense of self (moral identity) and in who they perceive as being highly moral and why (moral exemplars).

Objectives: This study aimed to investigate similarities and differences in moral identity and identification of moral exemplars between young adults aged 18 to 39 with ASD and their TD peers.

Methods: The ASD group included 83 participants, aged 18 to 39-years-old (83% female); the TD group included 69 participants, aged 18 to 39-

years-old (87% female). The ASD group scored significantly higher than the TD group on Hoekstra et al.'s (2001) abridged version of the Autism Spectrum Quotient (AQ-Short) ($t(145) = 11.32$, $p < .001$), confirming two distinct groups characterized this study's sample. Participants completed an online questionnaire that included: (a) two measures of moral identity, and (b) two open-ended questions, adapted from Walker et al. (1999), which asked participants to 1) name a person that they regarded as highly moral and 2) explain why they regarded this person as highly moral. Qualitative data were analyzed with inductive content analysis.

Results: ASD and TD groups did not differ significantly on either moral identity measure. Qualitative data indicated that compared to the TD group, the ASD group was more likely to identify moral exemplars who were fictional characters (e.g., book, movie, video game characters) or whom they had learned about but did not know personally (e.g., historical figures, political figures, religious figures). In contrast, the TD group was more likely to identify moral exemplars who they knew personally (e.g., parents, friends). Similar themes emerged as the ASD and TD groups explained why they considered their moral exemplars to be highly moral; both groups emphasized the kind/caring, honest, generous, fair/just, and/or accepting nature of their moral exemplars.

Conclusions: ASD and TD groups are similar in their perceptions of how important moral concerns such as fairness and caring are to their sense of self, combating the tendency for the popular press and social media to stereotype those with ASD as immoral. Moral and character education programs, as well as support programs for those with ASD, may also want to consider how to effectively use fictional characters, as well as historical figures, political figures, and religious figures, as moral role models for individuals with ASD, given that those with ASD more readily identified individuals in these categories as moral exemplars than their TD peers did.

206 **111.206** Oxytocin Treatment Modulates Social Affect in Autism

A. Mayer[1]*, A. K. Wermter*[2]*, S. Stroth*[3]*, M. Haberhausen*[2]*, T. Stehr*[4]*, I. Kamp-Becker*[5]*, F. Paulus*[6] *and S. Krach*[7]*, (1)Lübeck University, Lübeck, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University of Marburg, Marburg, Germany, (3)Philipps University Marburg, Marburg, Germany, (4)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Marburg, Germany, (5)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany, (6)Philipps-University Marburg, Marburg, Germany, (7)Center of Brain, Behavior and Metabolism, Luebeck, Germany*

Background: Persons with the diagnosis of Autism Spectrum Disorder (ASD) are characterized by substantial social deficits. One of the core symptoms is the reduced capacity to intuitively represent their own and others' mental states (*1–3*). However, it has remained unresolved, whether persons with the diagnosis of ASD can empathically share others' feeling states in an embodied manner (*4*). This deficit has been attributed to malfunctions of the interoceptive cortex (*5*), a network comprising the anterior insula cortex (AIC) and the anterior cingulate cortex (ACC) (*4*, *6*). First fMRI studies revealed that intranasal administration of the neuropeptide oxytocin modulates social processing on a behavioral and neural level (*7*, *8*) in healthy participants, while an in-depth investigation of the effects of oxytocin on social processes underlying neural networks in ASD is still lacking.

Objectives: In the present study we aimed at characterizing the effects of intranasal oxytocin treatment on the neural pathways involved in social affect in a group of persons with ASD. We pursued this question on three levels of affective experiences: understanding others basic emotional states ('Emotions'), sharing others physical pain ('Physical Pain'), and more complex social pain ('Social Pain'). We hypothesized that oxytocin treatment would modulate social affective experiences and activity in underlying neural networks compared to the placebo condition.

Methods: Twenty-six young men who matched the DSM IV criteria for ASD and who had a confirmed ICD-10 diagnosis of high-functioning ASD underwent a double-blind, cross-over, placebo controlled fMRI protocol including three experiments to examine social affect on distinct levels. Stimuli within all three conditions consisted of pictures or sketches displaying another either being in a sad, neutral or happy mood ('Emotions'), showing another's physically painful bodily injury or non-painful situation ('Physical Pain'), or a complex social scenario depicting a protagonist threatening his or her social integrity ('Social Pain') (*9*). Stimuli were presented for 6-12s, followed by a rating period to indicate the intensity of the vicarious embarrassment experience with a button press and low-level baseline.

Results: On the behavioural level we observe that oxytocin only slightly attenuates the affective response across the different domains of social affect. This was complemented by the fMRI data yielding a more distributed engagement in brain areas implicated in processing of arousal and affect as well as mentalizing regions.

Conclusions: The present results offer a new perspective on how intranasal oxytocin administration modulates brain networks for social affect in patients diagnosed with ASD. While our results show that persons with high-functioning ASD are capable to correctly assess basic emotions, physical pain as well as more complex social pain experiences, oxytocin treatment still attenuates the self-reported social affect. The underlying brain networks, in particular those implicated in processing of arousal and mentalizing show similar effect, highlighting a potential neural system mechanism for oxytocin treatment in ASD.

207 **111.207** Positive Affect Facilitates Eye Gaze Following in Preschoolers with Autism

A. N. Dennis[1]*, D. Hedley*[2]*, G. Vivanti*[3]*, C. Dissanayake*[2] *and H. J. Nuske*[4]*, (1)Department of Psychology, Haverford College, Haverford, PA, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (3)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (4)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background:

The ability to follow another person's gaze is a critical component of joint attention. Joint attention difficulties are a defining characteristic of autism spectrum disorder (ASD). Many therapists working with children who have ASD intentionally use a positive affective framework (e.g., smiles) to increase the child's attention to their face. However, little research to date has specifically investigated whether positive affect increases eye gaze following.

Objectives:

This study sought to investigate the effectiveness of positive affect in increasing eye gaze following. Given that children with ASD have been found to have difficulty processing subtle expressions of emotion (e.g., a small smile), subtle and exaggerated positive affect were examined separately to assess how emotion intensity influences eye gaze following in children with ASD, relative to typically developing (TD) children.

Methods:

Eye tracking technology was used to capture the eye gaze behavior of 19 preschoolers with ASD and 23 typically developing preschoolers as they observed the eye gaze shifts of actors displaying neutral, subtle positive, or exaggerated positive expressions. The actors first looked into the camera to establish mutual gaze (simulating eye contact), and then shifted their gaze to one of three pictures on the wall next to them. These pictures were coded as target (congruent with the actor's gaze) or non-target (incongruent with the actor's gaze; see Figure 1). Participant eye gaze following was assessed in two ways. First, by calculating the proportion of time the child looked at the target picture compared to the rest of the screen (proportion to target analysis); second, by assessing whether the child had the correct first look to the target picture (correct first look analysis).

Results:

The proportion to target analysis showed no group differences between TD children and those with ASD, however a main effect of emotion condition was found ($F(2,39) = 3.56$, $p = .038$, $\eta^2 = .155$). Between-condition pairwise comparisons showed a marginally significant difference between the neutral and subtle conditions ($p = .072$) with higher values in the subtle condition (see Figure 2), such that there was a higher proportion of eye gaze following to the target picture after the actor displayed the subtle positive facial expression, in both groups. Additionally, the correct first look analysis showed a significant group difference in the exaggerated positive emotion condition only ($\chi^2= 7.532$, $p = .023$). The ASD group was more likely to have the correct first look to the target animal when viewing an actor with an exaggerated positive affect (68%) than the TD group (26%).

Conclusions:

These results provide empirical support for the use of positive affect to engage a child's attention in early intervention. They specifically highlight the potential benefit of exaggerated positive affect for children with ASD, though these preliminary findings still require validation in larger samples.

208 **111.208** Quantifying the Social Gaze in Ongoing Triadic Interaction

A. Hartz[1], *M. Jording*[2], *B. Guth*[1], *K. Vogeley*[2] *and M. Schulte-Ruther*[1], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, University Hospital RWTH Aachen, Aachen, Germany, (2)Department of Psychiatry and Psychotherapy, University Hospital Cologne, Cologne, Germany*

Background: We use our eyes to obtain social information about others, but they also convey information about our inner mental state. Gaze encounters can therefore be considered as a social reciprocal process. Referring to our recently proposed theoretical framework of a "social gaze (state) space" that differentiates five different gaze states of an agent in triadic interactions: '*partner-oriented*', '*object-oriented*', '*introspective*', '*initiating joint attention*', and '*responding joint attention*', we aim to empirically and systematically investigate gaze behavior in typically developing and clinical populations across the life span.

Objectives: Social gaze behavior and its deviations in psychiatric conditions has typically been investigated using static, non-interactive settings (e.g. image or video stimuli) neglecting the highly dynamic character of real life gaze encounters. Increasingly, gaze contingent settings are being employed, but these are often restricted to atomic units of interactions (e.g. single trials of joint attention). We propose to employ an empirically informed agent that oscillates between different gaze states, thus mimicking typical human gaze behavior. This approach will allow to fully explore the dynamics of ongoing triadic encounters in a much more ecologically valid research setting.

Methods: We experimentally induced social gaze states in 37 adult volunteers (19 identifying themselves as female, 17 as male, 1 as queer) with no record of neurological or psychiatric conditions who were interacting with an algorithm-controlled virtual agent in ongoing triadic interactions. Behavioral parameters (e.g. temporal lag of gaze following after agent initiates attention, duration of object fixation after agent has responded to initiating joint attention,...) in different combinations of the five different gaze states were obtained to describe typical human gaze behavior.

Results: We extracted behavioral parameters including their dynamics and distribution within the investigated sample and used these to create an empirically informed, algorithm-controlled virtual Markovian agent that allows to study the full range of gaze-contingent triadic interactions.

Conclusions: We provide a reference space for investigating gaze behavior in clinical populations with impairments in social interactions, such as autism.

209 **111.209** Re-Evaluating the Reduced Social Motivation Theory of Autism

I. Dubey[1], *S. Brett*[2], *L. Ruta*[3], *M. Belmonte*[4], *V. Patel*[5], *G. Divan*[6], *J. Dasgupta*[7], *S. Gulati*[8], *S. Bhavnani*[7], *D. Mukherjee*[7], *R. Bishain*[9], *S. Chandran*[10], *G. Estrin*[11], *T. Gliga*[11], *M. H. Johnson*[12] *and B. Chakrabarti*[1], *(1)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (2)School of Psychology and Clinical Language Sciences, University of Reading, Reading, United Kingdom, (3)Institute of Applied Sciences and Intelligent Systems, "Eduardo Caianiello" (ScienceApp) – National Research Council of Italy (CNR), Messina, Italy, (4)Com DEALL Trust, Bangalore, India, (5)Department of Global Health and Population, Harvard Medical School, Boston, MA, (6)Sangath, Bardez, Goa, India, (7)Centre for Chronic Conditions and Injuries, Public Health Foundation of India, Gurgaon, India, (8)Child Neurology Division Department of Pediatrics, All India Institute of Medical Sciences, Delhi, India, (9)Computer Science and Engineering, Indian Institute of Technology, Bombay, India, (10)Computer Science and Engineering, Indian Institute of technology, Mumbai, India, (11)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (12)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Autism spectrum conditions (ASC) have been suggested to be characterised by reduced social motivation, resulting in lower social seeking behaviour and poorer learning of social skills (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). This 'social motivation hypothesis' presupposes that typically developing children have higher social motivation which helps them in seeking out social contacts and learning the associated skills. However, some empirical reports suggest that typically developing children do not show the expected pattern of high seeking behaviour for social stimuli, and that their preference for social stimuli might be at a chance level (Ewing, Pellicano, & Rhodes, 2013; Ruta et al., 2017). This observation emphasises the need for a systematic examination of social reward seeking in a large sample of typically developing children, and its relationship with autism-related trait measures.

Objectives: To test if a) typically developing children demonstrate higher social reward seeking behaviour, as measured by a simple button-press task (Ruta et al., 2017), and b) if individual differences in such social reward seeking behaviour are related to risk for autistic features.

Methods: 111 children aged 2-9 years were tested on a simple two-button task on a tablet PC, pressing one button to watch a social video (smiling child) and another button to watch a video of moving geometric patterns (Ruta et al., 2017). The stimuli were visually matched for their colour and level of movements. Participants were also tested on the Social Aptitude Scale (SAS) which has demonstrated high sensitivity and specificity (0.936 and 0.934 respectively) in identifying children at risk of autism (Liddle, Batty, & Goodman, 2009). In keeping with the hypothesis of reduced social motivation, we predicted that 1) these typical children would press the button more often for social than for non-social stimuli, and 2) children with lower scores on SAS would show less of this social seeking button preference.

Results: Similarly to earlier reports, typical children did not have any significant preference for social over non-social stimuli (t (111) = 1.03, p = 0.30). However, the number of social button presses correlated significantly with SAS score (r (83) = .28, p = .010).

Conclusions: Consistent with the previous report on this task (Ruta et al., 2017), current results show that comparable seeking behaviour for social and non-social stimuli in children might not indicate atypical development or poor social skills *per se*. However, lower seeking behaviour for social stimuli might be linked dimensionally with a higher risk for ASC.

210 **111.210** Relations between Spontaneous and Explicit Mentalizing in Autism and Typical Development

K. R. Warnell[1]*, S. Maniscalco*[2]*, K. A. Schaefer*[1]*, J. K. Ifesinachukwu*[1]*, S. Menssor*[1]*, L. A. Kirby*[3] *and E. Redcay*[2]*, (1)Department of Psychology, Texas State University, San Marcos, TX, (2)Department of Psychology, University of Maryland, College Park, MD, (3)Yale Child Study Center, New Haven, CT*

Background: Recent research on mentalizing—or thinking about others' thoughts, feelings, and desires—suggests that deliberate mental state reasoning may be dissociable from more spontaneous mentalizing. This possibility is especially relevant to autism spectrum disorder (ASD), where explicit social cognition often outpaces real-world social success. Previous ASD research investigating relations between different types of mentalizing, however, has used a limited set of tasks and produced mixed findings. Quantifying links between explicit and spontaneous mentalizing may illuminate cognitive mechanisms underlying real-world social behaviors in ASD.
Objectives: To evaluate, in both ASD and typical development, whether explicit measures of mental state reasoning are related to the tendency to spontaneously mentalize about naturalistic social stimuli.

Methods: Participants were 26 typical individuals (15 males, average age=19.86 years) and 24 individuals with ASD (17 males, average age=21.70 years) matched on age, sex, and verbal IQ. Participants completed two measures of spontaneous mentalizing: (1) the Spontaneous Theory of Mind Protocol (STOMP; Rice et al., 2014), in which participants described videos depicting complex social scenes and (2) the Describe-a-Friend task (Meins et al., 2008), in which participants described a close friend or family member. Both tasks yielded a measure of spontaneous mental state language (i.e., references to thoughts, feelings, and desires). Further, participants answered explicit questions about the mental states of characters in the videos and control questions about physical events. Participants also completed two conventional explicit mentalizing measures: (1) Mind in the Eyes (Baron-Cohen et al., 2001), involving inferring mental states from photographs of eyes and (2) Strange Stories (White et al., 2009), involving reasoning about mental states from stories.

Results: There were no significant group differences in the amount of spontaneous mentalizing for either the STOMP or Describe-a-Friend task. For the explicit questions about the STOMP videos, however, adults with ASD showed diminished performance when reasoning about mental states, but intact performance when reasoning about physical events. Controlling for age and verbal IQ, performance on those explicit mental state questions was related to the tendency to spontaneously mentalize for participants with ASD (r=.46, p=.048), but not for typical adults (r=-.264, p=.35). Across tasks, levels of spontaneous mentalizing were correlated for typical adults (r=.54, p=.01), but not for adults with ASD (r=-.076, p=.76). For the Mind in the Eyes and Strange Stories, typical adults performed significantly better than those with ASD, and, within each group, the two tasks were significantly correlated. For neither group, however, did the Mind in the Eyes or Strange Stories significantly relate to spontaneous mentalizing.

Conclusions: Overall, the relation between implicit and explicit mentalizing is complex, task-dependent, and varies between typical development and ASD. Intriguingly, only adults with ASD showed a relation between the tendency to offer spontaneous mental state description about naturalistic, socially-complex scenes and explicit measures of accurate mental state reasoning about those same scenes. These findings may suggest different routes to explicit and implicit mentalizing in typical development and ASD, and future research should continue to explore this possibility by including measures of mentalizing during social interaction.

211 **111.211** Relative Expressive Language Deficits Predict Anxiety in Youth with Autism Spectrum Disorder

P. E. Young[1]*, L. A. Santore*[2]*, C. M. Esposito*[3]*, A. H. Gerber*[2] *and M. D. Lerner*[4]*, (1)The Social Competence and Treatment Lab at Stony Brook University, Stony Brook, NY, (2)Stony Brook University, Stony Brook, NY, (3)Stony Brook University, Staten Island, NY, (4)Psychology, Stony Brook University, Stony Brook, NY*

Title: Relative Expressive Language Deficits Predict Anxiety in Youth with Autism Spectrum Disorder
Authors: Paul Young, Lee A. Santore, Christopher M. Esposito, Alan Gerber, Matthew D. Lerner

Affiliations: Stony Brook University

Background: Language deficits are characteristic of many youth with autism spectrum disorder (ASD; Van der Paelt et al. 2014), especially impairments in expressive language relative to receptive language (Grossman & Tager-Flusberg, 2012). Research indicates that expressive and receptive language deficits are associated with symptoms of anxiety, particularly social anxiety, in typically developing children (Snowling et al., 2006; Carson et al., 1998; Wadman et al., 2011). Anxiety disorders (AD), particularly social anxiety, are common in youth with ASD (Simonoff et al. 2008), and are strongly related to ASD symptom severity (Renno et al., 2014; Sukhodolsky et al., 2008). Thus, ASD symptom severity and expressive language deficits may both impact anxiety symptoms in ASD youth. However, whether relative expressive language deficits, controlling for ASD symptomatology, directly impact anxiety in ASD youth has not been tested.

Objectives: This study examined the relationship between relative expressive language deficits and elements of anxiety in ASD youth. We hypothesized that these deficits would be positively related to anxiety, specifically social anxiety, even after controlling for ASD symptom severity.

Methods: Fifty-six youth (Mage=12.43, SDage=2.78) with ADOS-2 (Lord et al., 2012) confirmed diagnoses completed the Kaufman Brief Intelligence

Test-2 (KBIT-2; Kaufman, 1997) and the Multidimensional Anxiety Scale (MASC; March, 1997) to measure language ability and anxiety, respectively. The two verbal sub-scales of the KBIT-2 were used to represent measure receptive and expressive language skills, as the Verbal Knowledge sub-scale measures receptive vocabulary (Kaufman & Kaufman, 2004), and the Riddles sub-scale parallels the expressive language sub-scale used in the original KBIT (Bain & Jaspers, 2010). The standardized difference score method (De Los Reyes & Kazdin, 2004) was used to evaluate the difference between the KBIT-2 verbal knowledge and riddles sub-scales. This difference was used to quantify the relative impairment gap between receptive and expressive language. Parents completed the Social Responsiveness Scale-2 (SRS-2; Constantino & Gruber, 2012) as a measure of ASD symptoms.

Results: Hierarchical multiple regression controlling for SRS-2 revealed that expressive language deficits, relative to receptive language, predicted increased levels of self-reported anxiety (*b*=.629, *p*=.027), specifically generalized anxiety disorder symptoms and separation, humiliation and rejection, social, and physical anxieties (all *bs*<.770, *ps*<.043), while controlling for individual differences in ASD symptomatology. Neither receptive nor expressive language alone were predictors of anxiety (all *ps*>.051).

Conclusions: Deficits in expressive language, relative to receptive, predicted levels of anxiety in ASD youth. These results suggest a need for providers to be aware of these deficits, as they are important predictors of anxiety. These findings also better characterize the phenotype of ASD and comorbid AD by addressing the deficits which contribute to this relationship.

212 **111.212** Self-Identified Motivations for Engaging in Sexual Offending By Offenders with Autism Spectrum Disorder

K. L. Payne[1]*, K. L. Maras*[2]*, A. Russell*[3] *and M. Brosnan*[4]*, (1)Psychology, University of Bath, Bath, United Kingdom, (2)Psychology, Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (3)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (4)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

People with autism spectrum disorder (ASD) are suggested to be over-represented in forensic populations. Research suggests that offenders with ASD are more likely commit certain types of crime (e.g., sexual offences, assault, robbery) than others (e.g., burglary, arson, trespass, driving, drug offences). Rehabilitation programmes largely target specific offences (e.g., sex-offences) and behaviours (e.g., anger) so it is important to understand the specific motivations of a specific group of offenders in order to effectively tailor programmes. This research focussed solely on individuals with ASD who engaged in sexual offending. To date, little is known about the motivations of individuals with ASD who engage in sexual offending. The limited available literature to date highlights potential factors such as social skills deficits, theory of mind deficits and a history of childhood abuse in sexual offending in ASD. Research to date has largely utilised evaluations from professional reports, however taking a person-first approach to addressing the reasons for engaging in offending behaviour is crucial to the success of rehabilitation programmes.

Objectives:

This research aimed to identify the self-identified motivations for engaging in sexual offences in adults with ASD.

Methods:

Nine male sexual offenders with ASD took part in a semi-structured interview. Participants were recruited from four prisons and two probation services in the UK. ASD diagnosis was confirmed by professionals working with the offenders. The mean age of participants was 29.56 (SD=8.68). Offences included rape, sexual assault (adult and child) and the downloading and possession of indecent images.

Once transcribed verbatim data were analysed using thematic analysis. Due to the subject area being under-researched coding was conducted in an inductive fashion where the researcher did not try to code the data according to a previously determined coding framework or analytic preconceptions; rather the coding was data driven. The identified themes were strongly linked to the data.

Results:

Results indicated a thematic separation between internal and external factors within the data. The three externally-occurring motivations for offending included disequilibrium (difficult life events; life instability; major life events), vulnerability (lack of familial support; lack of professional support; immaturity) and substance abuse (drugs; alcohol). The five internally occurring motivating factors identified were social difficulties (social skills deficits; loneliness), misunderstanding (lack of awareness of: the consequences, seriousness, and the rules/law; misbelief as to what is available online; lack of perspective), interpersonal relationships (transgressive relationships; lack of appropriate relationships; misunderstanding people; misunderstanding consent), self-discipline (loss of control; getting carried away) and sexual drive (contact and non-contact sexual drive).

Conclusions:

Overall this research concludes that the most commonly occurring motivations for offending revolve around misunderstanding (e.g., regarding the seriousness of behaviour and the law) and social skills deficits coupled with a lack of appropriate relationships. Future research should look to develop early interventions for individuals demonstrating sexually inappropriate behaviours which address the law, social skills deficits, what appropriate relationships are and how to access these.

213 **111.213** Sex Differences in Social Attention and Motivation in Autism: An Eye Tracking Study

C. Harrop[1]*, D. R. Jones*[2]*, S. Zheng*[3]*, S. Nowell*[4]*, B. A. Boyd*[5] *and N. J. Sasson*[2]*, (1)University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)University of Texas at Dallas, Richardson, TX, (3)Psychiatry, University of California, San Francisco, San Francisco, CA, (4)University of North Carolina at Chapel Hill, Carrboro, NC, (5)Juniper Gardens Children's Project, University of Kansas, Kansas City, KS*

Background: The sex ratio in autism spectrum disorder (ASD) has remained constant and weighted toward males. As a result, considerably less is known about females, with the majority of published research including largely, or in some cases exclusively, males. However, subtle but important differences exist between the male and female phenotype of ASD, including greater social motivation in ASD females (Sedgewick et al., 2016) and fewer and more typical circumscribed interests (CI; Sutherland et al., 2017). Eye-tracking has quantified abnormalities in visual attention to social stimuli and CI in ASD, but these studies have relied primarily on male samples.

Objectives: The aim of this study is to use eye-tracking to understand sex differences in attention to social and CI stimuli.

Methods: 57 children (ages 6 to 10) provided sufficient eye-tracking data for inclusion (>20% fixation time on screen): 35 children with a diagnosis of ASD (15 female) and 23 typically developing (TD) children (13 female). Subjects completed a validated eye-tracking paradigm (Sasson & Touchstone, 2014; Unruh et al., 2016), with twenty slides of paired social and non-social (object) images presented. Half of the object images represent frequently occurring CI in ASD, known as high autism interest (HAI) objects (e.g., trains; South et al., 2005, Turner-Brown et al., 2011), and the other half represent objects not associated with CI in ASD (e.g., plants).

Results: There was a strong effect of sex on initial orientation to faces (F=5.81, p=.02) with females faster to prioritize social stimuli, particularly when paired with HAI stimuli (F=5.91, p=.01; Figure 1a). ASD females attended to social stimuli faster than all other groups and ASD males were the slowest (Figure 1a). There was a Sex*Diagnosis interaction for the number of fixations to social stimuli (F=5.77, p=.02), with ASD males fixating to social stimuli fewer times than TD males (p=.006) and a marginal effect when compared to ASD females (p=.06; Figure 1b). This was particularly apparent for faces paired with HAI images, with ASD males attending fewer times compared to all other groups (p=.04). There was marginal Sex*Diagnosis interaction for overall fixation time to social stimuli (F=3.60, p=.06), with ASD males fixating less than ASD females (p=.03; Figure 1c).

Conclusions: Our data for ASD males replicates that of previous studies consisting largely, or exclusively, of males (Sasson & Touchstone, 2014; Unruh et al., 2016). However, our findings for ASD females differed; ASD females demonstrated an opposite pattern of attention to social stimuli, with attention patterns more comparable to TD females. This could reflect a *protective effect* in ASD females. Our data differ both from a recent ERP study that found attenuated responses to social stimuli in ASD females (Coffman et al., 2015), suggesting there may be a disconnected profile in ASD females, with heightened visual attention in females not leading to greater processing and encoding of social stimuli. Further work includes examining the neural correlates of social attention as well as examining the pupil responses of ASD females to social stimuli and more complex, ecologically valid eye tracking paradigms.

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111.214 Social Cognition Contributes to Social Functioning in Adults with Autism

***K. E. Morrison**, A. E. Pinkham and N. J. Sasson, University of Texas at Dallas, Richardson, TX*

Background: Adults with Autism Spectrum Disorder (ASD) are characterized by poor social functioning that contributes to smaller social networks, occupational challenges, and reduced quality of life. Identifying mechanisms of this poor social functioning offers promise for treatment and intervention.

Objectives: We examined the contribution of social cognitive ability to social functioning above and beyond general intellectual capacity and demographic features. Although social functioning has been most commonly evaluated in adults with ASD using self- and informant-report questionnaires, here we used performance-based measures that offer a more direct assessment of real-world social and functional abilities.

Methods: Adults with ASD (n=103; Age: M=24.28; IQ: M=105.64) completed a broad assessment of social cognitive ability: 1) emotion recognition tasks (Penn Emotion Recognition Task (ER-40) and the Bell Lysaker Emotion Recognition Task (BLERT)); 2) social appraisal tasks (The Awareness of Social Inference Task (TASIT), Reading the Mind in the Eyes, Cartoon Theory of Mind (CToM), and the Hinting task); 3) social perception tasks (Relationships Across Domains (RAD) and the Benton Facial Recognition Test); 4) an attribution style task (AIHQ); and 4) the Trustworthiness task.

Participants also completed two performance-based social functioning measures: 1) the Social Skills Performance Assessment (SSPA), a naturalistic role-play task enacting two real-life situations (e.g., meeting a new neighbor, negotiating with a landlord) later coded for discrete social skills (e.g., eye gaze, affect) and an overall index of social ability; and 2) the UCSD Performance-Based Skills Assessment (UPSA) assessed financial skills (e.g., counting change) and communication skills (e.g., scheduling appointments).

Results: A hierarchical regression was conducted for each outcome, entering general cognitive and demographic characteristics (e.g., Age, Gender, IQ, and Race) in the first block, followed by all social cognitive tasks in the second block. These predictors accounted for 52% of the variance in UPSA scores (F(17, 81)=5.13, p<.001), with cognitive and demographic information accounting for 33% of the variance (p < .001) and social cognitive tasks accounting for 19% (p=.006). Age and IQ, but not gender and race, were positively related to social functioning scores (p's<.014). For social cognitive tasks, only the CToM individually predicted higher social functioning (p=.04), and no other tasks were significant predictors (p's>.10).

Predictors together accounted for 29% of the variance in SSPA scores (F(17,75)=1.80, p=.04), however each block did not uniquely predict a significant proportion of variance (p's>.08). Higher TASIT and Trustworthiness scores significantly predicted higher social skills scores (p's<.03), and neither the demographic variables (p's>.14) nor the other social cognitive variables (p's>.26) significantly predicted social skills ability.

Conclusions: Social cognition contributes to social functioning for adults with autism over and above other characteristics including IQ and demographic variables. However, our results suggest different abilities may uniquely contribute to social skill and functional ability: general cognition and social appraisal were predictive of functional ability, but only social appraisal and trustworthiness performance were related to better social skills. Taken together, this may suggest that treatment of functional skills, but not social skill, may benefit from focusing on general cognitive ability in addition to specific social cognitive components.

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111.215 Social Interaction between Friends and Non Reciprocal Friends in a School-Aged Boy with Autism.

***J. Rodríguez-Medina**[1], H. Rodríguez-Navarro[2], M. Jiménez Ruiz[2], V. Arias[3], B. Rubia-Avi[2] and B. Arias[4], (1)Center for Transdisciplinary Research in Education, University of Valladolid, Valladolid, Spain, (2)Department of Pedagogy, University of Valladolid (Spain), Valladolid, Spain, (3)University of Salamanca (Spain), Salamanca, Spain, (4)Department of Psychology, University of Valladolid (Spain), Valladolid, Spain*

Background: Children with autism spectrum disorder have been shown to be on the periphery of their social networks more often; to receive lower scores on companionship, closeness, intimacy and help; and to have fewer reciprocal friendships compared to their typical peers. Non-reciprocal friendships are a relatively unexplored phenomenon; however, analysis of this phenomenon could contribute to a better understanding of these relationships between children with autism and their peers in mainstream schools and could be used to support the design and implementation of social interaction skills interventions.

Objectives: The current study's aim was to identify the reciprocal and non-reciprocal friendships of a boy with autism and to observe his social interaction behavior while attempting to identify the presence of differential patterns. These behavioral patterns may be related to accuracy in social network perception, so we were also interested in comparing friendship network perception accuracy between the boy and his peers.

Methods: This mixed-methods study examined differences in social interaction patterns between a school-aged boy with autism and his reciprocal, non-reciprocal, and non-friends during recess time at a mainstream school. The participants were a student with autism, aged 10 years and 3 months, and his 14 classmates (eight males) from a third-grade elementary-education classroom. Observational methodology was used with an idiographic, follow up, and multidimensional design approach. Polar coordinates analysis was used to identify the activation or inhibition relationships that occurred between interactive behaviors according to relationship types. Using cognitive social structures to assess the children's perceptions of their friendship networks provided a complete cognitive map of their perceptions concerning who was friends with whom in the group.

Results: Children displayed a moderate level of agreement with peers with regard to the friendship social network. It was more difficult for them to accurately identify the friendships of the boy with autism compared to those of newcomers. Correlation analysis revealed that the boy with autism exhibited lower levels of agreement with the consensus than the more peripheral actors did. After 40 sessions, the results showed significant mutual activation relationships in terms of the social responses and initiations to non-reciprocal friendships and joint engagement and a significant inhibitory effect on the solitary category, while the responses to reciprocal friends did not show this effect.

Conclusions: Consistent with previous findings, we found little evidence of a relationship between reciprocal nominations received by the student and real social interactions in the playground during systematic observation. Although the interactions with non-friends and with non-reciprocal friends may be a factor related to stress and anxiety and may pose a higher social challenge for children with autism spectrum disorder compared to interactions with friends, this factor could reduce in importance as the relationship develops. Studying non-reciprocal friendships can help to improve the knowledge of the processes that could contribute to the development of significant relationships among children with autism and their peers in ordinary school settings.

216 **111.216** Social Pain and Emotional Egocentricity in High-Functioning Autism-Spectrum-Disorder: Behavioral and Neurophysiological Evidence

H. M. Hartmann[1]*, H. H. Hitz*[2]*, P. Stepnicka*[2]*, L. Lengersdorff*[1] *and G. Silani*[2]*, (1)Social, Cognitive and Affective Neuroscience Unit, Department of Basic Psychological Research and Research Methods, University of Vienna, Vienna, Austria, (2)Department of Applied Psychology: Health, Development, Enhancement and Intervention, University of Vienna, Vienna, Austria*

Background: Empathy is a crucial social skill that is relevant for everyday social interactions, and therefore has already been widely studied in both neurotypical as well as clinical populations. It is defined as the individual ability to feel with and understand another person's emotional state (Singer & Lamm, 2009). Given that humans primarily use their own emotions and perceptions in guiding their thoughts about conspecifics, self-projection mechanisms can lead to empathic judgments that are sometimes egocentrically biased towards one's own perspective – a so called emotional egocentricity bias (EEB) may occur (Silani, Lamm, Ruff, & Singer, 2013). Therefore, a cognitive component of empathy, called self-other distinction (SOD), plays an essential role during empathic interactions, mainly to avoid confusion between the self and emotions of others. This ability is necessary in order to generate a full empathic response. Multiple studies have shown impairments in empathic responses in individuals with autism spectrum disorders (ASD) (e.g. Dziobek et al., 2008). To date, only few studies have tried to investigate if reduced empathic responses can be due to an impairment of SOD.

Objectives: To investigate SOD abilities in ASD as indicated by the occurrence of emotional egocentricity biases.

Methods: Using a virtual ball-tossing game called Cyberball, we aimed to induce congruent as well as incongruent feelings of social inclusion/exclusion between the participant and a confederate, in order to test the occurrence of the EEB. The paradigm was first validated in a pilot study with 52 healthy subjects. In our main study, we then investigated 17 participants with high-functioning ASD as well as 17 matched neurotypical (NT) controls by means of a behavioral task as well as functional magnetic resonance imaging (fMRI).

Results: Replicating the results from the pilot study, the results of the main study indicated a significant EEB during incongruent emotional empathic judgments. However, no significant group differences regarding the EEB could be found, suggesting similar ability for SOD in both the NT and ASD participants in this sample. In spite of a similar behavioral EEB in the NT and ASD populations, brain differences in the right temporo-parietal junction (rTPJ) and right dorso-lateral prefrontal cortex (rDLPFC), two key areas involved in Theory of Mind and SOD, were detected in situations of incongruent emotions between the self and other.

Conclusions: The present study adds valuable preliminary insights to the investigation of social cognition in this population and expands them to the domain of social pain. Furthermore, the results suggest neurophysiological differences between neurotypical and autistic individuals, possibly underpinning differences in the neural processes involved in SOD during empathic judgments. Investigating the ability of SOD in ASD will ultimately pave the way to better understand their social and emotional impairments and provides an important contribution for current and future research in this area.

217 **111.217** Social Partner Gaze Direction and Conversational Phase; Factors Affecting Social Attention during Face-to-Face Conversations in Autistic Adults?

M. Freeth[1] *and P. Bugembe*[2]*, (1)Psychology Department, University of Sheffield, Sheffield, United Kingdom, (2)Psychology department, University of Sheffield, Sheffield, United Kingdom*

Background:

Social attention in autism is atypical (see Chita-Tegmark, 2016 and Guillon et al. 2014 for recent reviews). However, the vast majority of evidence for this claim comes from studies where the social partner is not physically present. Consequently, to ensure acquisition of a comprehensive overview of social attention in autism, systematic analysis of factors known to influence face-to-face social attention in neurotypicals is necessary.

Objectives:

The current study assessed the influence of social partner gaze direction (direct or averted) and conversational phase (speaking or listening) on social attention in autistic adults and matched neurotypical adults.

Methods:

Thirteen adults with a diagnosis on the autism spectrum (11 males; 2 female) and 13 neurotypical adults (10 males; 3 females) participated in this study. Participants were matched one-to-one on age (within 5 years), verbal IQ and performance IQ assessed using the Wechsler Abbreviated Scale of Intelligence. All participants scored in the average/above average range for IQ. Participants completed a live, one-to-one informal conversation with the experimenter. Experimenter gaze direction was systematically modified between being “direct” towards the participant’s face, or “averted” away from the participant’s face. The following topics were discussed: opinions on home-town; weekend plans; national traits; hobbies. Participants’ eye movements were recorded using a mobile eye-tracking device during the conversation.

Results:

In relation to modification of the experimenter’s gaze direction (direct/averted), findings indicated that when the experimenter looked directly at the participant, autistic adults looked at the experimenter’s face less than did neurotypical adults, though there were striking between individual differences in the autistic group on this measure. However, the difference between the autistic group and neurotypical group in relation to face fixations was significantly reduced when the experimenter’s gaze was averted. In relation to assessing the potential influence of conversational phase, a greater proportion of time was spent fixating the experimenter’s eye region when participants were speaking compared to listening, this was evident both for neurotypical participants and autistic adults.

Conclusions:

These findings suggest that opportunities for reciprocal social gaze are missed by autistic adults when the social partner makes direct eye-contact. Secondly, this study found that autistic adults displayed a similar modulation of attention in relation to conversational phase as did neurotypical participants. Overall, this study provides a rich picture of the nature of social attention in face-to-face conversations adopted by autistic adults and demonstrates high individual variation of social attention styles in this population.

218 **111.218** Social Proficiency Relates to Socially-Adaptive Mirror System Functioning

J. Prinsen[1] *and K. Alaerts*[2]*, (1)Rehabilitation Sciences, KU Leuven, Leuven, Belgium, (2)Rehabilitation Sciences, University of Leuven, KU Leuven, Leuven, Belgium*

Background: Individuals with a diagnosis of autism spectrum disorders (ASD) have impairments in social communication and interaction. Also in the neurotypical population, individual differences in terms of social proficiency are prevalent. Researchers have proposed the fronto-parietal action observation network or ‘mirror system’ as a basic neural mechanism for socio-cognitive (dys)functioning. In contrast to the well-known but controversial ‘Broken Mirror Hypothesis’, Wang and Hamilton’s (2012) social top-down response modulation (STORM) model proposed that people with social difficulties (such as patients with ASD) may have an intact mirror system, but unlike social proficient participants, fail to modulate mirror system functioning according to the social context.

Objectives: In this study, we explored whether inter-individual differences in social proficiency and/or attachment towards others are related to one’s ability to show socially-adaptive mirror system functioning.

Methods: A total of 56 neurotypical participants were assessed on adaptive neurophysiological mirror system functioning by means of a well-established single pulse transcranial magnetic stimulation (TMS) paradigm. While undergoing TMS, participants observed video stimuli of an actress performing simple hand movements combined with either direct or averted gaze. In general, TMS-assessed mirror-motor responses are significantly larger upon the observation of actions accompanied by direct eye contact, compared to averted eye gaze. To assess inter-individual differences in social proficiency, participants completed the self-report versions of the Social Responsiveness Scale (SRS) and the State Adult Attachment Measurement (SAAM). The data-driven k-means cluster analysis technique was used to identify subgroups based on the standardized questionnaire scores.

Results: Cluster analysis revealed two meaningful profiles of social proficiency. Cluster 1, labeled the ‘Secure’ cluster, represented participants with secure attachment styles and high levels in social proficiency (n = 26). Cluster 2, the ‘Avoidant’ cluster, represented participants that are highly socially avoidant and have mild to severe impairments in social responsiveness (n = 30). The two subgroups showed a clear differentiation in terms of socially-adaptive mirror system functioning (Gaze × Cluster interaction: $F(1,49) = 7.85$, $p < .01$). Particularly, only for the ‘Secure’ social profiles, direct gaze specifically enhanced ‘mirroring’ ($p = .02$). For participants belonging to the ‘Avoidant’ cluster however, direct eye contact did not facilitate mirroring ($p = .18$). The general level of mirroring was similar for each group ($p = .51$). In other words; in participants that are less socially proficient, mirroring is intact; but it is not socially modulated by relevant social cues, such as eye gaze.

Conclusions: Our results provide further support to the STORM model by showing that the process of mirroring is adaptive to relevant social cues (such as eye contact). Specifically, the observation that not mirroring per se but socially-adaptive mirroring is diminished in individuals with low social proficiency argues against a strong account of the Broken Mirror Theory. Instead our results provide evidence that the top-down response modulation of the mirror system is altered in individuals with social difficulties. Although established in the neurotypical population, these findings may also be highly relevant for people with ASD.

219 **111.219** Social Stress and Autonomic Arousal in Young, High-Functioning Adults with Autism Spectrum Disorder.

R. Dijkhuis[1]*, H. Swaab*[2]*, W. G. Staal*[3]*, S. Van Rijn*[4] *and T. Ziermans*[5]*, (1)University of Leiden, Leiden, Netherlands, (2)Leiden University, Leiden, Netherlands, (3)Institute for Brain and Cognition, Leiden University, Leiden, Netherlands, (4)Leiden University, Leiden, Leiden, Netherlands, (5)University of Amsterdam, Amsterdam, Netherlands*

Background: Despite the hypothesized link between autonomic self-regulation and the social difficulties seen in many individuals with autism spectrum disorder (ASD; Klusek et al., 2014; Neuhaus et al., 2014; Smeekens), little is known about autonomic reactivity to socially stressful situations in young adults with ASD.

Objectives: To examine whether young adults with ASD show deviating autonomic regulation during social stress, and whether it is related to their subjective experience of stress.

Methods: During social stress we compared autonomic arousal, gaze behavior and subjective experience between young adults with high-functioning ASD (HFASD; N = 53) and their typically developing (TD) peers (N = 31). Heart rate and skin conductance were measured as indicators of sympathetic and parasympathetic functioning of the autonomic nervous system. Gaze behavior was indicated by eye tracking (fixation duration in seconds) for multiple customized areas of interest. Additionally, participants were asked to report on experienced stress during the task.

Results: Compared to their TD peers, the HFASD individuals showed less reactivity in heart rate variability (HRV) and lower sympathetic activation (skin conductance level) during social stress, while displaying similar gaze behavior and subjective. However, contrary to TD controls, the experience of stress was not related to task-induced arousal in HFASD individuals. No significant differences in gaze behavior and relations between gaze behavior and autonomic arousal were detected.

Conclusions: Our results suggest reduced awareness of arousal and less regulation of arousal during socially stressful events in young adults with HFASD compared to TD peers. These results add to the existing literature in showing that deviant functioning of the ANS might be key in the stress regulation problems seen in so many individuals with autism, also in young adults with HFASD. These conclusions pertain important implications for daily life and give insight in the role of stress regulation in adaptive social behavior.

220 **111.220** Subjective Beliefs about Social Skills Importance, but Not about Social Skills, Predict Peer Interactions in Adolescents with Autism Spectrum Disorder

L. A. Santore[1], *E. Kang*[1], *S. L. Sommer*[1], *C. E. Simson*[1], *D. Kumar*[1] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: Adolescents with autism spectrum disorder (ASD) exhibit frequent deficits in peer interactions (Rao et al., 2008). Recent work has highlighted that such adolescents' beliefs about their own social skills may importantly differentiate them from their typically developing peers (Lerner et al., 2012). Such beliefs can be broken down into two components: beliefs about what skills one actually uses (social skills behaviors; Gresham, 1986), and beliefs about whether those skills are important (social skills importance; Gresham & Elliot, 1990). Adolescents with ASD often believe social skills are important (Rankin et al., 2015; McMahon & Solomon, 2015), and over-report their use of social skills behaviors (Lerner et al., 2012). However, little work has examined the relative contribution of these beliefs in predicting actual peer interaction in adolescents with ASD.
Objectives: This study sought to investigate the relationship between self-reported social skills importance ratings, self-reported social skill behaviors, and observed unstructured peer interactions. It was hypothesized that high levels of self-reported beliefs about social skills behaviors would exhibit an additive relationship in predicting peer interactions among adolescents with ASD.

Methods: 25 Adolescents (M_{age}= 14.984, SD_{age}= 1.480, 19 male) with ADOS-2 (Lord et al., 2012) confirmed ASD diagnoses were assigned to social groups of 5-9 peers for one video recorded twenty-minute free interaction session (e.g., Lerner & Mikami, 2012). Peer interaction duration was coded by a team of blinded and reliable (ICC = .79) coders via the Social Interaction Observation System (SIOS; Bauminger, 2002). Participants completed a self-report measure of both social skill behaviors and social skill importance (SSIS; Gresham and Elliot, 2008).

Results: Multiple linear regression determined social skills importance ratings *negatively* predicted the duration of time spent interacting with peers, even when controlling for self-reported overall social skill behavior (b = -0.162, p = 0.006). This relationship was driven by high importance ratings for communication (b = -1.505, p = 0.002), cooperation (b= -.871, p = .015), engagement (b = -8.55, p = 0.005), and self-control (b = -0.794, p = 0.019). Self-reported social skill behavior was not a significant predictor of peer interactions (p = 0.251), nor was the interaction between such behavior and social skills importance (p = .73).

Conclusions: Contrary to hypotheses, high social skills importance ratings predicted *fewer* social interactions with peers, regardless of self-reported social behavior. It is possible that adolescents with ASD may place higher importance on areas where they need the most improvement (McMahon & Solomon, 2015) – that is, they may in fact identify deficits by labeling them as *important*. The four significant subdomains of importance ratings (e.g. communication, cooperation, engagement, and self-control) are all specific to interactions (Meier, DiPerna, & Oster, 2006), which may provide a window into how youth with ASD perceive their social behavior, even as they rate themselves to have greater social skills (Rankin et al., 2015). This finding reveals a complex and unexpected way in which social cognition may relate deferentially to social behavior in adolescents with ASD.

221 **111.221** Subtle Differences in Subjective Wellbeing for Adolescents with Autism Spectrum Disorder.

P. Ashton *and M. A. Stokes, Deakin University, Burwood, Australia*

Background: Adolescents with autism spectrum disorders (ASD) are prone to negative life experiences due to challenging social experiences and ASD symptomology. This is thought to have a detrimental effect on their subjective wellbeing compared to their typically developing (TD) peers, resulting in differences in levels of subjective wellbeing. Results to date have been equivocal, some finding reductions in wellbeing, other not.
Objectives: Therefore, the current study aimed to establish how wellbeing differs across gender and across diagnosis in a group of adolescents with and without ASD.

Methods: Participants aged 10-21 including high functioning adolescents with ASD (n=59), and a TD control group (n=35). Participants were then gender and aged matched giving 24 pairs. Participants completed the Personal Wellbeing Index – School Children Edition as measure of subjective wellbeing, the Rosenberg General Self-Esteem scale, and the Autism Spectrum Quotient to assess number of autistic traits.

Results: A difference between ASD and TD adolescents was found (p<0.05). No differences were found between adolescent males and females with ASD on wellbeing scores. Mediation analysis indicated that self-esteem fully mediated the relationship between the strength of autistic traits and subjective wellbeing. Linear regression analyses indicated that autistic traits did not predict wellbeing in the ASD group, but were negatively associated with wellbeing in the TD group (p<0.05). Self-esteem was a significant predictor of wellbeing in both groups (p<0.05), although strongest in the TD group. ASD and TD pairs were matched based on age and gender, with a significant difference found on wellbeing scores between matched pairs (p<0.05). Pairs were then separated and reanalysed with ASD participants having higher or lower wellbeing than their TD matched pair placed into two separate analyses. Matched pairs t-tests revealed that there for those with lower wellbeing were significantly lower than their matched pair, while those who were higher also were significantly higher.

Conclusions: Matched participants indicated that adolescents with and without ASD differ on wellbeing. But interestingly, not all adolescents with ASD had lower wellbeing, being higher than their age and gender matched pair. Nonetheless, in more instances the participant with ASD had lower wellbeing than their TD partner. These results suggest a considerably more complex picture with wellbeing in ASD, and may indicate something of the nature of ASD, in that those with ASD may not have sufficient insight to address scales such as the PWI. Alternatively, these differences may suggest an approach to intervening in subjective wellbeing among those with ASD. Either way, these results suggest further research would be useful.

222 **111.222** Temperament Mediates the Relationship between Symptom Severity and Adaptive Functioning in School-Aged Children with Autism Spectrum Disorder

__V. Lee__[1], E. Duku[2], L. Zwaigenbaum[3], T. Bennett[4], P. Szatmari[5], S. E. Bryson[6], M. Elsabbagh[7], E. Fombonne[8], P. Mirenda[9], W. Roberts[10], I. M. Smith[11], W. J. Ungar[12], T. Vaillancourt[13], J. Volden[3], C. Waddell[14], A. Thompson[2] and S. Georgiades[2], (1)McMaster Universtiy-Offord Centre, Hamilton, ON, Canada, (2)McMaster University, Hamilton, ON, Canada, (3)University of Alberta, Edmonton, AB, Canada, (4)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (5)The Hospital for Sick Children, Toronto, ON, Canada, (6)Dalhousie University, Halifax, NS, Canada, (7)McGill University, Montreal, PQ, Canada, (8)Psychiatry, Pediatrics & Behavioral Neurosciences, Oregon Health & Science University, Portland, OR, (9)University of British Columbia, Vancouver, BC, Canada, (10)isand, Toronto, ON, Canada, (11)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (12)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (13)University of Ottawa, Ottawa, ON, Canada, (14)Simon Fraser University, Vancouver, BC, Canada

Background: Temperament is defined as a set of individual differences in behavioural tendencies. An extensive body of literature establishes the association between temperament and childhood psychiatric disorders and more recent studies have documented specific temperament profiles in infants with Autism Spectrum Disorder (ASD). Previous studies have found that infants and children with ASD, when compared to a control group, tend to have a particular temperament profile characterized by higher negative affect, lower urgency and lower effortful control, relative to peers who do not have ASD. However, little is known about how temperament varies within the ASD population and how that variability is associated with later outcomes, such as the development of adaptive skills, in children with ASD.
Objectives: The objective of this study was twofold: a) to identify subgroups of school-aged children with ASD with distinct temperament profiles; and b) to examine whether temperament subgroup membership mediates the relationship between ASD symptom severity and adaptive functioning outcomes.

Methods: Data came from the Pathways in ASD study, a large Canadian longitudinal study of children with ASD. The sample was composed of 185 school-aged children with ASD at T_1 (mean age: 7.8 years; males = 155). Temperament profile was indexed using the T_1 Temperament in Middle Childhood Questionnaire (TMCQ). Children were followed over a 3-year period (T_1-T_3, with T_1 as the first assessment between age 7-8 years and one assessment every 12 months for 2 consecutive years). Seventeen TMCQ dimension scores were used in hierarchical cluster analysis to derive subgroups of children. A test of binary mediation was conducted to test whether the relation between T_2 autism symptom severity (Autism Diagnostic Observation Scale; ADOS) and T_3 adaptive functioning level (Vineland Adaptive Behaviour Scale; VABS II) was mediated by a child's temperament profile.

Results: A 2-cluster solution was selected as the best fit to the data; the two clusters were characterized by distinct temperament profiles (for most TMCQ dimensions). Compared to children in Cluster 2 (60.5% of sample), children in Cluster 1 (39.5% of sample) had higher scores on activation control, affiliation, assertiveness, attentional focusing, fantasy/openness, and soothability, and lower scores on anger/frustration, impulsivity, discomfort, fear, sadness, and shyness. Children in Cluster 1 had significantly lower adaptive functioning skills compared to children in Cluster 2 (F(1,165) = 44.98, p < 0.01). The total direct effect of ASD severity at T2 was a significant predictor of adaptive functioning outcome at T_3, before entering the mediator variable (t(161) = - 3.51, p <0.001). The mediation test revealed that the total indirect effect for temperament profile was significant (p < 0.001; point estimate = -0.16, 95% CI = -0.41 to -0.13), and influenced the relation between ASD severity and adaptive functioning outcome.

Conclusions: Study findings show that in school-aged children with ASD, distinct temperament profiles influence the relation between ASD severity and adaptive functioning outcome. These findings suggest that temperament may be a previously under-researched but important child-level characteristic to consider when investigating developmental outcomes and intervention mechanisms in children with ASD.

223 **111.223** The Aesthetic Perception Ability in Autism Spectrum Disorders: A Behavioural and Eye-Tracking Study

__S. Peretti__[1], M. C. Pino[1], M. Mariano[1], C. Di Dio[2], M. Valenti[1,3] and M. Mazza[1], (1)Department of Applied Clinical Sciences and Biotechnology, University of L'Aquila, L'Aquila, Italy, (2)Department of Psychology, Università Cattolica Sacro Cuoire, Milano, Italy, (3)Reference Centre for Autism of the Abruzzo Region, L'Aquila, Italy

Background:
The ability to experience aesthetics plays a fundamental role in social interactions. For instance, attractive individuals are commonly perceived as possessing positive personality attributions. This suggest that beauty is an important social cue that may affect the ability to experience pleasure playing a pivotal role in social behavior.

A crucial capacity for successful social interactions is Social Cognition (SC), that is a complex cognitive construct that allows to encode and decode the social world. It is known that people with Autism Spectrum Disorder (ASD) have an impairment of SC abilities. These abilities seem to be related with aesthetic perception that allow a person to anticipate interaction or action of others.

Objectives: The study aims at evaluating the ability of aesthetic perception in individuals with ASD compared to typically developing controls (TD), using the Golden Beauty (GB) behavioral task and adapted for eye-tracking.

Methods: 10 individuals with ASD (mean age±SD:20.7±4.64) selected by the Reference Regional Centre for Autism of L'Aquila, and 10 TD individuals (mean age±SD:20.17±0.98) selected by the University of L'Aquila, Italy, participated in the study. All participants underwent SC battery and then GB task with stimuli (sculptures with canonical and modified proportions) presented in three experimental conditions: objective aesthetic judgment (OAJ), subjective aesthetic judgment (SAJ) and proportion judgment (PJ).

Results: Preliminary results showed that ASD group have an impairment in all SC measures, compared to TD group. In the TD group, but not in the ASD one, we found significant correlations between same SC measures and all conditions of GB task. Regarding GB performance, ASD group have a lower ability to judge as objectively beautiful and subjectively pleasing (aesthetic judgments) the sculptures, compared to TD. The same happens for the proportion judgment that is related to the perceptual-cognitive component of the task. TD group evaluated the sculptures with canonical proportion as more pleasant and more proportionated, compared to the sculptures with modified proportion. No differences in the evaluation between canonical or modified sculptures were found in ASD group. It is worth noting that the evaluation of subjective pleasure was always lower in ASD people compared to the evaluation of objective beauty and proportion of sculptures. Finally, the eye-tracking data showed that individuals with ASD have lower gaze parameters for face and bust of sculptures in each condition of GB task, compared to TD people.

Conclusions: This study showed, for the first time, that persons with ASD have an impairment in the aesthetic perception ability. The incapacity to perceive aesthetic features of ASD people has relevance in influencing their incapacity to experience interpersonal and social pleasure. This could have a significant negatively impact on social interactions. Indeed, the perception of beauty is strongly linked with the SC ability as demonstrated by the correlations between SC measures and GB task in TD people. Our findings support the idea that SC and aesthetic perception are in close relationship to each other and this relation is lost or at least impaired in persons with ASD

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111.224 The Impact of Attention-Deficit/Hyperactivity Disorder and Motor Deficit on Socio-Emotional Behaviors of School-Aged Children with Autism Spectrum Disorder

Y. J. Shen[1]*, S. J. Chew*[2] *and L. C. Chen*[2,3]*, (1)National Taiwan University, Taipei city, Taiwan (Province of China), (2)School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei, Taiwan, (3)Department of Physical Therapy, Fooyin University, Kaohsiung, Taiwan*

Background: Autism spectrum disorder (ASD) is a group of developmental disorders marked by impaired social interaction and communication, restricted and repetitive behaviors. In addition to core symptoms, children with ASD often have various comorbidities, including attention-deficit/hyperactivity disorder (ADHD) and motor deficit (MD). Both the core symptoms and comorbidities of ASD have adverse effects on children's socio-emotional behaviors that are major concerns of their parents and teachers. However, previous studies mostly focused on ASD core symptoms but rarely investigated the impact of comorbidities on children with ASD.

Objectives: The purpose of this study was to examine the influence of comorbidities, including ADHD and MD on socio-emotional behaviors of school-aged children with ASD.

Methods: Forty-four children with high-functioning ASD (8.8±1.1 years of age, 38 boys) participated in this study. ASD and ADHD diagnoses were determined by child psychiatrists. Bruininks-Oseretsky Test of Motor Proficiency, Second Edition was used to determine MD of children with a cut-off standard score of 40. Children's socio-emotional behaviors were assessed using parental reports of the Child Behavior Checklist (CBCL). Cut-off T scores were 70 for the 8 CBCL narrow band syndromes and 63 for internalizing, externalizing, and total behavior problems. Two-way ANOVA was applied to examine the impact of ADHD and MD on socio-emotional behavior problems of children with ASD. Considering the influence of intellectual function on children with ASD, children's intellectual ability was controlled in the analyses.

Results: Among the 44 children with ASD, 20 (45%) were also diagnosed with ADHD. Nine out of 20 (45%) children with ASD and with ADHD and 13 out of 24 (54%) children with ASD but without ADHD were found to have MD. Statistical analyses revealed that comorbidity of ADHD significantly increased attention problems (F=5.620, P=0.023), aggressive behavior (F=5.901, P=0.02), and externalizing problems (F=4.685, P=0.037) in children with ASD while comorbidity of MD only significantly increased children's social problems (F=5.634, P=0.02). After controlling children's intellectual quotient, however, the effect of MD on social problems in children with ASD was diminished and became borderline (F=3.979, P=0.053). No ADHD*MD interaction effect was found for socio-emotional behaviors of children with ASD.

Conclusions: Comorbidities of ASD, including ADHD and MD have further negative impact on various domains of children's socio-emotional behaviors during school age. Medical professionals, teachers, and parents should be aware of the impact of comorbidities on functioning of children with ASD to help better plan for intervention or teaching strategies. Future research needs to consider possible influence of various comorbidities when investigating socio-emotional behaviors of children with ASD.

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111.225 The Impact of Autistic Traits on Prosody and Gesture Perception

L. Shim[1]*, F. E. Pollick*[2] *and I. M. Eigsti*[3]*, (1)School of Psychology, University of Glasgow, Glasgow, United Kingdom, (2)School of Psychology, University of Glasgow, Glagow, United Kingdom, (3)University of Connecticut, Storrs, CT*

Background: The integration of speech and gesture is an essential ability that helps humans to participate in daily communication and social interactions. Various studies support that this integration relates to the development of language and communication. However, deficits in communication and social reciprocity are commonly presented in Autism Spectrum Disorders (ASD) and several studies suggest that individuals with ASD have more difficulty in the integration of speech stimuli as well as in discriminating temporal asynchrony in linguistic and other scenarios. These differences in speech and gesture integration in ASD may impact on social and emotional communication and multisensory temporal integration.

Objectives: To investigate differences of speech-gesture processing between typical individuals and those with high levels of autistic traits using three different stimuli conditions, including auditory, visual, and audio-visual conditions.

Methods: We used a cutoff of above 29 on the Autism Quotient score to enter the High AQ (HAQ) group and below 18 to enter the Low AQ (LAQ) group. The ongoing study involves 24 right-handed individuals (17 LAQ and 7 HAQ) between the ages of 18 and 40 years old. All participants took the WASI to measure IQ. Three experiments were conducted: (1) Experiment 1 investigated performance differences in prosody perception between the two groups with 5 different tasks, (2) Experiment 2 investigated differences in processing gestures between the two groups and (3) Experiment 3 explored differences in the ability to distinguish emotional congruence and incongruence of prosody and gesture and between the two groups.

Stimuli- Two stimuli sets were used in this experiment: (1) From the Egisti et al.(2012) study, emotional (Angry, Neutral) and grammatical (Statement, Question) sentences with audio-only condition and (2) From the Piwek et al.(2015) study, emotional (Angry, Happy, Neutral) sentences in an audio-only condition, point-light displays in a video-only condition, and audio-visual stimuli including two different conditions (emotional congruence and incongruence) were used.

Results: The results of Experiment 1 revealed that there was no difference between LAQ and HAQ groups in prosody perception. However, in one task that involved finding emotional and grammatical prosody together, the HAQ group showed lower accuracy than the LAQ group ($p<0.05$). Experiment 2 showed that while both groups exhibited low accuracy in correctly perceiving emotions from the gestures (LAQ: 67.7%, HAQ: 56.75%), the LAQ group performed better ($p<0.05$) than HAQ. In Experiment 3, there was no group difference between LAQ and HAQ to find emotional congruence between auditory and visual stimuli. In overall reaction times, there were no group differences, but both groups showed the slowest reaction times in the gesture-only condition.

Conclusions: This study investigated how autistic traits impact on prosody and gesture perception. Two differences were found in that the HAQ group obtained lower accuracy performance in complex prosody and gesture-only task than the LAQ group. These results emphasise that although both groups performed similarly for several tests, significant performance differences exist between individuals with low and high autistic traits, suggesting that consideration of these differences can help to find how autistic traits impact on social communication.

226 **111.226** The Respiratory Sinus Arrhythmia in Young, Low-Functioning Children with and without Autism Spectrum Disorder

J. Lauttia[1]*, T. M. Helminen*[2]*, S. M. Kivimäki*[3]*, K. Eriksson*[4] *and A. Kylliainen*[2]*, (1)University of Tampere, Tampere, Finland, (2)Tampere University, Tampere, Finland, (3)City of Helsinki, Helsinki, Finland, (4)Tampere University and Tampere University Hospital, Tampere, Finland*

Background:

Heart rate variability, and more specifically, respiratory sinus arrhythmia (RSA) is considered as a peripheral biomarker of social competence and emotion regulation. Earlier research has often found lowered RSA in individuals with ASD and it has been associated with various difficulties in social cognition, such as emotion recognition, social responsiveness and spontaneous use of eye gaze. There have, however, been also contradictory findings showing no ASD specific differences in RSA. It is assumed that the decreased RSA is not unique to ASD but shown to relate social difficulties in other neurodevelopmental disorders too. In addition, the earlier studies have mainly been done in school-aged, high-functioning children with ASD leaving open the question whether lowered RSA evokes early in autistic development and relates to social difficulties also in low-functioning children with ASD.

Objectives:

The main aim of the study was to investigate baseline RSA in young, low-functioning children with severe ASD. In order to study the effects of developmental level to RSA, we had an IQ-matched comparison group of developmental delay children (DD) without ASD. Age-matched typically developing children (TD) served as a normative control group. In addition, the connections between RSA and reciprocal social interaction, communication and restricted, repetitive, and stereotyped patterns of behaviour were studied in all the groups.

Methods:

The final sample consisted of 14 children with ASD, 17 TD children and 16 children with DD. Every group included 2 girls and the age ranged from 29 to 81 months. Heart rate was measured whilst the children looked at a neutral video about a person building with Lego bricks for 3 minutes. Data was carefully offline video analysed in order to reject artefacts. RSA was analysed in 0,24–1,04 Hz using a Matlab-based in-house program. The parents filled Social Communication Questionnaire (SCQ) as a measure of autistic behaviour.

Results:

The findings revealed significant difference in RSA between the groups (Kruskal-Wallis H = 6,324, p = .042). Paired comparison showed that the children with ASD had lower RSA than TD children and children with DD. There were no differences in RSA between TD and DD children. SCQ domains of reciprocal social interaction and communication were not associated to RSA in any of the groups. However, a trend of interaction between RSA and restricted, repetitive, and stereotyped behaviour (RRB) was found both in the ASD and DD groups. The higher RSA was connected to more RRB in children with ASD whereas in children with DD higher RSA was connected with less RRB.

Conclusions:

The findings of the study indicated that lowered RSA is detectable early in the autistic development and is not related to the developmental delay without ASD. Interestingly, the RSA connection to restricted, repetitive, and stereotyped behaviour seemed to be reversed in children with ASD and children with developmental delay. Restricted and repetitive behaviour as an aid for self-regulation in ASD deserves further clarification.

227 **111.227** The Role of Social Awareness and Motivation in Interpersonal Behavior and Imitation in Children with Autism

E. Moody[1]*, C. Ledbetter*[2]*, B. Barger*[3]*, N. Reyes*[4] *and S. Rosenberg*[2]*, (1)University of Colorado, Denver, Aurora, CO, (2)University of Colorado Anschutz Medical Campus, Aurora, CO, (3)Georgia State University, Atlanta, GA, (4)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO*

Background: Imitation is one of several important social matching behaviors (Moody & McIntosh, 2006) implicated in numerous outcomes (e.g., Bavelas, Beavin-Black, Lemery, & Mullett, 1987). Imitation deficits are associated with autism (Rogers & Williams, 2006); although, there is variability in the consistency of this finding (Charman & Baron-Cohen, 1994). Deficits in social motivation have been proposed as a possible explanation for imitation deficits in autism (Rogers & Williams, 2006).

Objectives: This study investigates the relationship between social factors (i.e., motivation, social cognition, social communication and social awareness), and social and imitative ability in children with autism. This will provide a better understanding of the mechanisms underlying imitation deficits and social behavior and will guide future research on improving social abilities in individuals with autism.

Methods: Data for this analysis came from the Study to Explore Early Development (SEED; n = 628), a multi-site case-control study on risk factors for autism. Participants were included if they received a final classification of autism, and completed the following measures: 1) Social Responsiveness Scales (SRS), 2) Vineland Adaptive Behavior Scales-II (Vineland), 3) Autism Diagnostic Observation Schedule (ADOS) and 4) demographics. Separate models were computed for the Vineland Interpersonal Relationships subdomain and for a subset of Vineland items from the same subscale that relate to imitation (items 8, 12, 16, 18, and 21). Linear regression was used for all analyses; p-values less than 0.05 were considered significant. The primary exposures for these analyses were the social constructs from the SRS: social motivation, social cognition, social awareness, and social communication subscales. All analyses were adjusted for age, sex, maternal race, maternal ethnicity, and income. Autism severity (Calibrated Severity Score (CSS) from the ADOS) was tested as an effect modifier. However, no effect modification was found, therefore, CSS was included as a covariate. Due to the non-normal distribution of the Imitation score, a bootstrapped regression was conducted. All analysis was performed in R version 3.1.2 (2014-10-31). The *car* package v(2.0.25) was used for the bootstrap regression.

Results: Social awareness is significantly associated with the Vineland Interpersonal Relationships v-score (p = 0.0043). For every 10 point increase in Social Awareness there was a 0.36 decrease in the mean Interpersonal Relationship score after adjusting for Social Motivation, Communication, Cognition, autism severity, age, race, sex, ethnicity, income, and maternal education. Social Motivation was significantly associated with Imitation (p = <0.05). For every 1 point increase in Social Motivation there was a 0.038 (95% CI: 0.067-0.011) decrease in the mean Imitation score after adjusting for Social Awareness, Communication, Cognition, autism severity, age, race, sex, ethnicity, income, and maternal education.

Conclusions: There is a significant association between Social Motivation and Imitation, and between Social Awareness and Interpersonal Relationship skills after adjusting for other social domains, autism severity, and socioeconomic status. This suggests that separate social

constructs relate to social and imitative abilities in children with autism. This may help guide targets of intervention in the future; however, additional research is needed to better understand this association.

228 **111.228** Toddlers with Autism Observe the World in a More Variable Manner Exhibiting Large Intra-Individual Variability

I. Avni[1]*, A. Bar-Sinai*[2]*, I. Menashe*[3]*, G. Meiri*[4] *and I. Dinstein*[5,6,7]*, (1)Cognitive and Brain Sciences, Ben Gurion University of the Negev, Israel, Be'er sheva, Israel, (2)Ben Gurion University of the Negev, Beer Sheva, Israel, (3)Public Health Department, Ben-Gurion University, Beer Sheva, Israel, (4)Soroka Medical Center, Beer Sheba, Israel, (5)Department of Psychology, Ben Gurion University of the Negev, Beer Sheba, Israel, (6)Negev Autism Center, Ben Gurion University of the Negev, Beer Sheba, Israel, (7)Department of Cognitive and Brain Sciences, Ben Gurion University of the Negev, Beer Sheba, Israel*

Background: Previous eye-tracking studies have reported that children with autism do not fixate on social stimuli in the same manner as neurotypical children, perhaps interfering with their ability to learn social interactions. For example, children with autism exhibit reduced preference for social stimuli including faces, eyes, and biological motion. A lack of social preference may lead to idiosyncratic gaze preferences, large between-subject variability, and low inter-subject correlations. In the current study, toddlers with autism and matched controls observed several movies containing social stimuli twice. This design enabled us to determine whether between-subject variability was driven by reduced preference for social stimuli and quantify within-subject variability across the two presentations of each movie. All participating children were part of the regional autism database initiative at the Negev Autism Center in Israel (www.negevautism.org).
Objectives: To compare social preference, between-subject variability, and within-subject variability across autism and control children presented with naturalistic and animated movies containing social stimuli.

Methods: We recorded eye tracking data from 68 toddlers with autism and 29 control toddlers while freely viewing two animated movies and one naturalistic movie containing social interactions. Each of the movies was presented twice during the experiment. We then computed inter-subject correlations across individuals and intra-subject correlations across presentations from each group of subjects.

Results: Toddlers with autism exhibited significantly smaller inter-subject correlations (i.e. larger between-subject variability) in comparison to controls. Furthermore, toddlers with autism exhibited significantly smaller intra-subject correlations (i.e. larger within-subject variability) in comparison to controls.

Conclusions: Neurotypical children exhibit strong inter-subject correlations in gaze patterns, likely due to their preference for social stimuli. Children with autism, on the other hand, are not only different from each other, they also exhibit weak intra-subject correlations across presentations of the same movie. This indicates that their idiosyncratic gaze patterns are also less stable across repeated presentations of the same structured stimulus. Hence, toddlers with autism view the world in a more variable less consistent manner. This variability may have important implications for their ability to learn and explore the visual world.

229 **111.229** Where Do Children with ASD Look for Information in Ambiguous Social Situations?

A. Porthukaran[1]*, M. Hooper*[2]*, M. Davies*[1]*, J. Abrams*[1,3] *and J. M. Bebko*[1]*, (1)York University, Toronto, ON, Canada, (2)York University, Toronto, ON, CANADA, (3)Durham Catholic District School Board, Toronto, ON, Canada*

Background: Children with autism spectrum disorders (ASD) process information differently than typically developing peers (Loveland et al., 2001). Studies in social information processing have found that children with ASD do not attend to social contingencies (Schroeder, 2013). In a study by Klin and colleagues (2002), individuals with ASD looked at videos of social situations using eye-tracking technology to pinpoint gaze patterns. Individuals with ASD tended to fixate more on mouths and other objects rather than the eyes. Children with ASD are especially susceptible to bullying experiences and respond in different ways compared to typically developing children. Schroeder (2013) suggested that the way these children process social information increases their susceptibility to misunderstand bullying experiences as normative.
Objectives: The focus of this study was to identify what aspects of social bullying scenes children with ASD would attend to compared with TD children. Understanding what is salient to children with ASD is important in determining some of the causes of high rates of social difficulties among this population.

Methods: Twenty-three children with ASD (83% male), and 24 in the TD comparison group (79% male) were matched based on age, IQ and PIQ using a brief measure of intelligence (WASI). Participants were presented with two short videos depicting social interactions in which the intent of the perpetrator was ambiguous (e.g., may have been hostile or accidental) and one short video in which the intent was more clearly hostile. These videos were filmed from the first-person perspective. Participant eye movements were recorded using an eye-tracker. Areas of interest (AOI) were defined as the central components of each video (e.g., a child's face, a game board, child's arm) and total time spent looking at each AOI was recorded.

Results: Dynamic areas of interest were added to the social scenes to cover those areas most informative in the scene. In the clearly hostile scene, there were no differences compared with TD children in the amount of time during which children with ASD looked at social aspects of the scene ($p = 0.78$). However, in the two ambiguous scenes, children with ASD spent more time than typically developing controls looking at non-social aspects of the scene; for example, a backpack (TD = 4.8s, ASD = 9.2s; $p = 0.006$) instead of a potential thief (TD = 4.9s, ASD = 3.9s; $p = 0.01$).

Conclusions: In scenes where it was most crucial for children with ASD to focus on social information (i.e., those scenes where someone's intent was ambiguous), they instead focused on non-informative stimuli such as objects. In situations of bullying, such as those presented in these videos, this may lead children with ASD to miss details that help them to clarify the nature of these interactions. Children with ASD more frequently experience bullying than their typically developing peers. Emerging evidence suggests that how they process information in their environments is linked to difficulty in handling potential bullying situations. This research can help inform how children with ASD process complex information in more naturalistic settings.

230 **111.230** Young Adults' Autistic Behaviors Predict P1 and N170 ERP Responses to Emotion Stimuli

S. C. Taylor[1,2] *and C. L. Dickter*[1]*, (1)College of William and Mary, Williamsburg, VA, (2)Neuroscience Graduate Group, University of Pennsylvania, Philadelphia, PA*

Background: In addition to the core deficits of Autism Spectrum Disorder (ASD), deficits in emotional processing, especially with negative emotions and surprise, have been identified (Uljarevic & Hamilton, 2013). These behavioral deficits are reflected in differences in neural responses, specifically with the P1 and N170 event-related potential components (Black et al., 2016).
Objectives: Given that subclinical levels of autistic behaviors have been observed in the general population and have been associated with various psychosocial and interpersonal difficulties (e.g. Wainer et al., 2011), this study aimed to examine how the neural differences in emotion processing that have been identified in clinical populations are modified by autistic behaviors in a subclinical, college-aged population. This study further sought to determine if differences in emotion processing were modified by the facial features available, the emotion being displayed, or the task type.

Methods: This study examined 34 subclinical college students, comparing those with a higher number of autistic behaviors (n=12) to those with a lower number (n= 2), as measured by the Broad Autism Phenotype Questionnaire (Hurley, Losh, Parlier, Reznick, & Piven, 2007). Emotion processing was examined using a task composed of a series of still pictures that varied by emotion (angry, fearful, happy, neutral, and surprised) and facial features available (eye region, full face). Task type varied by instructions intended to modify the type of processing occurring. The matching task indicated to respond based on whether the emotion of the face matched that of the face presented before it. Alternatively, the valence task indicated to respond whether the emotion of the face was the target valence (i.e. positive or negative) or not.

Results: Those with low levels of autistic behaviors demonstrated greater neural attention to fearful stimuli, measured by N170 amplitude, while those with high levels did not, indicating a difference between the two groups in processing fear; $t= -2.68$, $p=.01$. This effect emerged in trials showing the eye region in the valence task (Figure 1a) and not in those in the matching task (Figure 1b). Analyses using autistic behaviors as a continuous variable showed higher autistic behaviors were related to decreased neural attention in response to surprise as measured both by P1 ($r= -.49$, $p =.00$) and N170; $r= -.42$, $p=.02$. Additionally, the results demonstrated that in participants with high levels of autistic behaviors, less neural attention occurred in response to faces in which only the eye region was shown, contrasting the increase in neural attention in those with low levels of autistic behaviors when presented the same stimuli.

Conclusions: In this study we demonstrated, in a rarely investigated population of subclinical young adults, that the neural processing of faces varies by emotion as well as by the facial features available differently based on the degree of self-reported autistic behaviors and that this effect is modulated by task type. This study helps reveal the early neural components during emotion processing in young adults representing the broader autism phenotype, which may be responsible for some of the social challenges associated with autism.

231 **111.231** The Role of Receptive and Expressive Language on Social Initiations in Young Children with Autism

***R. A. Bowler**, E. A. Bisi, A. Thomas, C. Carlson and B. J. Wilson, Seattle Pacific University, Seattle, WA*

Background: Children with autism spectrum disorder (ASD) often experience challenges with social interaction from an early age, which may be associated with social withdrawal and emotional and behavioral dysregulation later in life (Krasch, 2015). Additionally, many children with ASD have deficits in the usage and/or production of language (Farrar, Seung, & Lee, 2017; Hudry et al., 2009). Previous research suggests that for children with ASD, receptive language may be more delayed than expressive language (Hudry et al., 2009). Lower receptive and expressive skills may make it particularly challenging for children with ASD to initiate or engage in social interactions.
Objectives: The purpose of this study was to examine the unique roles of expressive and receptive language on social initiative behaviors for children with ASD compared to their TD peers. We hypothesized that both receptive and expressive language would moderate the association between developmental status and social initiation, such that children with ASD and lower levels of either receptive or expressive language would initiate less frequently than TD children.

Methods: Our sample included 115 children (ages 3:0 to 6:11), 71 (49% female) with TD and 44 children with ASD (20% female). Videotaped recordings of an 8-minute parent-child free-play task were coded using an adapted version of the Modified-Classroom Observation Schedule to Measure Intentional Communication (M-COSMIC; Clifford, Hudry, Brown, Pasco, & Charman, 2010), from which a percentage of child social initiations was later calculated. Child language ability for expressive and receptive language was assessed through the Verbal Comprehension and Naming Vocabulary subtests of the DAS-II (Elliott, 2007).

Results: A double moderation model was conducted using the PROCESS macro for SPSS (Hayes, 2013), to evaluate the effects of receptive and expressive language on the association between developmental status and the percentage of social initiations. Age and gender were controlled for in the analysis. Results indicated the main effect of status on percentage of initiations during a parent-child free-play task was significant ($B = -.581$, CI_{95} [-.937, -.225], $p = .002$). The main effects of expressive ($B = .000$, CI_{95} [-.003, .003], $p = .980$) and receptive language ($B = .001$, CI_{95} [-.003, .005], $p = .722$) on social initiations were not significant. The interaction effect of receptive language and status was significant ($B = .006$, CI_{95} [.001, .012], $p = .033$) but expressive language and status was not ($B = .003$, CI_{95} [-.003, .008], $p = .336$). Children with ASD and lower receptive language had the lowest percentage of social initiations. Results indicated that 39% of the variance in social initiation was accounted for by the variables in our model.

Conclusions: Supporting previous research, children with ASD in this study exhibited fewer social initiations than their TD peers. In the current study, social initiative behaviors were moderated by receptive but not expressive language, consistent with prior research on differences in receptive and expressive language for children with ASD (Hudry et al., 2009). Our findings suggest receptive language may be an important target for intervention to increase social initiation in young children with ASD.

Poster Session
112 - Miscellaneous
11:30 AM - 1:30 PM - Hall Grote Zaal

232 **112.232** Do Kids with Autism Get "the Feels"?; Making Sense of Interoception

***C. Tierney-Aves**[1], K. Mahler[1], A. Lazzara[2], M. Veglia[2], C. Lucas[2] and E. Miller[2], (1)Penn State Hershey Medical Center, Hershey, PA, (2)Penn State Hershey College of Medicine, Hershey, PA*

Background:

Professionals suspect that children with Autism Spectrum Disorder (ASD) have differences with their interoceptive system, defined as the sensory system that allows us to experience internal physiological sensations. Awareness of these interoceptive sensations is what underlies our ability to clearly interpret our emotions such as anger, anxiety, calm and distractibility.

Objectives:

The purpose of our study was to compare how parents of teens with and without high functioning autism interpret their child's levels of interoceptive awareness.

Methods:

Our study consisted of a 55 item Likert Scale survey administered to parents of teens with and without high functioning autism, and the responses were compared. For the purpose of this poster, we calculated average composite scores for eleven questions that targeted general emotional awareness (general emotional composite, GEC), three that targeted the perception of anger (anger composite, AC) and three that targeted the perception of calm (calm composite, CC). Lower scores indicate less interoceptive awareness. A two-sampled t-test was used to compare averages between ASD and controls and Cohen's d was used to determine effect size.

Results:

The ASD group consisted of 81 parents of teens. The average age of the teens in the ASD group was 13.65 years and 75% were boys. The control group consisted of 96 parents of teens. The average age of the teens in the control group was 12.91 years and 50% were boys. The ASD group had a significantly lower GEC than the control group (1.80 vs. 2.58, p<0.001, Cohen's d 2.19). The ASD group also had a significantly lower AC than the control group (1.82 vs. 2.48, p<0.001, Cohen's d 1.46) and lower CC than the control group (2.07 vs. 2.57, p<0.001, Cohen's d 1.05).

Conclusions:

Our study was the first to survey interoceptive awareness in teenagers with and without high functioning autism. Our results suggest that when compared to neurotypical controls, the parents of high functioning autistic teens interpret their children as less aware of their interoceptive sensations leading to reduced emotional awareness.

233 **112.233** Evaluating Digital Social Stories

E. Smith[1], *H. Johnson*[1], *A. Constantin*[2] *and M. Brosnan*[3], *(1)University of Bath, Bath, United Kingdom, (2)University of Edinburgh, Edinburgh, United Kingdom of Great Britain and Northern Ireland, (3)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

Social stories are a widely used intervention for people with a diagnosis of Autism Spectrum Disorder (ASD). Practitioners perceive them to be highly effective but meta analyses of the research literature reveals mixed findings. Crucial influences upon the effectiveness of social stories is argued to be in the consistency of their development and delivery as well as the behaviours targeted for intervention. The majority of existing research literature has focussed on evaluating effectiveness relating to either increasing or decreasing a specific behaviour. However, in practice the most common use of social stories by parents and practitioners is for supporting children with novel events and transitions.

Objectives:

The Digital social stories iPad app has been developed through participatory design and was evaluated for its impact upon supporting children with ASD in preparation for a novel event.

Methods:

Participants were 10 autistic children (8 male; 2 female), aged 7-11. All children were due to attend a 4-day school summer camp and their teacher had identified a specific area/event that was anticipated to cause a high level of concern/anxiety and problematic behaviours (e.g. being away from their family, eating different food). A unique social story was written for each child within the digital social stories app and presented on the iPad. The researcher read the social story with the child every day during the week before the camp. The child's teacher rated their level of anxiety, understanding and closeness to their individual target goal (identified in the social story) on an 11 point scale (0-10) before and after the social story intervention. A rating of problem severity during camp was also obtained.

Results:

Results revealed a significant increase in the child's perceived level of understanding (t = 2.34, p = 0.044), a move towards achieving the child's individual goal (t = 4.15, p = 0.002), and a decrease in perceived anxiety levels (t = 4.49, p = 0.002) when comparing the pre- and post- intervention teacher ratings. Problem severity during camp was also significantly correlated with getting closer to the goal (difference between pre- and post measure) r = 0.66, p = 0.038. Changes in anxiety (r = .57, p = 0.089) and understanding (r = 0.50, p = 0.14) were not significantly correlated with problem severity but did indicate a trend in the right direction.

Conclusions:

Empirical support was found for using Digital social stories to help children prepare for a novel, potentially challenging event by decreasing anxiety, increasing understanding and facilitating a move towards the child's individual target goal. Much research on social stories to date has been single case study design and this study represents a relatively large sample size, as well as focussing upon supporting upcoming events that may be challenging, rather than a specific challenging behaviour (which is typically the focus within the research literature).

Individual child profiles will be presented (anonymously) as well as the group data. Funding for the project was provided by The Leverhulme Trust.

234 **112.234** Video Self-Modeling to Modify Aggressive Behaviors in Students Significantly Impacted By Autism Spectrum Disorder

K. M. Sadler, *Curry School of Education and Human Development, University of Virginia, Charlottesville, VA*

Background:

Research has demonstrated that Video Self-Modeling (VSM) is an effective intervention for children with ASD, often producing substantial changes in the student's behavior (Bellini, 2016; Dowrick, 2012). VSM has tremendous potential to address disruptive behavior and aggression for students significantly impacted by ASD. For example, processing visual information is preferable to those with limited symbolic communication (Corbett & Abdullah, 2005; Foss-Feig, et al., 2016; Snell, et al., 2008). In addition, the modeled applications of skills presented in the videos is preferable to individuals with extreme dislike of social interactions (Buggey, 2005; Corbett & Abdullah, 2005). Furthermore, restricted interests or hyper-focused attention, could be utilized by individualizing the VSM to allow for higher likelihood of engagement (Dowrick, 2012; Gelbar, et al., 2012). Essential to the present study is the fact that within the published research, the use of VSM to reduce aggressive behavior was only demonstrated in one study, with an individual mildly impacted by ASD (Buggey, 2005). Despite it's potential, this is the only documented study that used VSM to decrease aggressive behaviors of students with ASD and there is no record of using VSM to decrease aggressive behaviors in students severely impacted by ASD.

Objectives:

The following research questions were addressed; (1) Can an antecedent based VSM technique be used to decrease high rates of aggressive behaviors for individuals severely impacted by ASD? (2) What effect will adding a direct instruction component to the antecedent based VSM technique have on the frequency of aggressive behavior? It is hypothesized that pre-planned, direct instruction in addition to regular viewings of the VSM, would aid in the acquisition of pro-social skills, and decrease incidents of aggressive behavior in a population of students with exacerbated ASD symptoms.

Methods:

A three series multiple baseline design was used with an intervention introduction at a different point in each series (Horner, et al., 2005). In this model each participant serves as his own control (baseline data on the dependent variable was collected for each participant until a trend emerged). A preference assessment, using a semi-structured interview, was conducted with the student's caregiver, classroom teacher, and behavior analyst. Preferences identified in the interview were tested by the primary researcher by applying reinforcement for various behaviors, not targeted in this study, and observing the consequential behaviors.

Results:

All participants demonstrated decreases in overall disruptive behavior according to the data collected (frequency counts, teacher interviews, field notes) during the intervention phase. Pro-social skills, demonstrated increases at differing rates per participants. Two students generalized skills to various settings and contexts.

Conclusions:

From the data, it appears that a VSM technique can be used to decrease the aggressive behaviors of individuals severely impacted by ASD. Further exploration needs to occur before a causal relationship between the dependent and independent variables can be determined. However, this experiment provides convincing evidence that combining a school-based functional assessment with a VSM intervention has the potential to treat persistent aggression often seen in students with ASD.

Oral Session - 1A
Diagnostic, Behavioral & Intellectual Assessment
113 - Detecting and Diagnosing ASD in Toddlers

1:45 PM - 2:35 PM - Grote Zaal

1:45 **113.001** Validating a New Visual Screener for Autism in an Unselected Sample of Low Income and Ethnic Minority Children

J. Harris[1], *Y. M. Janvier*[2], *C. N. Coffield*[3], *D. S. Mandell*[4], *Z. Cidav*[5], *M. Lopez*[6] *and N. V. Gonzalez*[6], *(1)Children's Specialized Hospital, Mountainside, NJ, (2)Medical, Lehigh Valley Medical Center, Allentown, PA, (3)Pediatrics, Rutgers RWJ Medical School, New Brunswick, NJ, (4)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (5)University of Pennsylvania, Philadelphia, PA, (6)Autism, Children's Specialized Hospital, Fanwood, NJ*

Background:

Significant disparities exist in early access to care among low income and minority children at risk for ASD. These disparities may be due in part to the lack of ASD screening tools designed for this population. Existing tools typically require parents to have sophisticated reading comprehension and understanding of developmental milestones. The Developmental Check-In (DCI), a primarily visual tool with minimal literacy demands, was developed specifically for this population. Previous research with the DCI found that it outperformed the Modified Checklist for Autism in Toddlers-Revised (MCHAT-R) and Social Communication Questionnaire (SCQ) at identifying ASD among young underserved children at risk for ASD.

As a next step in validating the DCI, we examined its psychometric properties in an unselected sample of young underserved children.

Objectives:

To compare the performance of the DCI with that of other, validated ASD screening tools (M-CHAT-R & SCQ) in detecting ASD among an unselected sample of young underserved children.

Methods:

Subjects were 24 to 60 month old children enrolled at Head Start programs, which are located in underserved communities and serve low income families. Parents completed the DCI, MCHAT-R, SCQ, medical history form, adaptive behavior measure (ABAS) and demographic information. Parents provided consent for their child’s Head Start teacher to complete the same 3 screening tools. Evaluations were offered to children at risk on any parent or teacher-completed screening tool. The children were evaluated using the Mullen Scales of Early Learning and the ADOS-2. Clinical diagnosis was determined by a licensed, experienced clinician (developmental pediatrician, psychologist or advanced practice nurse) based on patient history, clinical observation and ADOS-2 classification. Differences in performance were estimated using receiver operating characteristic curves.

Results:

Completed parent-report measures were collected for 439 children. Child care providers also completed screening for 68% of the sample. Forty-one children (9%) were subsequently diagnosed with ASD. The parent-completed DCI better identified children at risk for ASD than the MCHAT-R ($p<0.0001$) or the SCQ ($p= 0.0139$). Area under the curve in the ROC analysis was 0.84, 0.67, and 0.76, respectively. For teacher-completed tools, there were no significant differences between the DCI and the MCHAT-R ($p = 0.06$) or SCQ ($p = 0.48$).

Conclusions:

The parent-report version of the DCI performed better than two validated screening tools in identifying young children with ASD who were from families with low income, and/or who were non-white, Hispanic, and/or for whom English was not the primary language spoken in the home. When considered with previous findings that the DCI also performed better among young, underserved children at-risk for ASD, the DCI is a promising tool for reducing disparities in diagnosing ASD. Based on the rate of ASD (9%) among children with completed parent screens, this study also suggests that ASD screening in underserved childcare settings is a useful method for identifying children at risk.

1:57 **113.002** Cognitive and Behavioural Differences in Toddlers with Autism Spectrum Disorder from Multiplex and Simplex Families

C. Dissanayake[1,2,3]*, J. P. Searles*[4]*, J. Barbaro*[1] *and N. Sadka*[1]*, (1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)Olga Tennison Autism Research Centre, Bundoora, Australia, (4)Olga Tennison Autism Research Centre, La Trobe University, Bundoora, Australia*

Background: Studies of 'high-risk' siblings have provided valuable information regarding the early Autism phenotype and our understanding of the early developmental trajectories of affected individuals later diagnosed with Autism Spectrum Disorder (ASD). However, it remains unclear whether these cases of affected siblings are representative of the wider population of children with ASD. To date there is only one published (Taylor et al., 2015) and one unpublished (Pandey, 2008) study on this topic, with inconsistent findings, and both failing to take account of birth order in determining whether children are from Simplex families.

Objectives: Our objective was to investigate whether the early development of toddlers with ASD from Multiplex (MPX) families, who have an affected older sibling, is similar to toddlers from Simplex (SPX) families where there is no affected sibling or family member. A further aim was to determine the pattern of association between ASD symptom severity and cognitive functioning within each group to help shed light on possible mechanisms for group similarities/differences.

Methods: Behavioural and cognitive assessment data, as well as demographic details, from an un-selected sample of 244 toddlers, diagnosed with ASD (183 males) at age 2-years, were utilised to address the study aims. The sample comprised 45 MPX children, 127 first-born (FB) SPX children and 72 later born (LB) SPX children. Children in each group, matched on age, gender and parental education, had been administered the Autism Diagnostic Observational Schedule (ADOS) and the Mullen Scales of Early Learning (MSEL) to assess their autism symptoms and cognition, respectively. Parents had been administered the Autism Diagnostic Interview (ADI-R). The test administrators were blind to the study aims.

Results: MPX children had significantly higher developmental quotients (DQ), with differences found on Verbal, Nonverbal, and Overall DQ between the MPX group and each of the FB SPX and LB SPX groups; the SPX groups were not different from each other. The three groups did not differ on overall symptom severity as measured on the ADOS, or on their Social Affect (SA) and Restricted and Repetitive Behaviour (RRB) scores. No group differences were found on the ADI-R Social Interaction or Communication domains, with the only difference being that the SPX LB children had lower scores on the RRB domain compared with the other groups. Although autism symptom severity (ADOS and ADI-R scores) and the MSEL DQ scores were negatively correlated in each group, the groups were similar in the pattern of relationship found between autism severity and cognitive ability.

Conclusions: The different cognitive profiles between MPX and SPX groups suggest that findings from high-risk sib studies may not generalise to other samples of children with ASD. It is important that future research examine biological and environmental factors that may explain the enhanced cognitive development of children with ASD from MXP families.

2:09 **113.003** Early Identification of ASD through Telemedicine: Potential Value for Underserved Populations

N. A. Broderick[1]*, P. Juárez*[2]*, A. S. Weitlauf*[3]*, A. Nicholson*[4]*, A. Pasternak*[5]*, J. F. Hine*[2]*, A. Stainbrook*[6] *and Z. Warren*[2]*, (1)Pediatrics, Vanderbilt University Medical Center - Treatment and Research Institute for Autism Spectrum Disorder, Nashville, TN, (2)Vanderbilt University Medical Center, Nashville, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (4)Vanderbilt University, Pleasant View, TN, (5)Vanderbilt Kennedy Center/TRIAD, Nashville, TN, (6)Vanderbilt Kennedy Center, Nashville, TN*

Background: There is growing evidence that accurate, stable diagnosis of ASD is possible during the second year of life and very young children with ASD receiving early behavioral intervention services demonstrate substantial gains in functioning. Although early diagnosis of ASD is possible in the first years of life, children from traditionally underserved communities are often not identified until much later ages. Substantial evidence suggests that families from low-resource communities struggle to access evaluation services through diagnostic centers, even when universal screening programs are implemented. Such diagnostic delays and health disparities contribute to family stress and restrict access to ASD intervention services. These struggles highlight the need for novel approaches to ASD screening, evaluation, and diagnostic decision-making that will realistically advance early detection and intervention, particularly for families facing geographical and resource barriers. Telemedicine and telehealth initiatives have improved access and care outcomes in other populations and may be a mechanism for accurately identifying young children with ASD.

Objectives: This work evaluated the benefit of a telemedicine evaluation procedure for young children at risk for ASD. First, we assessed telemedicine-based diagnostic accuracy in relation to blinded gold-standard evaluations. Second, we evaluated feasibility and family- and provider-rated acceptability of implementation in a telehealth facility serving a rural catchment

Methods: Children (n=20) and caregivers in the diagnostic accuracy study participated in a telemedicine evaluation [diagnostic interview and observation using Screening Tool for Autism in Toddlers (STAT)] with a licensed clinical psychologist (mean practice = 6.2 years) and then immediately were evaluated in person by a blinded clinician utilizing comprehensive assessment methods (Mullen, Vineland, ADOS-2, and diagnostic interview).

Children (n=45), their caregivers, and clinicians in the feasibility and acceptability study participated in the telemedicine procedures within a rural health clinic and provided data regarding the diagnostic experience via an anonymous follow-up survey.

Results: In the diagnostic accuracy study, all cases of ASD identified via telemedicine were confirmed by comprehensive in-person evaluation. However, 20% of children ultimately diagnosed with ASD in-person had not been assigned an ASD diagnosis as a result of the telemedicine procedure. Both clinician best estimate diagnosis and telemedicine assessment instrument yielded these results.

In the follow-up study, families and clinicians in the rural health clinic model indicated high levels of satisfaction with telemedicine procedures.

Remote diagnostic clinicians felt it appropriate to issue an ASD diagnosis for approximately 62% of children evaluated with this model; approximately 24% were not diagnosed with ASD. They did not feel definitively capable of ruling-in or out ASD based on this consultation in a minority of (approximately 13%) of cases.

Conclusions: The findings support the feasibility, preliminary accuracy, and potential clinical utility of telemedicine-based assessment procedures for accurately identifying young children with ASD in traditionally underserved rural communities. Both families and system providers indicated that telemedicine consultation may be desirable and overcome traditional barriers to diagnosis in underserved communities. Future evaluation of broader applications of telemedicine-based diagnostic assessment procedures is warranted to more fully understand ultimate potential clinical and service system benefit.

2:21 **113.004** Effectiveness of the STAT and STAT-Q within a Multidisciplinary Assessment for Early Identification of Autism Spectrum Disorder

***V. Nanclares-Nogues**, Pediatric Developmental Center, AIMMC, Advocate Children's Hospital, Chicago, IL*

Background: To date, no consistent assessment protocol is used across health care systems to establish early diagnosis of autism spectrum disorders (ASDs). The American Academy of Pediatrics (AAP) has suggested the use of both Level I screening of all children starting at 18 months using the M-CHAT (Robins et. al., 2001) or similar tools, and comprehensive evaluations for children who screen positive for autism risk. While the AAP recommends ongoing screening starting at 18 months, these guidelines are not being implemented consistently. In Illinois, children who are seen for early diagnosis are assessed by a multidisciplinary team within a Medical Diagnostic Evaluation (MDX) with no consistent protocol. Implementation of a consistent protocol utilizing a standardized level II screener -the Screening Tool for Autism in Toddlers and Young Children (STAT: Stone, Coonrod, Turner & Pozdol, 2004) along with developmental testing and clinical judgment - has the potential to enhance accuracy of ASD diagnosis in young children in a cost-effective manner. In addition, the STAT-Q Parent Questionnaire allows for parent input and increases understanding of the child.

Objectives: This study aims to analyze the specificity and sensitivity of both the STAT and the STAT-Q as part of a consistent protocol for identifying young children with ASD in an effort to develop a standardized screening protocol that is both clinically effective and financially viable.

Methods: 95 children 18 and 36 months of age, both English and Spanish-speaking, were assessed through the MDX utilizing developmental testing, autism specific validated instruments, as well as clinical judgment. Three groups were developed to compare sensitivity and specificity of the STAT and STAT-Q within this multidisciplinary evaluation: Group I- STAT compared to overall diagnosis; Group II-STAT-Q with overall diagnosis; and Group III- STAT-Q with positive screen on the STAT.

Results: Diagnostic Odds Ratios (DOR) was used as a measure of the overall diagnostic power of each tool. Receiver-operating-characteristic (ROC) analysis was performed to assess and compare the sensitivity and specificity of the STAT and STAT-Q when compared to overall diagnosis. Preliminary results show strong sensitivity and specificity of the STAT (97.5% and 73% respectively), with slightly lower sensitivity and specificity of the STAT-Q with clinical diagnosis (approximately 65% and 40% respectively); higher sensitivity when comparing the STAT-Q with the STAT (mothers 78% versus fathers 65%) and lower specificity of the STAT-Q with the STAT (mothers 20% and fathers 36%). A much larger sample (>150) will be available by April 1, 2018 to further describe positive predictive value of using these instruments within a multidisciplinary assessment. We will also examine impact of age, gender, and language on these relations.

Conclusions: This project hopes to demonstrate the effectiveness of the STAT and STAT-Q within multidisciplinary assessment of young children utilizing a standardized tool, including parent concerns, along with clinical judgment. These tools are efficient, sensitive, and cost effective; thus, the project has the potential to contribute to the creation of a standardized protocol for accurate early identification of ASD, allowing children to get into appropriate intervention programs at younger ages.

Oral Session - 1B
Diagnostic, Behavioral & Intellectual Assessment
114 - Diagnostic and Adaptive Profiles in Adolescents & Adults with ASD

2:40 PM - 3:30 PM - Grote Zaal

2:40 **114.001** Investigating the Factors Underlying Discrepancies in IQ and Adaptive Functioning in ASD in the EU-AIMS Longitudinal European Autism Project (EU-AIMS LEAP)

***J. Tillmann**[1], T. Banaschewski[2], S. Bolte[3], J. K. Buitelaar[4], A. San Jose Caceres[5], C. H. Chatham[6], D. V. Crawley[5], R. Holt[7], E. Loth[5], B. Oakley[5], E. Simonoff[8] and T. Charman[9], (1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom of Great Britain and Northern Ireland, (2)Child and Adolescent Psychiatry, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, (3)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (4)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (5)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (7)University of Cambridge, Cambridge, United Kingdom, (8)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (9)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Individuals with Autism Spectrum Disorder (ASD) exhibit significant impairments in their adaptive functioning. A recurrent finding is that the level of adaptive functioning is significantly lower than would be expected based on cognitive ability, and that this discrepancy is particularly prominent among higher-ability individuals. This suggests that despite having intact verbal and non-verbal processing skills, many individuals with ASD are having difficulty functionally applying their cognitive strengths to daily contexts. The factors that underlie these

discrepancies remain however poorly understood.
Objectives: We investigated IQ-adaptive functioning discrepancies in relation to age, sex, IQ, levels of ASD symptom severity and associated psychiatric symptomatology (e.g. symptoms of ADHD, anxiety and depression) in the EU-AIMS LEAP cohort.

Methods: 299 children and adults with ASD between the ages of 6 and 30 years with IQs varying between 75 and 148 were included in the analysis. First, binary logistic regressions were used to examine predictors of an "IQ-adaptive functioning deficit" across Vineland domains following Duncan & Bishop (2015), whereby a deficit was determined differently for subjects with full-scale IQ (FSIQ) between 75-99 (IQ-Vineland difference score of at least 1SD: ≥ 15) than for subjects with FSIQs ≥ 100 (Vineland domain score falling below the adequate range: i.e. <85). For those that had a deficit as defined above, multivariate regressions were then used to examine predictors of the magnitude of the IQ-adaptive discrepancy.

Results: Across Vineland domain scores, 60-75% of subjects with ASD had an IQ-adaptive functioning deficit (e.g. IQ-Vineland composite discrepancy: $M = 30.9$, $SD = 17.2$, $Min = -21.1$, $Max = 78$). Model comparisons using binary logistic regression accounting for age, sex and full-scale IQ showed that including ASD symptom measures significantly improved the model fit over and above measures of psychiatric symptom measures, but not vice versa. In relation to unique predictors of an adaptive functioning deficit, we found that higher scores (i.e. greater symptoms) for repetitive/ restrictive behaviours or interests (RBS-R; p from .028 to .007) and greater social communication symptoms (SRS-2; p from .08 to .005), significantly predicted an adaptive functioning deficit across most domains. Conversely, we found little evidence that other psychiatric symptoms affected the likelihood of exhibiting a deficit. Older age and higher FSIQ were significant predictors for adaptive functioning deficits; for the adaptive behaviour composite only, males had significantly higher odds of exhibiting a deficit. For those subjects with a deficit, multivariate regression models demonstrated that higher SRS-2 ($p < .001$) and higher RBS-R scores ($p = .03$), but not scores on measures of associated psychiatric conditions, were significant predictors of the IQ-adaptive functioning magnitude.

Conclusions: The findings demonstrate that both the presence/absence of an adaptive functioning impairment in individuals with ASD, as well as the magnitude of such a deficit in relation to cognitive skills, is related to core ASD symptom characteristics more so than to other commonly associated psychiatric symptoms.

2:52 **114.002** Psychometric Properties of Questionnaires and Diagnostic Measures for Autism Spectrum Disorders in Adults: A Systematic Review

S. Wigham[1], *J. Rodgers*[2], *T. Berney*[3], *A. LeCouteur*[3], *B. Ingham*[4] *and J. R. Parr*[2], *(1)Institute of Neuroscience, Newcastle University, Newcastle upon Tyne, United Kingdom, (2)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (3)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (4)Northumberland Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom*

Background: Accurately diagnosing autism spectrum disorders (ASD) in adulthood can be challenging. Structured questionnaires (SQs) and diagnostic measures (DMs) are frequently used to assist case recognition and diagnosis.
Objectives: This study reviewed research evidence on SQs and DMs published since the UK National Institute for Health and Care Excellence evidence update (NICE; 2014).

Methods: The Cochrane library, Medline, Embase and PsycINFO were searched.

Results: Nineteen studies met inclusion criteria. Sensitivity and specificity of SQs was best for individuals with previously confirmed ASD diagnoses, and reduced in participants referred for diagnostic assessments, with discrimination of ASD from mental health disorders especially limited. For adults with intellectual disability diagnostic accuracy increased when a combination of SQs were used. Evidence suggests some utility of DMs in identifying ASD amongst clinic referrals, though specificity for diagnosis was relatively low.

Conclusions: In mental health settings the use of a single SQ is unlikely to accurately identify adults without ASD, or differentiate ASD from mental health disorders. This is important as adults seeking an ASD diagnostic assessment are likely to have co-existing mental health disorders. Robust ASD assessment tools specifically for use in adult diagnostic health services in the presence of co-occurring mental health and neurodevelopmental disorders is a research priority.

3:04 **114.003** Self-Reports Vs Observer Ratings of Autistic Traits: A Comparison of Their Validity over the Adult Lifespan

A. Roestorf[1], *S. B. Gaigg*[2], *D. M. Williams*[3] *and D. M. Bowler*[4], *(1)Psychology, City University London, London, United Kingdom of Great Britain and Northern Ireland, (2)City, University of London, London, United Kingdom, (3)University of Kent, Canterbury, United Kingdom, (4)Autism Research Group, City, University of London, London, United Kingdom*

Background: Autism Spectrum Disorder (ASD) is a lifelong condition, yet prevalence rates in adulthood are thought to be "underestimated, under-reported and underdiagnosed due to generational effects, evolving diagnostic criteria and developmental changes across the life course" (Wright et al., 2016). Recent research (Ashwood et al., 2016) has highlighted that self-report measures of autistic traits, which are often used as screening instruments for pre-diagnostic referrals (Sizoo et al., 2015), do not correlate with observer-rated measures (ADOS-2). This has important implications for the use of self-report measures as diagnostic screeners and raises questions about factors that might play a role in poor diagnostic validity of self-reports. Age and general intellectual functioning might play an important role in this context because greater life experience and ability to contemplate ones strengths and weaknesses may render self-reports more accurate. Mental health difficulties, such as anxiety and depression, and meta-cognitive difficulties such as those characterising Alexithymia, may also be involved since such co-morbidities may skew perceptions of personal strengths and weaknesses, whilst also moderating the expression of certain clinical features (e.g., repetitive behaviours).
Objectives: We examined the association between self-report (AQ) and observer-rated (ADOS) autistic traits and explored possible moderating effects of age, age of diagnosis, intellectual ability, co-morbid mental health difficulties and alexithymia.

Methods: 109 younger (<50yrs; n = 76) and older (>50yrs; n = 33) adults with a clinical diagnosis of ASD, recruited across three sites, completed the ADOS-2, the AQ and a measure of general intellectual functioning (WAIS or WASI). A sub-sample of 40 adults completed self-report measures of anxiety (BAI), depression (BDI) and alexithymia (TAS-20).

Results: Data from 109 participants confirmed previous reports of lack of association between self-reported autistic traits (AQ) and observer-based ratings (ADOS-2; r=.128, ns). Contrary to predictions, this was true for both younger and older adults, independent of age-of-diagnosis, and for individuals with above- and below-average IQs of 100. Interestingly, however, both age (r=.34) and IQ (r=.30) were positively correlated with AQ (p<.001) but not ADOS-2 scores, suggesting that older and more able autistic adults tend to report greater autism-related difficulties even when this is not necessarily borne out in their expressed behaviour. In the sub-sample of 40 adults, anxiety, depression and alexithymia could again not account for the absent correlation between AQ and ADOS-2 scores. However, whilst AQ scores were strongly correlated with BAI (r=.47), BDI (r=.60) and TAS-20 (r=.56) scores, none of these correlated with ADOS-2 (r<.12, *ns*).

Conclusions: The findings replicate previous observations of a lack of correlation between self-report and observer-rated measures of autistic traits in older and younger autistic adults of varying ability levels. The reliable correlations between the AQ (but not ADOS) and measures of anxiety, depression and alexithymia suggest that the AQ may be sensitive to non-specific mental-health vulnerabilities rather than to the defining characteristics of ASD specifically. These findings hold important implications for clinical practice concerning referral for diagnosis in adulthood and later life, and post-diagnostic support pathways that enable autistic individuals to achieve better quality of life.

3:16 **114.004** Predictors of Adaptive Behavior in Adolescents with ASD

B. Tomaszewski[1]*, S. Odom*[1]*, L. E. Smith DaWalt*[2] *and K. Hume*[1]*, (1)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)University of Wisconsin-Madison Waisman Center, Madison, WI*

Background: Individuals with ASD demonstrate adaptive behavior difficulties regardless of intellectual functioning. Adaptive behavior is considered critical for performing tasks independently and better adaptive behavior skills are associated with greater opportunities for postsecondary employment. Prior research on adaptive behavior in adolescents with ASD typically includes only individuals with high functioning ASD (i.e., IQ > 70) and is from predominantly White samples. The present study aims to examine adaptive behavior in ASD in a large, diverse national sample of high school students with ASD across the full range of intellectual functioning and autism symptomology.
Objectives: The purpose of the current study was to (1) describe the communication, daily living skills, and socialization adaptive behavior profiles in adolescents with ASD and (2) examine the effects of intellectual functioning and autism symptomology on the adaptive behavior profiles in adolescents with ASD.

Methods: Adolescents with ASD (n=547) were part of a larger RCT of a comprehensive treatment model for high school students with ASD (mean chronological age= 16.2 years SD=1.44 years, range=14-21 years). 43% of the sample was non-White. The current study utilizes data collected prior to the intervention. Nonverbal IQ (NVIQ) was assessed using the Leiter International Performance Scales- 3rd edition. Teachers completed the Vineland Adaptive Behavior Scales, 2nd edition- Teacher Report as a measure of adaptive behavior and the Social Responsiveness Scale-2nd edition (SRS-2) as a measure of autism symptomology. A multivariate multiple regression was performed to examine the extent to which intellectual functioning and autism symptomology predicted communication, daily living skills, and socialization domains of adaptive behavior.

Results: Findings indicated that adolescents with ASD had an average NVIQ of 85.5 (SD=27.2, range=30-141) and SRS-2 score of 70.4 (SD=12.2, range=39-110). The average adaptive behavior scores on communication were 77.6(SD=18.2., range=20-122), daily living skills were 80.8(SD=17.6, range=20-121), and socialization were 73.8(SD=14.4, range=30-122). Intellectual functioning and autism symptomology were significant predictors of adaptive behavior and accounted for 52% of the variance in communication, 52% of the variance in daily living skills, and 51% of the variance in socialization. Increases in NVIQ scores were associated with higher communication (B = .36, SE=.02, p <.001), daily living skills (B= .33, SE=.02, p <. 001), and socialization (B= .13, SE=.02, p <.001) standard scores controlling for autism symptomology. Higher autism symptomology was associated with lower communication (B = -.51, SE= .05, p <.001), daily living skills (B = -.50, SE=.50, p < .001), and socialization (B=-.71, SE=.04, p < .001) standard scores controlling for intellectual functioning.

Conclusions: This study represents the largest current sample of high school students with ASD. Adolescents with ASD in this diverse sample represented the full range of intellectual functioning and autism symptomology. On average, adaptive behavior scores were significantly below the standardization sample mean indicating that this sample demonstrates adaptive behavior difficulties. Higher intellectual functioning and lower autism symptomology were associated with greater adaptive behavior skills. Findings suggest the significance of adaptive behavior as an important area for targeted interventions during adolescence.

Oral Session - 2A
Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
115 - Brain Networks and Connectivity in ASD

1:45 PM - 2:35 PM - Willem Burger Zaal

1:45 **115.001** Maturation of Resting State Power Spectrum and Functional Connectivity in Autism Spectrum Disorder

P. Garces[1]*, S. Baumeister*[2]*, L. Mason*[3]*, C. H. Chatham*[4]*, S. Holiga*[1]*, J. Dukart*[1]*, L. G. EU-AIMS*[5]*, D. Brandeis*[2,6] *and J. F. Hipp*[7]*, (1)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann-La Roche, Basel, Switzerland, (2)Department of Child and Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim/Heidelberg University, Mannheim, Germany, (3)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (4)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (5)EU-AIMS Organization, London, United Kingdom, (6)Department of Child and Adolescent Psychiatry, Psychiatric Hospital, University of Zürich, Zurich, Switzerland, (7)Neuroscience and Rare Diseases (NRD), Roche Pharma Research and Early Development, Roche Innovation Center, Basel, Switzerland*

Background: Understanding the developmental trajectory of neuronal mechanisms underlying autism spectrum disorder (ASD) is critical to developing effective treatments. Resting state EEG provides an index of cortical neuronal oscillations that reflects brain function. Previous studies have used resting state EEG to compare local and long-range synchronization of neuronal oscillations between individuals with ASD and neurotypical controls. Although ASD-related alterations have been described in a large number of studies, findings are very heterogeneous and inconsistent. Well-powered studies providing an unbiased evaluation of putative resting-state EEG abnormalities in ASD are urgently needed.
Objectives: The present study evaluates the developmental trajectories of resting state power spectrum and functional connectivity in high

functioning ASD from childhood to adulthood in a comprehensive and large dataset and in comparison to TD.

Methods: EEG data were acquired as part of the EUAIMS Longitudinal European Autism Project (LEAP) (www.eu-aims.com). Clinical diagnosis of ASD was established with DSM-IV / ICD-10 or DSM-5. In this analysis, 141 TD and 153 ASD participants between 6 and 30 years and IQ>70 were included. Subjects underwent a resting state EEG (2 min eyes open, 2 min eyes closed in alternating blocks of 30 sec, 5 centers, 60 or more EEG channels). Power spectra and functional connectivity were evaluated in sensor and source space. Source time series were extracted using beamforming and finite element forward models built from individual MRIs. Power spectra (1-32) Hz were computed with Morlet wavelet transform. Functional connectivity was estimated between sensors and between 50 regions of interest (source space analysis) using phase and amplitude synchronization measures (phase locking value, phase lag index and power correlations). Statistical modeling was performed with linear-mixed effects models with group, age, gender, IQ, and all interactions with group as fixed effects, recording site as a random effect, and allowing for different variances for ASD and TD groups (nlme package in R). The analysis was unbiased with respect to directionality of the effect, spatial location, and frequency; cluster based permutation techniques were employed to account for multiple comparisons.

Results: Highly significant age-related changes were found both for power spectrum and functional connectivity. Relative power decreased with age at lower frequencies (2-6Hz) and increased at higher frequencies (10-32Hz). Functional connectivity showed complex patterns of age modulations. Whole brain averaged functional connectivity values increased robustly with age in 4-20 Hz range for power correlations and phase locking value. These age-related modulations are in line with previous literature demonstrating the validity and sensitivity of our power spectral and functional connectivity estimates. No significant group effects (p>0.05, main effect or interactions with age, IQ or gender) in mean or variance were found in power spectrum or functional connectivity.

Conclusions: Both resting state power spectrum and functional connectivity showed strong age-related maturation from childhood to adulthood in high functioning ASD and TD cohorts. However, we did not find differences between ASD and TD in both measures. This indicates that, across brain rhythms, local and long-range synchronization in high functioning ASD may mature according to a typical developmental trajectory.

1:57 **115.002** Altered Resting-State Functional Connectivity in Individuals with ASDs and Impaired Cognitive Functioning

M. A. Reiter[1,2]*, L. E. Mash*[1,2]*, J. Liu*[2]*, C. H. Fong*[3]*, A. C. Linke*[3]*, I. Fishman*[3] *and R. A. Mueller*[3]*, (1)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA, (2)Brain Development Imaging Laboratories, Department of Psychology, San Diego State University, San Diego, CA, (3)Brain Development Imaging Laboratories, San Diego State University, San Diego, CA*

Background: General functional level, as measured by IQ, is an important correlate of adaptive functioning (Liss et. al, 2001), a set of cognitive, social, and practical abilities enabling mastery of age-expected daily-living skills. Although >50% of individuals with Autism Spectrum Disorders (ASDs) exhibit IQ scores below 85 (CDC, 2014), little is known about functional brain organization in this population, as high-quality fMRI data can usually only be collected from high-functioning individuals. Improved understanding of brain mechanisms that predict long-term outcome in broader segments of the ASD spectrum is an urgent research priority.

Objectives: To examine intrinsic functional connectivity (iFC) in children and adolescents with ASDs and IQ≤85 (L-ASD) in comparison with typically developing (TD) and ASD peers with higher IQ (H-ASD).

Methods: T1-weighted anatomical and eyes-open fMRI resting-state scans from 88 individuals (44 ASD, 44 TD) were taken from in-house data (SDSU: n=36) and two sites (NYU: n=28; OHSU: n=24) from the Autism Brain Imaging Data Exchange (ABIDE). The full sample was split by diagnosis and IQ scores into 4 groups of 22 individuals (L-ASD [IQ≤85] mean IQ: 77±6; H-ASD: 123±8; Average-TD [A-TD]: 100±7; High-TD [H-TD]: 124±8). All groups were matched within and across scanning-sites on head-motion, age, gender, and handedness.

Following standard preprocessing, mean timeseries were extracted from seeds in the medial prefrontal cortex (mPFC), posterior cingulate cortex (PCC), posterior superior temporal sulcus (pSTS), insula, and amygdala, and entered into a subject-level GLM. Whole-brain group differences in iFC for 4 contrasts of interest (L-ASD vs. H-ASD, L-ASD vs. A-TD, H-ASD vs. H-TD, and A-TD vs. H-TD; Figure 1) were examined using AFNI 3dttest++. All results were significant at a voxelwise $p < .005$, corrected to control for false-discovery rate ($\alpha < .05$) using permutation testing.

Results: Compared to the H-ASD group, the L-ASD group showed significantly weaker positive iFC between the mPFC and PCC, and between pSTS bilaterally and occipital cortices (Figure 2). Compared to the A-TD group, the L-ASD group showed increased connectivity between mPFC and cuneal and intracalcarine cortex. Compared to the H-TD group, the H-ASD group had higher connectivity (mostly reduced anti-correlations) between the PCC and right superior frontal gyrus, right anterior insula, and left Crus-1 of the cerebellum. Group differences were largely consistent across scanning sites. There were no significant iFC differences between the two TD groups.

Conclusions: Our findings suggest that within the autism spectrum, general functional level may be associated with specific patterns of functional network abnormalities, affecting social-processing regions and core hubs of the default-mode and salience networks. Remarkable in L-ASD participants was atypical iFC with visual cortices, reduced for social cognition (pSTS), but increased with a default mode region (mPFC). Some earlier findings have suggested that visual cortex may play compensatory roles in ASDs (Simard et al., 2015), and our findings suggest that any such mechanisms may be less engaged in individuals with L-ASDs. Our preliminary study illustrates the importance of including individuals with L-ASDs in research seeking to relate brain functioning in autism to long-term outcome variables.

2:09 **115.003** Autistic Syndrome Modulates Interpersonal Neural Synchronization in Children with Autism Spectrum Disorder in Cooperative Interactions

Q. Wang[1]*, T. Liu*[2]*, Z. Han*[3]*, X. Hu*[4]*, H. Wang*[3]*, Y. Wu*[5] *and L. Yi*[6]*, (1)Peking University, Beijing, China, (2)School of Management, Zhejiang University, Hangzhou, China, (3)Beijing Normal University, Beijing, China, (4)Department of Special Education, Beijing Normal University, Beijing, China, (5)School of Psychological and Cognitive Sciences, Peking University, Beijing, China, (6)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

Background: The core symptom of individuals with autism spectrum disorder (ASD) includes social deficits in communication and interpersonal interaction. However, most neuroscience studies exploring the neural subtracts of the social deficits in ASD have mainly examined single participants' brain responses to pictures or video-clips displayed on a monitor from a perspective of a passive observer, due to the limitation of the brain-imaging technique.

Objectives: Our goal was to fully understand the neural processing in children with ASD during real interpersonal interactions. Especially, we wanted to test whether interactive cooperation behaviors could evoke higher interpersonal neural coherence (INC) than solo, non-interactive behaviors in children with ASD, as previously found in typically-developing individuals (e.g., Cui et al., 2012). Furthermore, we aimed to examine whether the degree of the synchronization was modulated by the severity of autistic syndrome in children with ASD.

Methods: We used a functional near-infrared spectroscopy (fNIRS) based hyper-scanning technique to simultaneously measure the prefrontal activations in 15 pairs of children with ASD (6- to 11-year-old) and their parents in a two-person key-press task. The children's task was to press a key when a "go" signal was present to show synchronized behavior with their parents in a cooperation condition or to press a key as fast as possible under observation of their parents in a single condition. We also measured these children's severity of autistic syndrome using the autism spectrum quotient (AQ).

Results: Behavioral results were shown in Figure 1. Children showed worse performance in the cooperation condition than in the single condition. Additionally, we found positive correlations between DRT (difference of response time between the children and their parents in the cooperation condition) and AQ communication and imagination subscale scores, indicating that children with ASD with higher levels of autistic syndrome had lower action synchronization with their parents.Concerning the neural results (Figure 2), the child-parent pairs showed higher INC across their right superior frontal cortex (SFC) in the cooperation condition than in the single condition. Importantly, there were negative correlations between DINC (difference of INC between the single and cooperation conditions) and AQ communication, imagination subscale and total scores. That means children with ASD with higher levels of autistic syndrome showed less increased neural synchronization with their parents when they were engaged in interactive cooperation behaviors than in solo, non-interactive behaviors. In addition, we found a negative correlation between DRT and DINC.

Conclusions: The present study examined inter-brain communication between children with ASD and their parents in real social interactions. We found that children with ASD showed increased interpersonal neural synchronization in the right SFC in the cooperative interactions with their parents than their solo, non-interactive behaviors. Furthermore, this neural synchronization was modulated by the children's autistic syndrome, which also covaried with their cooperation task performance. Our study moved a major step forward to understanding of neural correlates underlying social deficits in ASD.

2:21 **115.004** The Non-Psychoactive Cannabinoid Cannabidivarin (CBDV) Modulates the Functional Connectivity of the Default Mode Network in Adults with ASD but Not in Controls.

C. M. Pretzsch[1]*, J. Freyberg*[2]*, B. Voinescu*[2]*, R. A. Bethlehem*[3]*, M. Leming*[4]*, M. A. Mendez*[5]*, R. H. Wichers*[6]*, L. Ajram*[7]*, E. Daly*[6]*, D. G. Murphy*[8]*, S. C. Williams*[9]*, J. Suckling*[10] *and G. M. McAlonan*[11]*, (1)IoPPN King's College London, London, United Kingdom, (2)King's College London, London, United Kingdom, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (4)University of Cambridge, Cambridge, United Kingdom, (5)Forensic and Neurodevelopmental Sciences, King's College London, London, United Kingdom, (6)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Institute of Psychiatry, London, United Kingdom, (8)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (9)Centre for Neuroimaging Sciences, King's College London, London, United Kingdom, (10)University of Cambridge, Cambridge, United Kingdom of Great Britain and Northern Ireland, (11)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Research in epilepsy indicates that the brain's endocannabinoid system is an important regulator of neural activity. The endocannabinoid system has also been suggested as a treatment target in conditions linked to epilepsy, including autism spectrum disorder (ASD). However, there is no direct evidence that cannabinoids regulate brain function differently in ASD compared to controls.

Objectives: Therefore, the aim of this pilot study was to compare brain network activity in otherwise healthy men with and without ASD following a single dose of cannabidivarin (CBDV), using functional MRI. We focused on the dorsal and ventral Default Mode Network (DMN) because of the DMN's role in social and self-reflective processes, known to be affected in ASD.

Methods: A total of 19 adults with ASD and 19 healthy controls (age-matched) were recruited to a double-blind, randomised, cross-over design. Scans were acquired 2 hours (corresponding with peak plasma levels) after oral administration of either placebo or CBDV; and were a minimum of 13 days apart to ensure adequate drug wash-out between scans. We conducted pre-planned contrasts tested with non-parametric inference at a false discovery rate (q=0.05) to examine significant DMN functional connectivity (FC): i) group differences (control n = 19; ASD n = 19) at baseline (placebo); and ii) group differences (control n = 15; ASD n = 13) in the CBDV condition.

Results: There was no statistically significant between-group difference in the dorsal or ventral DMN at baseline; there was no group difference in the dorsal DMN in the CDBV condition. However, there was a significant group difference in FC of the ventral DMN in the CBDV condition. Specifically, the ASD group had lower FC than controls between the left parahippocampal gyrus and the right posterior cingulate cortex ($t(26) = 4.78$, $p<.0001$, $d = 1.80$) and between the right parahippocampal gyrus and left posterior cingulate cortex ($t(26) = 3.44$, $p=.04$, $d = 1.32$). Post hoc testing within groups revealed that CBDV caused a significant reduction in FC between the left parahippocampal gyrus and the right posterior cingulate cortex compared to baseline ($t(28) = -2.5$, p=.02, $d = 0.91$) in ASD only; and no change in controls.

Conclusions: Our results reveal a difference in responsivity to CDBV in individuals with and without ASD. Whether this translates into a therapeutic response, and/or provides a means to identify individuals with ASD who may respond to CBDV, is not known; but this deserves further study.

Oral Session - 2B
Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
116 - Neural Development in Infants at Increased Risk of ASD
2:40 PM - 3:30 PM - Willem Burger Zaal

2:40 **116.001** Early Salient Network Connectivity and Attention to Faces in Infants at High-Risk for ASD

T. Tsang[1]*, J. Liu*[1]*, L. P. Jackson*[2]*, C. Ponting*[1]*, S. Jeste*[1]*, S. Y. Bookheimer*[3] *and M. Dapretto*[3]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)UCLA, Los Angeles, CA, (3)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: Attenuated attention to social stimuli during infancy, including faces, has been recognized as a risk marker for developing ASD (Chawarska, Macari, & Shic, 2012; Jones & Klin, 2013). However, little is known about its neural underpinnings, which may inform the ontogeny of autism symptomatology. Mounting evidence implicates early alterations in functional brain connectivity in the emergence of ASD (Emerson et al., 2017). Of particular interest is the Salience Network (SN), a functional brain network involved in detecting and guiding attention to the most salient aspects of one's internal and external environment. Altered SN connectivity complement behavioral observations of heightened attention to non-social sensory inputs at the expense of developmentally relevant social stimuli in ASD (e.g., Green et al., 2016). As faces represent a highly salient class of stimuli for young infants, SN connectivity may relate to trajectories in face-looking in infants at high-risk for ASD.
Objectives: The current study aims to determine whether patterns of SN connectivity at 6 weeks predict individual trajectories in social attention to faces during the first year in infants at high- (HR) and low-risk (LR) for ASD.

Methods: 50 HR and LR infants participated in a longitudinal study; risk status was determined by virtue of having at least one older sibling with a confirmed ASD diagnosis. At 6 weeks, infants completed an 8-minute resting-state fMRI scan during natural sleep. Eye-tracking was conducted at 3-, 6-, 9-, and 12-months of age while infants viewed video excerpts of *Charlie Brown* and *Sesame Street*. Percent fixation to the character's faces was recorded and longitudinally analyzed with a Bayesian hierarchical linear model. SN connectivity at 6-weeks was identified using the right anterior insula (rAI) seed derived from an infant atlas (Shi et al., 2011), and estimates of individual rate of change in face-looking from 3- to 12-months was used as a covariate in the SN connectivity analysis.

Results: The eye-tracking analyses revealed a significant interaction between risk and age, such that LR infants increasingly attended to faces at a faster rate than HR infants (95% CI: 0.38-10.54; $p<0.001$). When eye-tracking data were incorporated in the 6-week resting state fMRI analyses, greater functional connectivity between the hub of the SN (i.e., rAI) and regions associated with social processing (i.e., anterior cingulate cortex, orbitofrontal cortices, inferior frontal gyrus) in LR infants, relative to HR infants, predicted greater increases in attention to faces ($Z>2.3$, $p<0.01$).

Conclusions: Six-week-old patterns of SN connectivity predicted developmental trends in social attention to faces, suggesting that very early functional connections between regions implicated in salience detection and social processing may be foundational to the perceived salience of faces observed in typical development. Conversely, the lack of a relationship between SN connectivity and social attention to faces in HR infants may imply a disruption in normative processes underlying the development of social attention; we found HR infants trailed LR infants in normative face-looking trajectories. Differences in SN connectivity at 6 weeks strongly suggest that neural underpinnings of ASD likely begin before birth, with cascading effects on social attention.

2:52 **116.002** Functional Connectivity during Language Processing in Infants with Familial Risk for ASD

***X. A. Tran**[1], N. M. McDonald[2], A. H. Dickinson[1], J. Frohlich[3], M. Dapretto[4] and S. Jeste[1], (1)University of California, Los Angeles, Los Angeles, CA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)University of California Los Angeles, Los Angeles, CA, (4)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: At the circuit-level, autism spectrum disorder (ASD) is characterized by disruptions in neural connectivity. Studies in early childhood have shown that resting-state frontal EEG power in the gamma (Benasich 2008, Gou 2011) and alpha bands (Levin 2017) relate to language ability. Infants are at elevated risk for developing ASD (familial-risk) if they have an older sibling with ASD; these infants are also at risk of language delay (Messinger 2015, Charman 2017). Given these elevated risks, neural connectivity during language processing in familial-risk infants warrants further investigation, particularly as it relates to language outcomes.
Objectives: We asked if: 1) there are differences in baseline EEG power and connectivity during a language processing task between 3-month old familial-risk and low-risk (no family history of ASD) infants, and 2) connectivity correlates with language ability and ASD symptoms at 18 months. Our overarching hypothesis is that neural connectivity is disrupted in infants with familial risk for ASD, with the largest differences found in infants with delayed or atypical development.

Methods: Participants included 33 familial-risk infants and 30 low-risk infants, from an ongoing longitudinal study at the UCLA Autism Center for Excellence. EEG was acquired at 3-month while each subject listened passively to a continuous stream of syllables for 2 minutes (EGI 128 channels). EEG was collected using NetStation, filtered at 1-50 Hz, and cleaned using EEGlab and independent component analysis. Relative spectral power was calculated using Welch's method on average re-referenced data. Phase coherence was calculated using *newcrossf* on Laplacian filtered data. Frontal and temporal relative power and coherence were calculated in the theta (4-6 Hz), alpha (6-12 Hz), beta (12-30 Hz), and gamma (30-50 Hz) bands. Language ability and ASD symptoms were assessed at 18-month using the Mullen Scales of Early Learning (MSEL) and Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T), respectively. Independent samples t-tests were used to compare group differences in power and coherence; Pearson's correlations were used to relate coherence to MSEL verbal t-score (average of expressive and receptive language) and ADOS-T overall score.

Results: **P-values from independent samples t-tests are in Table 1; significant behavioral correlations are in Table 2**. 1) There were no significant group differences in frontal and temporal power ($p > 0.05$, Table 1). Across the frequency bands, familial-risk infants generally have hypoconnectivity in interhemispheric frontal and left frontal-right temporal connections; and hyperconnectivity in right-frontal and right frontal–left temporal connections. 2) Across the 50 subjects with 18-month behavioral data, right frontal-left temporal coherence in the beta band negatively correlated with 18-month MSEL verbal t-score ($R=-0.283$, $p=0.046$), and positively correlated with 18-month ADOS-T overall score ($R=0.471$, $p=0.001$).

Conclusions: Familial-risk infants show evidence of aberrant frontal-temporal connectivity at 3-month of age during a language processing task, and connectivity was associated with language ability and ASD symptoms at 18-month. Our findings suggest that neural connectivity during auditory language processing in early infancy is important for subsequent language development. We will expand our connectivity analysis to 6-12-month time points to examine potential divergent developmental trajectories in infants with atypical development.

3:04 **116.003** Application of Inter-Trial-Coherence Methods to Investigate Early Visual Processing in Infants at Familial Risk for ASD or ADHD

***E. S. Piccardi**[1], E. J. Jones[2], T. Charman[3], M. H. Johnson[4], T. Gliga[1] and &. The BASIS Team[1], (1)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre of Brain and Cognitive*

Development, Birkbeck College, University of London, London, United Kingdom

Background: Atypicalities in sensory perception are observed in individuals diagnosed with Autism Spectrum Disorders (ASD) and Attention Deficit Hyperactivity Disorders (ADHD) but have rarely been contrasted in experimental studies. In the visual domain, superior performance on visual search tasks in ASD individuals and hypersensitivity to flickering lights in both ASD and ADHD populations have been cited as evidence of unusual sensory profiles. Investigating similarities and differences in early sensory symptomatology may help in unraveling common or distinct developmental pathways.

Objectives: To measure a reliable visual response, black-and-white checkerboards were presented under free-viewing conditions to three groups of 10-month-olds: infants at familial risk for ASD (HR-ASD, N=47), ADHD (HR-ADHD, N=21) and low risk controls with no family history of ASD or ADHD (LR-CT, N=18).

Methods: 138 checkerboards were presented during two blocks lasting 4 minutes each. Continuous EEG was recorded and three indices time-locked to checkerboards presentation computed: 1) early visual-evoked potentials (VEPs); 2) alpha band (6Hz-10Hz) inter-trial phase coherence (ITC); 3) neural habituation of early VEPs (i.e., change in amplitude/latency of VEP components between first *vs*. second half of the first block presentation).

Results: Analysis of VEPs amplitude and latency revealed statistically significant group differences in the first 200ms post-stimulus onset. The P100 component was enhanced in amplitude and delayed in latency in infants at familial risk for ASD or ADHD compared to controls (*ps*<.05) (Fig.1). Analysis of ITC revealed a statistically significant increase in alpha band phase alignment (p<.05) occurring in HR-ASD and HR-ADHD infants compared to controls. Furthermore, in line with research describing VEPs as resulting from a phase alignment of the ongoing EEG, a positive correlation between P1 peak amplitude and ITC was found in the whole sample (p<.05) (Fig.2). Finally, analysis of neural habituation of VEPs indicated that reduction in the peak-to-peak amplitude of the N1-P2 complex with repeated stimulus presentation was absent in infants at familial risk for ASD, whereas an overall sensitization to repeated visual stimulation was observed in infants at familial risk for ADHD (*ps*<.05).

Conclusions: Neural hypersensitivity to low-level visual information might represent a common pathway to later behavioral atypicality in both infants at familial risk for ASD or ADHD. Despite this similarity, distinct profiles of neural tuning to repeated low-level visual stimulation were observed in HR-ASD and HR-ADHD infants. While absence of habituation to repeated visual stimulation in HR-ASD infants might result from consistent cortical hyperexcitability, sensitization to repeated visual stimulation in HR-ADHD infants might result from reduced cortical inhibition. In turn, these atypicalities might contribute to aberrant top-down sampling of visual information. The nature of these atypicalities will be further characterized by investigating alpha band pre-stimulus phase properties and by relating EEG indices to parent report measures of infants' sensory processing.

3:16 **116.004** Cortical Source Analysis of ERP Responses to Faces in Etiologically Distinct Groups of Infants at High-Risk for ASD

M. Guy[1]*, J. E. Richards*[2] *and J. E. Roberts*[3]*, (1)Loyola University Chicago, Chicago, IL, (2)University of South Carolina, Columbia, SC, (3)Psychology, University of South Carolina, Columbia, SC*

Background:

The aim of this study was to examine cortical sources active during face processing in two groups of infants at high-risk of autism spectrum disorder (ASD). Event-related potentials (ERPs) associated with specialized face processing (i.e., N290) were measured in response to faces and toys across high-risk groups, including infant siblings of children with ASD (ASIBs) and infants diagnosed with fragile X syndrome (FXS), as well as low-risk control (LRC) infants (Guy, Richards, Tonnsen, & Roberts, 2017). All groups demonstrated greater amplitude N290 responses to faces than toys. Infants with FXS displayed the greatest amplitude N290 and most differentiated responses to faces and toys.

Objectives:

Cortical source analysis was utilized to investigate whether group differences in ERP responses corresponded to different levels of activation in brain regions most closely linked to specialized face processing or differences in areas active during face processing.

Methods:

Twelve-month-olds were recruited for this study, including 21 ASIBs, 15 infants diagnosed with FXS, and 21 LRC infants. All participants completed an ERP experiment including face and toy stimuli. Structural MRIs were collected from a subset of the participants and a group-specific (ASIB, FXS, or LRC) average head model was used to complete source analysis in infants that did not contribute their own MRI (Guy, Richards, & Roberts, 2017). Realistic head models were created from the MRIs. Current density reconstruction (CDR) of the N290 was calculated to examine activation in regions of interest (ROIs) believed to be relevant to face processing. CDR activity was analyzed in an ANOVA including the factors of participant group, stimulus type, and ROI.

Results:

There was a significant main effect of stimulus type, $F(1, 55) = 21.47$, $p < .0001$, reflecting greater activation to faces than toys. There was a stimulus type by ROI interaction, $F(17, 935) = 4.91$, $p < .0001$, due to higher levels of activation in response to faces than toys in the middle fusiform gyrus and nearby temporal and occipital brain areas. Additionally, an interaction of group, stimulus type, and ROI was observed, $F(34, 935) = 1.45$, $p = .0465$. As shown in Figure 1, LRC infants demonstrated greatest levels of activation in response to faces in brain areas most closely linked to specialized face processing (i.e., middle fusiform gyrus, anterior fusiform gyrus, parahippocampal gyrus, lingual gyrus), but infants with FXS were the only participant group to display higher levels of activation to faces than toys across all ROIs examined.

Conclusions:

The results provide evidence for unique patterns of neural activation during face processing across infants at high- and low-risk for ASD, and across distinct high-risk groups. All infants demonstrated greater activation to faces than toys in brain areas most associated with specialized face processing, but only infants with FXS consistently displayed higher levels of activation to faces across a broad range of areas analyzed. These results indicate that greater amplitude N290 responses observed in infants with FXS are due to an increased area of activation during face processing, rather than greater activation in specialized face processing areas.

Oral Session - 3A
Adult Outcome: Medical, Cognitive, Behavioral
117 - Well Being and Quality of Life in Adulthood
1:45 PM - 2:35 PM - Willem Burger Hal

1:45 **117.001** Special Interests and Subjective Wellbeing in Autistic Adults

R. Grove[1], *R. A. Hoekstra*[2], *M. Wierda*[3] *and S. Begeer*[4], *(1)University of New South Wales, Sydney, Australia, (2)Department of Psychology, King's College London, London, United Kingdom, (3)VU University, Amsterdam, Netherlands, (4)VU University Amsterdam, Amsterdam, Netherlands*

Background: Restricted, repetitive patterns of behaviour, activities and interests are core characteristics of autism. However, there is limited research evaluating the role of special interests in the lives of autistic adults. It has been reported that 75 to 95% of autistic individuals have special interests in particular topic areas (Turner-Brown et al., 2011). A better understanding of the role and significance of special interests is needed.

Objectives: To explore special interests topics, intensity and motivation in autistic adults. To evaluate the association between special interests and quality of life, including subjective wellbeing and domain specific life satisfaction.

Methods: Participants were recruited through the Netherlands Autism Register (NAR), a longitudinal database of autistic individuals including 687 autistic adults (338 females (Mean age = 45.3); 349 males (Mean age = 32.5)). Participants were asked whether they have one or more special interests, and, if present, to list their topics of special interest and the number of days per week and hours per day spent engaged in their special interest(s). They were also asked to rate their overall wellbeing, as well as domain-specific areas including satisfaction with health, education, workplace, leisure activities, social contact and contribution to society. The Special Interest Motivation Scale (Grove et al., 2015) was administered to evaluate motivation for engaging in special interests, including extrinsic motivational factors ‘prestige' and 'achievement' and intrinsic motivational factors linked to 'personal life values and goals', 'intrinsic interest and knowledge' and 'engagement and flow'. Data were analysed using regression and confirmatory factor analyses.

Results: Two thirds of the sample reported having a special interest, with more males reporting a special interest than females ($p < 0.01$). Autistic women most frequently endorsed special interests in autism, nature and art. Computers, music and autism were the most popular special interest topics for men. Most autistic adults engaged in more than one special interest, highlighting that these interests may not be as circumscribed as previously described. Both autistic men and women self-reported that their special interests had a positive impact on their life and were no obstacle to functioning. However, there was a negative correlation between time spent engaging in special interests and subjective wellbeing ($p < 0.05$). Intrinsic motivation factors were more frequently endorsed than extrinsic factors. Intrinsic motivation for engaging in special interests was associated with increased subjective wellbeing ($p < 0.01$). Intrinsic motivation factors positively predicted satisfaction with social contact and leisure ($p < 0.05$).

Conclusions: Engagement in special interests was associated with positive outcomes, such as increased subjective wellbeing and satisfaction across specific life domains including social contact and leisure. However, a very high intensity of engagement with special interests was negatively related to wellbeing. Intrinsic motivation to engage in special interests may play an important role in our understanding of special interests in autism and be key to both general and domain-specific wellbeing and quality of life. Combined, these findings have important implications for the role of special interests in the lives of autistic adults.

1:57 **117.002** Patterns of Cognitive Reappraisal and Expressive Suppression Use and Relationship with Psychological Wellbeing in Youth on the Autism Spectrum: A Cluster Analysis Approach

R. Y. Cai[1], *A. L. Richdale*[1] *and M. Uljarevic*[2,3,4], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, CA, (4)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA*

Background: Emotion regulation (ER) has been proposed to be a trans-diagnostic factor in the development and maintenance of psychopathology in the general population, yet the nature of the relationships between ER strategy use and psychological wellbeing has not been comprehensively explored in individuals on the autism spectrum. Additionally, although positive and negative aspects of psychological wellbeing are distinct constructs and the habitual use of certain ER strategies has been shown to be related to both positive and negative aspects of psychological wellbeing, ER research in autism have exclusively focused on negative aspects of wellbeing (primarily anxiety and depression).

Objectives: The overall aim of this study was to assess how the individual differences in self-reported ER strategy use, specifically cognitive reappraisal and expressive suppression, relate to levels of both positive and negative psychological well-being, incorporating both hedonic and eudaimonic approaches. We first explored individual differences in patterns of self-reported reappraisal and suppression strategy use among youth on the spectrum We then examined how individual differences in ER strategy use relate to self-reported levels of positive and negative psychological wellbeing. It was hypothesised that individuals characterized by high reappraisal and low suppression would have better psychological wellbeing than those with low reappraisal and high suppression.

Methods: Fifty-six individuals aged 14 – 24 years ($M_{\text{age}} = 18.15$; $SD_{\text{age}} = 2.30$) completed the ER Questionnaire (ERQ), Diagnostic and Statistical Manual of Mental Disorders-5 Dimensional Anxiety Scales (DSM-5 DAS), Patient Health Questionnaire-9 (PHQ-9), Warwick-Edinburgh Mental Well-being Scale (WEMWBS), and Autism-Spectrum Quotient-Short (AQ-Short). Individuals were grouped into four clusters based on their ERQ subscale scores. A K-means cluster analysis was conducted in SPSS version 21 to classify participants according to their pattern of reappraisal and suppression subscale scores. The optical number of clusters was determined by plotting the within-group sum of squares for each cluster by applying the k-means procedure using R version 3.3.0 and identifying the elbow in the resulting scree plot. Further analyses were then conducted to test the hypothesis.

Results: Four clusters were chosen based on the scree plot for the K-means cluster analysis. The participant clusters were: 1) high suppressors and high reappraisers (HSHR); 2) high suppressors and low reappraisers (HSLR); 3) low suppressors and high reappraisers (LSHR); and 4) low suppressors and low reappraisers (LSLR). Individuals in the HSLR group expressed higher depressive symptoms ($U = 31$, $z = -2.20$, $p = .028$, $r = .45$) and lower positive wellbeing (mean difference via the Turkey HSD test = 16.11, $p < .001$) when compared with the LSHR group. Interestingly, individuals who self-reported using both high suppression and reappraisal expressed relatively high positive wellbeing and low depression symptoms.

Conclusions: Our findings demonstrate, for the first time, that individuals on the spectrum who self-reported using both high suppression and reappraisal expressed relatively high positive wellbeing and relatively low levels of depression symptoms. We suggest the maladaptive effect of habitual suppression use may be buffered by the habitual use of reappraisal, and this interaction between adaptive and maladaptive ER strategy use has clinical implications.

2:09 **117.003** Quality of Life in the Adult Autism Population in the UK

***A. Petrou**[1], D. Mason[2], J. Rodgers[3], J. R. Parr[3], D. Garland[4] and H. McConachie[5], (1)Newcastle University, Newcastle Upon Tyne, United Kingdom, (2)Institute of Neuroscience, Newcastle University, Newcastle-upon-Tyne, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (4)Northumberland, Tyne & Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (5)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom*

Background:

Previous research suggests Quality of Life (QoL) in autistic adults may be higher in males than in females, that QoL does not vary consistently with age, that QoL may be predicted by available support and having paid or voluntary employment, and that behavioural characteristics may be related to an individual's QoL. As a multidimensional subjective construct, QoL is conceptualised as having different domains that represent different aspects of a person's life, for instance, physical, psychological, or social QoL.

Objectives:

(1) To describe the QoL of adults on the autism spectrum in the UK and to compare it to that of the general population of adults. (2) To investigate what factors may predict QoL in adults on the autism spectrum.

Methods:

Participants are 370 autistic adults, and relatives/carers acting as 'consultees' for adults lacking capacity to consent for themselves to research participation, who are part of The Adult Autism Spectrum Cohort–UK (ASC-UK) (males=199, females=158, other gender=13; mean age=41.6 years, range=17–80; mean age at diagnosis=36.5 years, range=2-74). The ASC-UK enables longitudinal research aiming to investigate the life experiences of adults on the autism spectrum. Autistic adults were recruited through health teams, voluntary sector organisations, and the autism community. They completed a questionnaire about health and experiences, the Social Responsiveness Scale (a measure of autism severity), and the World Health Organisation Quality of Life questionnaire (WHOQoL-BREF). The WHOQOL-BREF consists of 26 questions that measure 4 domains: physical, psychological, social, and environment. Raw scores for each subscale were transformed into standardised scores from 0-100; higher scores indicate better QoL. Analyses on gender as well as age included male and female participants only. Age groupings were as follows: 16-25 years (n=62), 26-40 years (n=108), 41-60 years (n=149), and 61+ years (n=38).

Results:

Compared to the UK adult population, reported QoL was lower across all four domains of the WHOQoL-BREF for adults on the autism spectrum (effect sizes from 0.74 to 1.63). Males reported higher QoL than females in the physical domain (mean=52.6 vs 46.7) whereas females reported higher QoL than males in the social domain (mean=44.6 vs 38.4). Participants aged 16-25 years reported higher psychological QoL than participants aged 26-40 years (mean=48.8 vs 41.3). Participants aged 16-25 years reported higher environment QoL than participants aged 41-60 years (mean=60.4 vs 53.4). Being employed, receiving support, and being in a relationship positively predicted physical, social, and environmental QoL, respectively. In contrast, having a mental health condition and increased autism severity predicted lower QoL in each domain, and being female predicted lower physical, psychological, and environmental QoL.

Conclusions:

QoL is lower for adults on the autism spectrum than for the UK general population, with social QoL the lowest subscale. Contrary to some previous literature, an effect of age on QoL was found with younger participants reporting better QoL. In most domains, men fared better than women. There are several notable predictors of QoL, such as employment status and relationship status that could act as protective factors for autistic adults.

2:21 **117.004** Ageing with Autism: A Later Lifespan Approach to Cognition, Mental Health and Quality of Life

***A. Roestorf**[1], P. Howlin[2,3], C. Povey[4] and D. M. Bowler[5], (1)Psychology, City University London, London, United Kingdom of Great Britain and Northern Ireland, (2)King's College London, London, United Kingdom, (3)The University of Sydney, Sydney, Australia, (4)The National Autistic Society, London, United Kingdom, (5)Autism Research Group, City, University of London, London, United Kingdom*

Background: Several commentators have highlighted the need for research on ageing and autism spectrum disorder (ASD), yet few have explored the effects of growing older with autism (Perkins & Berkman, 2012; Wright et al., 2016). Little is known about long-term outcomes for cognitive ability, mental health and quality of life (QoL: Physical, Psychological, Social and Environmental). Cross-sectional studies of older autistic adults have identified poorer QoL compared to typically ageing (TA) groups, but selectively preserved cognitive ability in older autistic adults with average to above-average intellectual ability (Geurts & Lever, 2015), including our own cross-sectional study (Roestorf & Bowler, 2016). We followed our sample in a longitudinal study across 4-years to establish a clearer picture of ageing with autism.

Objectives: Our focus was to understand the effects of growing older with ASD on memory, executive function, language and intellectual ability, as well as autism-related symptoms, mental health and QoL. Our aim was to identify strengths and difficulties that exist for autistic adults across the lifespan, and ways in which QoL can be improved and maintained into later life.

Methods: Our study involved younger and older adults with a confirmed diagnosis of ASD (n=63), and a typically ageing (TA) comparison group (n=44) matched on age (mean=49.79, SD=15.30) and IQ (mean=114.37, SD=14.50). Time-1 (T1) involved cross-sectional comparisons between ASD-TA groups, which extended to longitudinal follow-up at Time-2 (T2; ASD,n=35; TA,n=22; mean interval 2.5 years). Participants completed standardized assessments of cognitive functioning (IQ, memory, language, executive function), and self-report measures of mental health (anxiety, depression) and QoL.

Results: In our original cross-sectional study we reported no age-related effects in ASD, and comparable performance to TA groups on all cognitive measures, but poorer quality of life and higher rates of anxiety and depression in ASD (Roestorf & Bowler, 2016), which replicated the findings from previous observations (Geurts & Vissers, 2012; Lever & Geurts, 2015). In the current, longitudinal study, the preliminary analyses on T2 data show a similar patterning: mental health difficulties at T2 persisted in ASD for anxiety (*p*<.001, η^2.33) and depression (*p*=.002, η^2.22), the latter presenting greater difficulties for autistic women (*p*=.004, η^2.30). The analyses of cognitive data are ongoing, but show promising outcomes for older autistic adults: whereas, younger-ASD participants presented ongoing difficulties in selective cognitive functions (e.g. rapid information processing, *p*=.017,η^2.21), a preserved level of ability was observed in older-ASD.

Conclusions: Across our studies, we observed ASD as undergoing a different kind of late-life ageing from that seen in TA. Whilst our cross-sectional work indicated either no difference or “parallel” profiles (Geurts & Vissers, 2012) in older-ASD compared to older-TA adults (Roestorf & Bowler, 2016), longitudinally, we observed a preserved level of cognitive ability in older-ASD adults, despite greater severity of anxiety and depression and poorer QoL. These findings highlight the need for continued mental health supports for autistic adults into later life, and the identification of the cognitive strengths that need to be developed to enable autistic adults to lead autonomous and rewarding lives across the adult lifespan.

Oral Session - 3B
Molecular and Cellular Biology / Animal Models
118 - Molecular Pathways and Convergent Biology in Model Systems
2:40 PM - 3:30 PM - Willem Burger Hal

2:40 **118.001** 16p11.2 Autism Risk Gene Kctd13 Deletion Reduces Synaptic Transmission Via Increased RhoA

***C. M. Powell**[1], C. O. Escamilla[2], I. Filonova[2,3], A. K. Walker[2], Z. X. Xuan[2], R. Holehonnur[2], F. Espinosa[2], S. Liu[2], S. B. Thyme[4], I. A. Lopez-Garcia[2], D. B. Mendoza[2], N. Usui[2,5,6], J. Ellegood[7], A. J. Eisch[2,8], G. Konopka[2], J. P. Lerch[9], A. F. Schier[10] and H. Speed[2], (1)Neurobiology, UAB School of Medicine, Birmingham, AL, (2)The University of Texas Southwestern Medical Center, Dallas, TX, (3)Okinawa Institute of Science and Technology, Okinawa, Japan, (4)Molecular and Cellular Biology, Harvard University, Cambridge, MA, (5)Division of Developmental Mental Functions, University of Fukui, Fukui, Japan, (6)United Graduate School of Child Development, Osaka University, Osaka, Japan, (7)Hospital for Sick Children, Toronto, ON, Canada, (8)Department of Anesthesiology and Critical Care Medicine, The Children's Hospital of Philadelphia Research Institute, Philadelphia, TX, (9)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (10)Harvard University, Cambridge, MA*

Background: 16p11.2 deletions and duplications are genetic risk factors for multiple neuropsychiatric conditions including autism, intellectual disability, attention-deficit/hyperactivity disorder (ADHD), schizophrenia, bipolar, epilepsy, and obesity as well as alterations in brain size and head circumference. This chromosomal region contains ~29 genes, none of which has been individually linked to 16p11.2-associated neuropsychiatric disorders. Additional human genetic findings, however, do suggest a smaller critical region of 5 genes or less that includes the potassium-channel-tetramerization-domain-containing 13 gene (*KCTD13*, a.k.a. *BACURD1*, *POLDIP1*, *PDIP1*, *TNFAIP1-like*). *Kctd13* has been implicated in brain size in 16p11.2 CNVs via morpholino-mediated knockdown of *Kctd13* in zebrafish. 16p11.2 copy number variants (CNV) are among the most prevalent CNVs in autism spectrum disorders (ASDs). Of many 16p11.2 genes, *KCTD13* has been implicated as a major driver of neurodevelopmental phenotypes. The function of KCTD13 in mammalian brain, however, remains unknown. Because KCTD13 is known to regulate levels of the small GTPase RhoA in HeLa cells in culture and because RhoA regulates actin dynamics, we hypothesized that KCTD13 modulates synaptic transmission in the brain.

Objectives: To determine the role of *Kctd13* in mammalian brain using a novel genetic mouse model lacking the Kctd13 gene.

Methods: We characterize our novel *Kctd13* deletion mouse model using protein biochemistry, acute hippocampus slice electrophysiology whole-cell and extracellular recordings, neuronal morphological analysis, molecular biology tools, and behavior along with in vitro pharmacology.

Results: Here we delete *Kctd13* in mice and demonstrate reduced synaptic transmission in the hippocampus. Reduced synaptic transmission correlates with increased levels of RhoA, a KCTD13/CUL3 ubiquitin ligase substrate, and is reversed by RhoA inhibition with two distinct inhibitors, suggesting increased RhoA as an important mechanism. Similar effects on synaptic transmission were observed at cortical synapses. In contrast to a previous knockdown study, deletion of *Kctd13* does not increase brain size or neurogenesis in mice or zebrafish.

Conclusions: These findings implicate *Kctd13* in regulation of neuronal function relevant to neuropsychiatric disorders and clarify the role of *Kctd13* in neurogenesis and brain size. Our data also reveal a potential role for RhoA as a therapeutic target in disorders associated with *KCTD13* deletion.

2:52 **118.002** A Cellular and Molecular Basis for Social Behavior Deficits in Autism

***M. P. Anderson**, Pathology and Neurology, Harvard Medical School/Beth Israel Deaconess Medical Center, Boston, MA*

Background: Diverse genetic defects, immunological insults, and certain forms of epilepsy (infantile epileptic encephalopathies) are implicated in the pathogenesis of autism spectrum disorder (ASD). Maternal 15q11-13 triplications cause a highly penetrant autism with comorbid epilepsy that is linked to increased *UBE3A* dosages, a ubiquitin-ligase and transcriptional co-regulator. While the impressive deficits in sociability make them a core diagnostic criteria in ASD, the specific brain locus, neuronal cell-types, and molecular and cellular deficits in these circuits that give rise to this behavioral deficit have remained largely unknown.

Objectives: Define the neuronal circuit defects and molecular mechanisms whereby increased UBE3A and/or seizures impair sociability.

Methods: We combine a range of techniques including conditional genetic mouse models, genome-wide transcriptional profiling, protein interaction network analysis, conditional viral vectors, *in vivo* chemogenetics, and slice optogenetic electrophysiology with extensive behavioral analysis.

Results: Nuclear-confined increases of UBE3A impair sociability by repressing *Cbln1* gene expression, a key node in an autism gene network of protein-protein interactions that trans-synaptically binds NRXN and GRID, two gene families frequently deleted in autism. Separately, epileptic seizures (causing activity-dependent *Cbln1* repression) synergize with "asymptomatic" increases of *Ube3a* to impair sociability and do so through neurophysiological effects on glutamatergic neurons of the ventral tegmental area (VTA). Importantly, the seizures and UBE3A-induced sociability deficits are rescued by chemogenetic activation of, or Cbln1 delivery to, these brainstem VTA glutamatergic neurons.

Conclusions: Thus we show that experiencing seizures can uncover the effects of hidden asymptomatic gene mutations that make them prone to seizure-induced autism-related difficulties with social interaction. We also identify a major function of the enigmatic population of glutamatergic neurons in the brainstem VTA establishing their role as a key element of the neuronal circuitry that promotes sociability behavior. We also identify this brain locus and specialized cell-type as a major site where seizures and increased UBE3A synergize to impair sociability.

3:04

118.003 Evaluation of Convergent Molecular Pathways during Neuronal Development Using Autism-Specific Induced Pluripotent STEM CELLS

D. Dykxhoorn[1]*, B. A. DeRosa*[2]*, D. Van Booven*[1]*, C. Garcia-Serje*[3]*, L. Wang*[4]*, M. L. Cuccaro*[1]*, J. M. Vance*[3]*, M. W. Nestor*[5]*, H. N. Cukier*[1] *and M. A. Pericak-Vance*[1]*, (1)John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL, (2)Molecular and Medical Genetics, Oregon Health & Science University, Portland, OR, (3)Hussman Institute for Human Genomics, Miami, FL, (4)Hussman INstitute for HUman Genomics, Miami, FL, (5)Hussman Institute for Autism, Baltimore, MD*

Background:
Autism is a phenotypically and etiologically complex group of neurodevelopmental conditions that are behaviorally defined based on the presence of social-communicative problems and restricted and repetitive behaviors. Recent studies have shown that autism risk loci are highly enriched in genes expressed during early neocortical development and genes which encode proteins that function in biological pathways involved in regulating transcription, chromatin remodeling, cell adhesion, signaling complexes, and synapse function. However, there has been a considerable lag in understanding the relationship between suspected ASD risk variants and how these variants result in the cell-based phenotypes with which they are associated.

Objectives: The aim of this study is to use induced pluripotent stem cell (iPSC)-based approaches to identify key differences in important neurobiological processes by evaluating the expression of gene networks that regulate these processes, both in a temporal and neural-specific manner.

Methods: We examined the transcriptional differences between iPSC-derived cortical neurons from individuals with autism and cognitively normal control individuals over a 135 day cortical neuron differentiation approach using RNA-Seq. Bioinformatic analysis was performed by weighted gene coexpression network analysis (WGCNA) and Ingenuity Pathway Analysis (IPA). This transcriptional analysis was complemented by functional examination of these neurons using electrophysiological, morphological, and biochemical analyses.

Results: Transcriptional analyses of autism and control neurons in culture at days 35 and 135 of their *in vitro* development showed autism-specific transcriptional signatures mainly affecting pathways/networks involved in neuronal differentiation, the cytoskeletal matrix structure formation (i.e. axon guidance and cell migration), regionalization, patterning, DNA and RNA metabolism. Additionally, developing networks of neurons were analyzed using multi-electrode array (MEA) recordings, measurements of calcium transients, immunocytochemical analyses for important morphological markers, and cell migration assays at time-points aligning with the transcriptional analyses. Neurons from autism individuals demonstrated significantly decreased network spiking activity from MEA recordings (40-80% decrease, $p<0.05$) as well as decreased numbers of calcium transients (30-60% decrease, $p<0.01$). Additionally, autism lines showed significant differences in neurite morphology and decreased cell migration ($p<0.05$) at early neuronal differentiation times.

Conclusions: The results of this study suggest that iPSC-derived neurons from individuals with ASD may have early deficits in network activity and morphology based on a combination of cell based assays, including MEA, calcium transients, and quantification of neurite outgrowth that complement their transcriptomic profiles. Taken together, these data suggests a convergence of pathophysiological processes that effect neuronal functionality in autism.

3:16

118.004 Using Induced Pluripotent Stem Cells Derived from Patient Blood for Transcriptional Modeling and Drug Repositioning in Phelan-Mcdermid Syndrome

A. Browne[1]*, E. Drapeau*[2]*, M. S. Breen*[2]*, H. Harony-Nicolas*[2] *and J. Buxbaum*[3]*, (1)Neuroscience, Icahn School of Medicine at Mount Sinai, New York, NY, (2)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY*

Background: Autism spectrum disorder (ASD) has high heritability and a prevalence of nearly 1% worldwide, but heterogeneity of patients has made identifying the underlying etiology difficult. By focusing on monogenic disorders with high penetrance for causing ASD, common pathways might be identified. Phelan-McDermid syndrome (PMS) is one such monogenic ASD-associated syndrome that is caused by haploinsufficiency of the gene *SHANK3*, which encodes for a scaffolding protein of the post-synaptic density at glutamatergic synapses. While animal models provide great insight into the pathways involved in PMS, many features of the disease may not be captured because of brain variation across species. One approach to deal with this shortcoming is to generate induced pluripotent stem cells (iPSCs) from patients that can then be differentiated into neural progenitor cells (NPCs) and neurons. Researchers from other groups using iPSC-derived neurons from PMS patients have found excitatory synaptic deficits similar to those seen in animal models.

Objectives: NPCs and neurons derived from patient and sibling iPSCs illuminate two distinct time points in the neurodevelopmental trajectory of PMS and allow for the identification of disrupted pathways that can be targeted through drug repositioning. With this project, we aim to 1) generate high-quality iPSC clones from blood samples collected from PMS patients and their unaffected siblings; 2) differentiate these iPSCs into both NPCs and neurons to capture the neurodevelopmental profile of PMS; 3) identify PMS-associated differential gene expression in iPSC-derived neural cells by RNA sequencing; 4) integrate the results with other PMS and ASD models to identify convergent findings; and 5) identify candidate drugs by comparing gene expression patterns for FDA-approved drugs with PMS-associated expression.

Methods: Blood samples from 6 patient/sibling pairs were collected and reprogrammed using a modified, non-integrating Sendai virus protocol. For each individual, 2-3 iPSC clones were validated and banked before using them for monolayer-based NPC generation, followed by 6 weeks of terminal differentiation into neurons. NPC and neuron samples were validated with immunolabeling for established NPC and neuron markers before subjecting them to RNA sequencing and differential expression. A transcriptional signature for PMS was generated and compared with expression data from a SHANK3 rat model from our lab to identify convergent pathways. For drug discovery, compounds with known expression profiles were ranked by their anticorrelation to the PMS signature.

Results: Differentially expressed genes between case and control lines were identified for each cell type and used for gene ontology enrichment analysis to identify the most significantly disrupted pathways. Comparing the iPSC-derived neural cells with a SHANK3 knockout rat model of PMS from our lab revealed convergent dysregulation of Wnt signaling and extracellular matrix-related genes, while the top candidates from drug repositioning endeavors were enhancers of GABAergic signaling.

Conclusions: Elucidating the transcriptional profile of neural cells derived from PMS patient iPSCs provides both a unique perspective on the neurobiological underpinnings of PMS, and a template that can be used with known drug expression profiles for repositioning and screening.

Oral Session - 4A
Sensory, Motor, and Repetitive Behaviors and Interests
119 - Mechanisms for Atypical Sensory Processing
1:45 PM - 2:35 PM - Jurriaanse Zaal

1:45 **119.001** Neural Mechanisms of Habituation to Sensory Stimuli and Generalization of Response in Youth with and without ASD

S. A. Green[1]*, L. M. Hernandez*[2]*, K. E. Lawrence*[2]*, J. Liu*[2]*, T. Tsang*[2]*, J. E. Yeargin*[3]*, M. Dapretto*[1] *and S. Y. Bookheimer*[1]*, (1)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Brain Mapping Center, UCLA, Los Angeles, CA*

Background: Sensory over-responsivity (SOR) is an impairing condition that is extremely common in children with ASD, and is manifested as negative reactions to sensory stimuli (e.g., noisy environments, scratchy clothing; Liss et al., 2006; Ben-Sasson et al., 2007). Prior results from our lab showed that SOR in ASD was related to greater brain activity and reduced habituation to auditory and tactile stimuli in amygdala and somatosensory cortex (Green et al, 2015), suggesting that treatment of SOR needs to take into account fundamental differences in neural mechanisms of response to sensory information, including initial arousal, habituation, and generalization of response. In this study, we extend our findings on neural responses to sensory stimuli by examining neural mechanisms of generalization in children with and without ASD and differing levels of SOR.

Objectives: To examine (1) differences in brain responses to auditory and tactile stimuli in youth with and without ASD; (2) the extent to which ASD and TD youth generalize responses to new but similar stimuli; and (3) brain responses and generalization as a function of SOR severity.

Methods: Participants were 38 children and adolescents with ASD and 22 TD matched controls, aged 8-17 years. During fMRI, participants were presented with mildly aversive auditory (pulsing white noise) and tactile (scratchy sponges) stimulation. Stimuli were presented first in a habituation phase (6 blocks of 15-sec trials each of auditory and tactile stimuli together). Subsequently, different but similar stimuli matched for aversiveness (i.e. different frequencies of white noise; different sponge material) were presented in a generalization phase (4 blocks of 15-sec trials each of the stimuli). Participants' parents rated their symptoms of SOR with the Short Sensory Profile (Dunn, 1999) and the Sensory Over-Responsivity Inventory (Schoen et al. 2008). Scores on the auditory and tactile sensitivity subscales were standardized and combined to create a sensory composite score.

Results: Within- and between-group analyses were conducted using FSL and corrected for multiple comparisons ($p<.05$). In the first (Habituation) phase, the ASD group showed significantly greater activation in widespread regions including limbic areas, sensory cortices, and medial prefrontal cortex (Figure 1). Activity in these regions was positively correlated with parental report of SOR severity within the ASD group. In the second (Generalization) phase, the ASD group showed significantly greater activation only in sensory-motor cortex (Figure 2). However, in this phase, SOR was correlated with greater activity in right amygala and orbital and medial prefrontal cortex but not with activity in auditory or somatosensory cortex.

Conclusions: We replicate prior findings that SOR in ASD is related to hyperactivation in response to sensory stimuli in sensory and limbic regions, and further highlight potential mechanisms for deficits in generalizing responses to sensory stimuli. Specifically, ASD youth may have a deficit in generalizing primary sensory processing of tactile stimuli, and those with SOR may have a distinct deficit in modulating amygdala response to sensory stimuli. Results suggest that ASD youth with SOR may respond to new but similar stimuli as if they are novel and salient, with implications for intervention.

1:57 **119.002** Differential Processing of Body Odors and Common Odors in ASD: Sensory-Motor Vs. Emotional Analysis

V. Parma[1]*, M. Furlan*[2,3]*, D. N. Top*[4]*, K. G. Stephenson*[4]*, J. S. Beck*[5]*, N. C. Russell*[4]*, A. W. Carr*[4]*, L. Peacock*[5] *and M. South*[6]*, (1)William James Center for Research, ISPA - Instituto Universitário, Lisbon, Portugal, (2)International School for Advanced Studies, Trieste, Italy, (3)University of Padova, Padova, Italy, (4)Brigham Young University, Provo, UT, (5)Psychology, Brigham Young University, Provo, UT, (6)Psychology & Neuroscience, Brigham Young University, Provo, UT*

Background: There is emerging evidence from ASD samples for associations between olfactory processing and social engagement as well as for manifestations of anxiety. There is likewise evidence for links between neuroanatomical networks implicated in ASD and networks known to support typical olfactory processing. Studies of social and nonsocial olfaction may shed light on these associations. Body odors provide a wealth of social information and their brain processing is distinguished from that of common odors in typical individuals. However, there are no reported neuroimaging studies of either social or nonsocial olfactory processing in ASD.

Objectives: The goal of the present study was to compare the neural bases of social body odors versus common, nonsocial odors in adults with ASD and neurotypical controls. Specifically, we are interested in dissociating familiar and unfamiliar masked body odors to evaluate detection for signals of implicit threat.

Methods: Preliminary results are based on 45 healthy adult volunteers including ASD (n=22) and neurotypical comparison (NT; n=23) participants. During fMRI scanning, participants were asked to indicate the intensity and pleasantness of various odors including clean air (baseline), a neutral common odor (cedarwood oil), and two body odors masked with the neutral odor (i.e., participants could consciously only smell the cedarwood).

One odor was from a familiar individual (family or roommate) and the other was the odor of a stranger. We conducted two-way ANOVA with diagnosis as between-subject factor and odor condition as a within-subject factor. These preliminary results are uncorrected, p<0.008.

Results: Results indicate that both groups processed body odors in distinct networks from the nonsocial common odor. However, the ASD group activated more sensory areas than controls for both body odor conditions. In contrast, the control group activated insula and amygdala more than the ASD group for familiar but not unfamiliar body odors.

Conclusions: These results suggest that individuals with ASD are able to distinguish social from common odors, but do so on based on analyzing sensorimotor properties of the stimuli rather than relying on the relevant social information embedded in body odors. To our knowledge, this is the first neuroimaging study to reveal the neural basis for atypical odor-mediated social communicative behaviors in ASD. Difficulties with discrimination of implicit emotional stimuli may likewise contribute to ongoing states of uncertainty that underlie anxiety in many people diagnosed with ASD.

2:09 **119.003** Atypical Basic Psychophysics in Autism: Violation of Weber's Law in Vision and in Haptic

B. S. Hadad *and S. Schwartz, University of Haifa, Haifa, Israel*

Background: Perceptual atypicalities are increasingly invoked as contributory causes of the fundamental characteristics of Autism Spectrum Disorders (ASD). The mechanism underlying these alterations remains unclear, as the literature mostly focuses on high-level perceptual processes without much recourse to potential underlying constraints of basic sensory-perceptual processing.
Objectives: Reduced perceptual inference by which processing is more sensitive to the absolute metrics of the environment has been generally demonstrated in ASD. However, despite the potential role of elementary inferential encoding of stimuli in this altered perception in autism, sensory and perceptual calibration, based on immediate stimulation, has hardly been tested. To characterize this basic psychophysics in autism we tested adherence to Weber, a principle subserving one of the most fundamental function of transient plasticity, where the output of perceptual processes depends not only on the absolute change but also on its calibration based on the immediate standard stimulation. Sensitivity along stimulus intensities changes according to a rule of D*I*/*I*=*C*, where D*I* is the increase in stimulus intensity to a stimulus of intensity *I* that is required to produce a detectable change in intensity. *C* (Weber fraction) should thus remain constant. We tested the adherence to this principle in both vision and haptic.

Methods: JNDs for size judgments were tested in the visual domain in Exp. 1 (20 high-functioning ASD and 20 TD), and JNDs for weight discrimination were tested in the haptic domain in Exp. 2 (12 high-functioning ASD and 11 TD). JNDs were calculated based on the actual psychometric functions of each individual, for each condition.

Results:

Exp. 1. Weber's fraction (D*I*/*I*) computed for each disc size, for each subject, varied with disc size for the ASD but not for the TD group, $F(3,135) = 3.31$, $p < .02$, $\eta^2_p = .07$. The fractions for the autistic group, which decreased linearly with disc size, $F(3,75) = 6.93$, $p < .0001$, $\eta^2 = .22$, demonstrated violation of Weber. In a clear contrast, these fractions remained fairly constant across disc sizes for the TD group, $F(3,60) = 2.63$, $p > .10$, $\eta^2 = .09$, demonstrating the expected adherence to Weber.

Exp. 2. As in vision, a significant interaction between group and weight was found, F(3, 69) = 2.62, p<0.03, η2p =.13, and further analysis of this interaction confirmed Weber law, with fractions remaining constant across the different weights for the TD group, F<1. For the ASD group, in contrast, Weber's fraction again decreased linearly with increased weight, F(3, 36)=2.69, P<0.06, η2=.2.

Conclusions: In a striking contrast to its consistency in typical perception, results for the ASD group show that Weber's law does not hold in visual and haptic perception in autism. The results identified a general mechanism underlying alterations in basic psychophysics that may account for sensory symptoms in autism, and for the atypical perception demonstrated for higher level perceptual processing.

2:21 **119.004** Impaired Auditory Habituation Correlates with Symptom Severity in Children with Autism Spectrum Disorder

W. Jamal[1], A. Cardinaux[1], R. Cheung[1], L. Vogelsang[2], A. Agarwal[1], E. Losordo[3], L. Denna[1], S. Diamond[1], ***M. Kjelgaard***[4] *and P. Sinha[1], (1)Massachusetts Institute of Technology, Cambridge, MA, (2)Insttiute of Neuroinformatics, University of Zurich, Zurich, Switzerland, (3)MGH Institute of Health Professions, Boston, MA, (4)Marymount Manhattan College, New York, NY*

Background: It is estimated that nearly 90% of all children with autism suffer from sensory abnormalities, often hypersensitivities, to stimuli that neuro-typical individuals could easily ignore (Leekam et al., 2007). However, empirical data show that these hypersensitivities are not caused by abnormally acute sensory capabilities (DePape et al., 2012; Bölte et al., 2012). Here, we consider habituation as an alternative account of hypersensitivities in autism, and investigate its relationship with behavioral traits. Habituation involves reduction of neural and behavioral response over the presentation of repeated, predictable stimuli. Our group recently proposed a theoretical account of autism as a disorder of prediction, positing that the ability to predict and therefore habituate to regular stimulus sequences would be reduced in autism.
Objectives: We aimed to investigate whether autism may be associated with reduced sensory habituation in the auditory domain, and the degree to which auditory habituation patterns correlate with behavioral characteristics.

Methods: To investigate whether habituation is indeed reduced in autism, EEG data were recorded from neurotypical (NT) and autistic children during 300 trials of repeated auditory tone bursts. ERPs were calculated for each subject in 50 trial segments using a sliding window. We calculated the line of best fit across successive potentials (amplitude) of the most prominent ERP peak using the least squares method. Slopes of the best-fit line for each subject were used to determine the habituation profiles for each participant, which were then correlated with the ADOS comparison score and other measures used for clinical characterization.

Results: Figure 1A shows sample ERP peaks and the best-fit line from one NT and one ASD participant in response to auditory tones. The NT participant shows gradual reduction in ERP amplitude over time, while the ASD participant shows a slight increase. The bar-plot (Figure 1B) shows the habituation slopes of individual ASD (n=9) and NT (n=21) participants. NT participants exhibit pronounced habituation, in contrast to those with ASD. ASD and NT groups show significant differences in their auditory habituation profiles (p=0.0078). Figure 1C shows that the rates of habituation in the ASD group are significantly (p<0.05) correlated with their ADOS scores with a Pearson correlation coefficient, r = 0.712. Conducting this analysis across multiple behavioral metrics reveals interesting groupings of those traits that are, or are not, significantly correlated with habituation rates.

Conclusions: The initial data support the hypothesis that autism is associated with reduced habituation to sensory stimuli and may help explain commonly observed features of ASD: sensory hypersensitivities (aversion to stimuli with negative valence) as well as restricted and repetitive interests (sustained engagement with positive valence stimuli). Furthermore, these results provide support for the broader hypothesis of impaired prediction in autism.

Oral Session - 4B
Communication and Language
120 - On Gestures and ASD (Perspectives Across the Lifespan)
2:40 PM - 3:30 PM - Jurriaanse Zaal

2:40 **120.001** Gesture Development and Maternal Responsiveness between 12-24 Months

A. B. Choi[1]*, P. Shah*[2]*, M. Rowe*[3]*, C. A. Nelson*[4] *and H. Tager-Flusberg*[5]*, (1)Harvard University, Cambridge, MA, (2)Boston University, Boston, MA, (3)Harvard Graduate School of Education, Cambridge, MA, (4)Boston Children's Hospital, Boston, MA, (5)Psychological and Brain Sciences, Boston University, Boston, MA*

Background: Pre-linguistic infants use gestures to communicate. Children's early gestures also predict subsequent language learning (Rowe & Goldin-Meadow, 2009). One potential mechanism, through which gesture may facilitate language learning is that an infant's gestures elicit responses from communicative partners, which, in turn, help develop the infant's language skills (Tamis-LeMonda et al., 2001). For example, when the infant points to a cookie, her mother responds by saying, "You want the cookie," providing the label for the object. The response then helps the infant to learn the word "cookie." Despite the important roles gestures play in language learning, surprisingly few studies have directly examined the relations between infant gesture production, maternal responsiveness, and language outcomes (Iverson & Goldin-Meadow, 2005). Here, we studied such relations, specifically in infant siblings of children with ASD, who show deficits in gestural communication (Winder et al., 2012).

Objectives: To investigate whether (1) infant siblings of children with ASD (high-risk; HRA) exhibit differences from low risk infants (low-risk; LRC) in gesture production between 12 and 24 months, (2) mothers of high- and low-risk infants differ in the proportion of infant gestures they respond to, and (3) early gestures, maternal responsiveness, and language outcomes are related.

Methods: 70 mother-child dyads were videotaped in the lab during a 10-minute free-play interaction at 12, 18, and 24 months. The ADOS and best clinical estimate at 18-36 months were used to determine ASD diagnosis (+) or lack thereof (-) and classify infants into outcome groups: HRA+: *n* = 17; HRA-: *n* = 25; LRC: *n* = 29. The MSEL was administered at 36 months, and raw scores from Expressive and Receptive Language subscales were combined to calculate language outcomes. Gestures were reliably coded from videotaped sessions following Özçalışkan and Goldin-Meadow (2009). Maternal contingent responses to infants' gestures were coded and defined as verbal or nonverbal behaviors that occurred within one utterance of each gesture and involved translation, repetition, or expansion of the gesture.

Results: (1) Kruskal-Wallis tests revealed significant differences between groups in the total number of gestures produced at 12 and 18 months (Figure 1). Follow-up pairwise comparisons showed that HRA+ and LRC groups produced significantly fewer gestures, compared to HRA- infants at 12 months. At 18 months, HRA+ and HRA- groups produced significantly fewer gestures than the LRC group. (2) Kruskal-Wallis tests indicated no significant group differences in the proportions of maternal responses to infant gestures between 12 and 24 months (Figure 2). (3) Using Pearson correlations, we found maternal responses at 12 months were significantly negatively related to infants' language scores at 36 months for the HRA+ group, but were positively trending in the HRA- and LRC groups.

Conclusions: Despite the differences in early gesture production in infant siblings, their mothers provided similar contingent responses to infants' gestures, as did mothers of low-risk infants. Understanding both infant and parent behavior in high-risk dyads may shed light on the language learning process of this population and have implications for early intervention practices.

2:52 **120.002** Maternal Gestures and Infant Responses in High- and Low-Risk for Autism Spectrum Disorder Dyads

P. Shah[1]*, A. B. Choi*[2]*, M. Rowe*[3]*, C. A. Nelson*[4] *and H. Tager-Flusberg*[5]*, (1)Boston University, Boston, MA, (2)Harvard University, Cambridge, MA, (3)Harvard Graduate School of Education, Cambridge, MA, (4)Boston Children's Hospital, Boston, MA, (5)Psychological and Brain Sciences, Boston University, Boston, MA*

Background: Language, including gestural communication, is delayed in infant siblings of children with autism spectrum disorder (ASD), who are at high risk for the disorder (high-risk; HRA). Factors such as parental communication influence infant language development. In typically developing infant-mother dyads, maternal gestures tend to remain stable over time (Iverson et al. 1999), but this has not been extensively studied in mothers of HRA children. Talbott et al. (2015) found that mothers of HRA 12-month infants not diagnosed and later diagnosed with ASD produced similar rates of total gestures. The responsivity of infants during communication may relate to parental communicative actions (Goodman et al. 2005) or to future ASD diagnosis (Wan et al. 2013). However, it remains unclear whether infants and their mothers respond contingently to each other's gestures. Here, we specifically examined maternal gestures and their infants' responses as the initial step toward a better understanding of the nature of maternal gestures and bi-directionality of communicative synchrony.

Objectives: To investigate whether: (1) mothers of high- and low-risk (LRC) infants change over time in gesture production at 12, 18, and 24 months of infant age; (2) infant responsivity to maternal gestures differs between diagnostic groups at the three age groups.

Methods: 70 mother-child dyads were videotaped in the lab during a 10-minute free-play interaction at 12, 18, and 24 months. The ADOS and best clinical estimate at 18-36 months were used to determine ASD diagnosis (+) or lack thereof (-) and classify infants into outcome groups: HRA+: *n* = 17; HRA-: *n* = 25; LRC: *n* = 29. Gestures were reliably coded and further classified into two categories following Özçalışkan and Goldin-Meadow (2009): gestures produced alone (e.g., pointing to a dog) or with speech (e.g., "look at the dog!" + pointing to a dog). Infant responses to maternal gestures were coded and defined as verbal or nonverbal behaviors that occurred within one utterance of each gesture.

Results: (1) Mothers of HRA+, HRA-, and LRC infants produced similar rates of gestures, with or without speech, at 12, 18, and 24 months (Kruskal-

Wallis; Figure 1). (2) Infants produced significantly more overall responses to maternal gestures over time, and the groups did not differ in their responses (repeated measures ANOVA). Infants responded differently to maternal gestures produced with or without speech (Figure 2). Visual inspection suggests that infants responded proportionally more to gestures alone than to gesture-speech combinations. In addition, while infants remained stable in their responses to gestures produced alone over time, they significantly increased responses to gestures produced with speech between 12-24 months.

Conclusions: In our sample, HRA+, HRA-, and LRC mothers and their infants demonstrated comparable gestural input and responses, respectively. Infants – regardless of group – responded differentially to maternal gestures depending on whether the mother produced the gesture with speech or if the mother gestured without speech. These findings can guide further research and inform our understanding of infant and maternal behavior in the development of infants' communication.

3:04

120.003 Early Language and Gesture Profiles of Toddlers with ASD As Measured By Developmental Screeners

*H. Grosman[1], C. Beacham[2], **C. Klaiman**[3] and S. Richardson[4], (1)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (2)Marcus Autism Center, Children's Healthcare of Atlanta, and Emory University School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (4)Marcus Autism Center, Atlanta, GA*

Background: Parent-report measures identifying early concerns and Autism Spectrum Disorders (ASD) red-flags are critical for informing appropriate referrals to diagnostic evaluations and services. One of the most salient early concerns related to ASD leading to early evaluation is language delay (Coonrod & Stone, 2004). The Ages and Stages Questionnaire (ASQ-3) is a broadband developmental screener that includes a Communication domain, focusing on receptive and expressive language skills as well as early social communication and gesture use. Prior studies on the ASQ-3 suggest that the Communication domain is sensitive to ASD red-flags, with a significant number of children falling in the "fail" range of concern receiving a diagnosis of ASD (Hardy et al., 2015). The MacArthur-Bates Communicative Development Inventory (MCDI) is a parent-report measure of early language and social communication that focuses on children's larger inventory of the same skills measured by the ASQ-3 Communication domain. Our study assesses the MCDI profiles of children who do not screen in the concern range on the ASQ-3 Communication domain.

Objectives: Understand the relationship between broadband developmental screeners and parent-report measures of early language and gesture inventory in an ASD evaluation.

Methods: Our sample includes 59 children (81.4% male) all of whom received an ASD diagnosis following a gold-standard evaluation. Out of 59 children, 9 individuals (15.3%) did not come up in the concern range on the ASQ-3 Communication domain. Children were between the ages of 16-31 months (mean=24.8, SD=3.91) and referred based on parental concerns and/or referrals from pediatricians or early interventionists. Parents completed the ASQ-3 and MCDI, and children were evaluated with the Mullen Scales of Early Learning and Autism Diagnostic Observation Schedule, Second Edition (ADOS-2, Toddler Module). Comparisons between groups were analyzed using independent t-tests. Data from 50 additional participants is expected to be collected before May 2018.

Results: Significant differences were observed in MCDI scores by the ASQ-3 "concern" and "no concern" groups, with parents of individuals who did not screen in the concern range on the ASQ-3 Communication domain as per scoring guidelines outlined in the ASQ-3 manual reporting larger gesture inventory and stronger receptive and expressive language skills ($t(55)=4.8$, $t(57)=7.3$, $t(57)=2.9$, all p's$<.005$) on the MCDI. When measures of gesture inventory were divided into early gestures (such as reaching, pointing, waving and routine based games like peek-a-boo) and late gestures (such as complex imitation and pretend play), differences between screening groups remained significant at the $p<.001$ level.

Conclusions: Consistent with previous research, this study revealed that the ASQ-3 Communication domain was sensitive to red-flags of ASD in early social communication and language development. In addition, the results show strong agreement between communication concerns as picked up by broadband developmental screeners and metrics of early word and gesture inventory. These results provide further support for the utility of parent-report screeners specific to language use in ASD diagnostic assessments, as the brief communication survey aligned with a much larger and nuanced measure of word inventory and social communication skills.

3:16

120.004 Adults with ASD Signal Conversational Turn Taking with Their Hands

__A. de Marchena__[1,2], A. Bagdasarov[3], E. S. Kim[4], Z. M. Dravis[4], B. B. Maddox[5], E. F. Ferguson[2], L. Adeoye[6], A. A. Pallathra[7], L. Bateman[2], A. Pomykacz[8], E. S. Brodkin[9], J. Pandey[4], J. Parish-Morris[4] and R. T. Schultz[4], (1)University of the Sciences, Philadelphia, PA, (2)The Center for Autism Research/CHOP, Philadelphia, PA, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (5)University of Pennsylvania, Philadelphia, PA, (6)The Center for Autism Research/CHOP, Phladelphia, PA, (7)Department of Psychiatry, Catholic University of America, Washington, DC, (8)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (9)Department of Psychiatry, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA

Background:

Co-speech hand gestures serve many communicative functions, often denoted by gesture "types." For example, gestures can be *deictic* (pointing), or *representational* (depicting physical properties of referents, e.g., shape/movement). The evidence for whether or not verbally fluent people with ASD use gestures to fulfill similar functions as those without ASD is mixed. However, to date, no ASD study has examined *interactive* gestures, which serve primarily pragmatic and discourse functions, such as indicating uncertainty or regulating conversational turn-taking.

Objectives:

Co-speech gestures in ASD have primarily been studied via elicited narratives, which offer limited opportunities for back-and-forth interaction, and thus, reduced performance of interactive gestures. Gestures serve different functions based on social context, thus, the objective of the current study was to examine communicative functions of co-speech gestures during back-and-forth conversation.

Methods:

Adults with ASD (n=21) and age-, gender, and IQ-matched typically developing controls (TDC; n=21) completed a five-trial collaborative referential communication task designed to elicit spontaneous back-and-forth conversation in a controlled setting. We examined whether gestures broadly fulfill different communicative functions in ASD vs. TDC by coding gesture types; gestures were coded as *interactive, representational*, *deictic*, *beat* (i.e., moving hands in time to speech), *numeric* (e.g., holding up two fingers to indicate two of something), and *other* (primarily unclassifiable gestures). As described below, a surprising finding emerged, which prompted us to further explore the varied functions of *interactive* gestures used by this sample. Interactive gestures were thus further coded according to the pragmatic/discourse function served, as follows: regulating *turn-taking*, expressing *uncertainty*, marking language as reflecting *shared information*, indicating *agreement*, and indicating *disagreement*.

Results:

Participants with ASD gestured at a marginally lower rate overall (*p*=.09, *d*=0.54). Across groups, participants primarily used representational gestures, with beat and interactive gestures the next most common (main effect of type, *p*<.001, η^2=.79, see Figure). Groups differed in terms of their preference for different types (group X type interaction, *p*=.002, η^2=.45), a large effect that was primarily driven by an *increased* rate of interactive gestures (*p*=.03, *d*=0.78), and other/unclassifiable gestures (*p*=.01, *d*=1.00) in ASD. This finding ran counter to our original hypothesis that adults with ASD would use *fewer* interactive gestures, so we conducted an exploratory analysis to investigate the interactive functions adults with ASD may be signaling in gesture. Groups were comparable across all subcategories of interactive gestures, with the exception of *turn-taking*, which was signaled via gesture over three times as often in the ASD group (*p*=.01, *d*=0.98, see Table).

Conclusions:

Adults with ASD surprisingly used *more* gestures than controls to serve interactive functions in their discourse. An exploratory analysis of these functions suggested that adults with ASD may use gesture to regulate conversational turn taking to a greater extent than controls. Conversational turn taking in general has been understudied in ASD, and the results of the current study provide compelling evidence that we should broaden our units of analysis to include nonverbal communication (including gesture, but also including, e.g., eye gaze, body movements, and prosody) to fully understand conversational strengths and weaknesses in ASD.

Oral Session - 5A
Epidemiology
121 - Prenatal Autism Risk Factors
1:45 PM - 2:35 PM - Arcadis Zaal

1:45 **121.001** Is the Tdap Vaccine Administered during Pregnancy Associated with Autism Spectrum Disorder in Offspring?

__T. A. Becerra-Culqui__, H. F. Tseng, D. Getahun and V. Chiu, Research & Evaluation, Kaiser Permanente Southern California, Pasadena, CA

Background: Prenatal infections and fever are associated with increased autism spectrum disorder (ASD) risk. The increasing practice to vaccinate pregnant women to protect mother and child makes it important to assess not only short-term but also longer-term safety events potentially linked to prenatal vaccination. Except for influenza vaccination, no study to our knowledge has investigated the association between the Tetanus, diphtheria, acellular pertussis vaccine (Tdap) during pregnancy and ASD.

Objectives: To investigate the association between prenatal Tdap vaccination and ASD risk in offspring.

Methods: This retrospective cohort study included 81,993 children born at Kaiser Permanente Southern California (KPSC) from January 1, 2011 to December 31, 2014. Information on maternal Tdap vaccination from pregnancy start to delivery date and children's clinical diagnoses of ASDs were obtained from the KPSC electronic medical record (EMR). ASD was identified by International Classification of Diseases, 9th edition codes 299.0, 299.8, or 299.9 and 10th edition codes F84.0, F84.5, F84.8, F84.9 recorded after age one. They were followed from birth to first ASD diagnosis, end of membership, or end of follow-up (June 30, 2017), whichever came first. Cox hazards models were used to estimate the unadjusted and adjusted hazard ratios (HR) to assess the association between maternal Tdap vaccination and ASD. We used propensity score analyses with inverse probability of treatment weighting to adjust for confounding.

Results: Prenatal Tdap vaccination ranged from 26% to 79% during the study years. The 2012 year had the lowest uptake and 2014 had the highest. Women vaccinated during pregnancy were more likely to be Asian/Pacific Islander, have a bachelors or higher educational degree, be pregnant for the first time, also have received the flu vaccine prenatally, and give birth at term.

Follow-up time ranged between 1.2 and 6.5 years. ASD was diagnosed in 1,341 children (1.6%). Diagnosis ranged from 1.9% in children born in 2011 to 1.2% in children born in 2014. ASD incidence rate was 4.05 per 1,000 person-years in the unexposed and 3.78 per 1,000 person-years in the Tdap exposed group. The unadjusted hazard ratio was 0.98 [95% confidence interval (CI): 0.88, 1.09].

The propensity score adjusted analyses showed that prenatal Tdap vaccination was not associated with increased ASD risk (HR: 0.85, CI: 0.77, 0.95). Results were consistent among women who were pregnant with their first child (HR: 0.87, CI: 0.75, 1.01) and across children born in the 2011-2014 study years (HR: 0.87, CI: 0.70, 1.07; HR: 0.79, CI: 0.62, 1.02; HR: 0.98, CI: 0.79, 1.22; HR: 0.86, CI: 0.65, 1.14; respectively).

Conclusions: Getting vaccinated with Tdap during pregnancy was not associated with increased risk of ASD in offspring, and the association was consistent among women pregnant for the first time and by year of birth. Indication of decreased ASD risk in the overall results could be due to unmeasured confounding, such as evolving practices in Tdap vaccine and ASD service implementation during the study years. Future studies with updated data are warranted to further evaluate potential associations between Tdap and ASD.

1:57 **121.002** Prenatal Inflammation and Autism Risk in a Swedish Birth Cohort

__R. Gardner__[1], C. Dalman[2], B. K. Lee[3] and H. Karlsson[4], (1)Karolinska Institutet, Stockholm, Sweden, (2)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden, (3)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (4)Department of Neuroscience, Karolinska Institutet, Stockholm, Sweden

Background:

Mounting evidence from both animal and human studies indicates that maternal immune function during pregnancy can influence neurodevelopmental outcomes relevant to autism. Most human studies of inflammatory markers measured in biosamples collected during the perinatal period conduct analyte-by-analyte statistical analyses, which can be problematic in terms of the number of statistical tests conducted and the underlying correlations among immune markers.

Objectives:

We aimed to measure acute phase proteins and cytokines in maternal serum samples collected during early pregnancy, as markers of prenatal inflammation and immune function, and to determine associations with later risk of autism spectrum disorders (ASD).

Methods:

We performed a case-control study of 430 ASD cases and 589 unaffected controls born 1998-2000 in Sweden, with case ascertainment as of December 2011. Maternal sera samples were collected from regional biobanks. Nine acute phase proteins (α-2 microglobulin, C-reactive protein, haptoglobulin, serum amyloid P, procalcitonin, ferritin, tissue plasminogen activator, fibrinogen, and serum amyloid A) and seventeen cytokines (IL-1beta, IL-2, IL-4, IL-5, IL-6, IL-7, IL-8, IL-10, IL-12p70, IL-13, IL-17, IFN-gamma, G-CSF, GM-CSF, MCP1, MIP-1beta, TNF- alpha) were measured using a magnetic bead-based multiplex panel. Markers were individually examined, as well as combined into an inflammatory risk score based on ridge regression coefficients. We used logistic regression models adjusted for sex, birth year, maternal age, maternal immigration (Swedish born or not), parity, gestational week at sampling, and season at sampling.

Results:

Our preliminary analyses indicate that higher maternal levels of two cytokines were individually associated at $p < 0.05$ with increased risk of ASD in continuous analysis of log2-transformed concentrations: IL-17 (OR 1.12, 95% CI 1.01-1.25) and G-CSF (OR 1.13, 95% CI 1.02-1.27). None of the nine APP markers were associated with offspring ASD risk. A one standard deviation increase in the inflammatory risk score (including information for all analytes measured) was associated with an 85% increase in odds of ASD, OR: 1.85, 95% CI 1.42-2.42.

Conclusions:

The maternal immune system, assessed in early pregnancy, is associated with subtle changes in risk for offspring ASD. These risks were apparent when examining certain markers individually. The individual markers related to ASD are interesting for their previously documented roles. Animal studies have shown that maternal IL-17 is required for offspring behavioral changes after maternal immune activation. G-CSF promotes neurogenesis within the central nervous system. Risks were also apparent when examining a composite inflammatory risk score. The risk score approach moves beyond analyte-by-analyte testing in order to avoid multiple comparisons and over-fitting of the data, as well as to improve generalizability of the results and address the underlying correlations among analytes.

2:09 **121.003** Prenatal Air Pollution Exposure and Autism: Preliminary Findings from Two Prospective High-Familial Risk Birth Cohorts

H. E. Volk[1], *B. Y. Park*[2], *F. Lurmann*[3], *H. Minor*[3], *R. McConnell*[4], *S. Ozonoff*[5], *L. A. Croen*[6], *M. D. Fallin*[1], *I. Hertz-Picciotto*[7] *and C. J. Newschaffer*[8], *(1)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Sonoma Technology, Inc., Petaluma, CA, (4)University of Southern California, Los Angeles, CA, (5)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (6)Division of Research, Kaiser Permanente, Oakland, CA, (7)University of California at Davis, Davis, CA, (8)AJ Drexel Autism Institute, Philadelphia, PA*

Background: Prenatal air pollution exposure has been associated with autism spectrum disorder (ASD) in case-control studies, but not yet examined in a prospective cohort in the US.

Objectives: To examine the relationship between prenatal air pollution exposure and risk of ASD and non-typical development in the Early Autism Risk Longitudinal Investigation (EARLI) and Markers of Autism Risk in Babies, Learning Early Signs (MARBLES) cohorts.

Methods: EARLI and MARBLES enrolled pregnant mothers who already have a child with ASD and followed the new infant longitudinally through 36 months of age. Maternal residences and corresponding dates from pregnancy to birth were collected via questionnaire and extracted from prospective follow-up contact reports. Monthly near-roadway air pollution (NRAP) estimates were assigned to geo-coded locations using the CALINE line-source dispersion model, for California locations, or the MOVES model for locations outside of California. Weekly measures of exposure to criteria air pollutants (nitrogen dioxide (NO_2), ozone, and particulate matter less than 2.5 or 10 microns in diameter ($PM_{2.5}$, PM_{10})) were assigned to each location using inverse distance weighting from the nearest Environmental Protection Agency (EPA) monitor. ASD diagnosis at 36 months was determined based on Autism Diagnostic Observational Schedule (ADOS) score and by meeting DSM-IV-TR criteria for Autistic Disorder or PDD-NOS. Typical development was defined as not meeting ASD criteria and having Mullen Scales of Early Learning Scores within 1.5 SD of the mean, and ADOS more than 3 points below the ASD cut-off. Separate logistic regression models were used to examine the association between NRAP exposure during pregnancy and ASD risk. Distributed lag models (DLM) were used to identify windows of susceptibility to NO_2, ozone, PM_{10}, and $PM_{2.5}$ exposure. All models were adjusted for recruitment site / parent study, child gender, child race, ethnicity, and birth year, maternal age at birth and education level. Analyses were conducted on 114 children from EARLI and 96 from MARBLES.

Results: Average NRAP and NO_2 exposure was elevated for US East Cost EARLI study locations (Maryland and Pennsylvania), compared to West Cost EARLI and MARBLES study locations (Northern California). PM_{10} and $PM_{2.5}$ exposure was similar across study locations. Ozone level was lower at the Kaiser Permanente EARLI site, compared to others. After adjustment for confounders, increased prenatal NRAP exposure was associated with increased ASD risk, compared to TD, in EARLI (OR=2.2 per 1 SD (~3ppb) change in exposure, 95% Confidence Interval (95%CI) 1.2-4.3), but not in MARBLES (OR=0.85, 95%CI 0.4-1.6). DLM results from MARBLES suggest that increasing exposure to ozone during mid-gestation and to NO_2 and $PM_{2.5}$ during mid-late gestation may be associated with modestly increased ASD risk OR per five unit changed ranged from OR=1.1-1.5. Windows of susceptibility were not identified in EARLI.

Conclusions: Preliminary findings suggest that prenatal exposure to air pollution may be associated with increased ASD risk. However, variation in air pollution exposure based on geographic location, that could suggest different patterns of regional confounding, pollution source, and background susceptibility from other environmental and genetic factors all need additional exploration.

2:21 **121.004** An Environmental-Wide Association Study (EnWAS) of Pre- and Perinatal Factors Associated with Autism Spectrum Disorders

S. Lamballais[1], ***E. Geenjaar***[2], *R. Muetzel*[3], *T. Henning*[4] *and T. White*[5], *(1)Erasmus University, Rotterdam, Netherlands, (2)Technical University Delft, Rotterdam, Netherlands, (3)Erasmus MC / Sophia Children's Hospital, Rotterdam, Netherlands, (4)Department of Psychiatry, Erasmus MC-University Medical Center, Rotterdam, Netherlands, (5)Child and Adolescent Psychiatry, Erasmus University Medical Centre, Rotterfdam, Netherlands*

Background: A number of environmental factors present during pre- and perinatal life have been shown to be associated with the later development of autism spectrum disorders (ASD). These factors include biomarkers, such as maternal levels of vitamin D, measures of inflammation, exposure to selective serotonin reuptake inhibitors, and mixed studies of pollution and folate. In addition, a family history of specific forms of psychopathology can also increase the risk for a child later developing ASD. Many epidemiological studies evaluate one exposure with one outcome, while carefully controlling for potential confounding factors. However, similar to hypotheses proposed in genetics, it may be that multiple environmental factors are involved in emerging ASD, with each contributing a small effect.
Objectives: It is the *goal* of this proposal to test the hypothesis that multiple variables presenting in pre- and perinatal life are associated with the development of ASD. We will test this by performing an environmental-wide association study of ASD. Using such an approach, we can identify potentially new environmental factors associated with ASD, and compare prior positive factors with the new hits. Finally, we can create a 'polyenvironmental risk score,' similar to a polygenic risk score, to assess whether multiple environmental factors can predict the emergence of ASD.

Methods: The study is embedded in the Generation R Study, a prospective, longitudinal birth cohort in which nearly 10,000 pregnant mothers were recruited. The total number of children in which the social responsiveness scale (SRS) for autistic symptoms and who had less than 60% missing data was 3,891. This group was split into a discovery set of 2,920 and a replication set of 971 children. The variables entered into the environmental-wide association study included only questionnaire and biomarker data that were collected either during prenatal life or at the time of birth and included 912 variables. We assessed each variable first using univariate regression analyses, followed by multiple regression analyses correcting for maternal age at birth, parity, maternal education, birth weight, ethnicity, sex, and birth year. Multiple correction on the discovery cohort was performed using false discovery rate (FDR).

Results: A total of 578 of the 912 variables were significant after FDR correction, suggesting confounding due to the high covariance structure of environmental and questionnaire variables. After controlling for the eight covariates typically used in epidemiological studies of ASD, 311 of the 912 variables were significant above the FDR correction. Of these 311 significant variables, 97 were significant in the replication sample. A 'Manhattan' plot of the environmental variables adjusted for covariates are show in in the Figure.

Conclusions: Using data collected during pre- and perinatal life, we show that multiple variables, especially those linked to parental psychopathology and maternal health, were associated with the later development of ASD.

Oral Session - 5B
Epidemiology
122 - Methodological Challenges in Autism Observational Epidemiology
2:40 PM - 3:30 PM - Arcadis Zaal

2:40 **122.001** Live Birth Bias May Play a Role in Epidemiological Analyses of Air Pollution and Autism Spectrum Disorders

R. Raz[1]*, M. A. Kioumourtzoglou*[2] *and M. Weisskopf*[3]*, (1)The Hebrew University of Jerusalem, Jerusalem, Israel, (2)Department of Environmental Health Sciences, Columbia University Mailman School of Public Health, New York, NY, (3)Harvard T.H. Chan School of Public Health, Boston, MA*

Background: There has been increasing interest in the scientific literature recently on the role of air pollution exposures on the development of autism spectrum disorder (ASD). Findings and conclusions across epidemiological studies, reviews and meta-analysis however, are not consistent. In a recent publication testing the associations between prenatal exposure to NO_2 and autism, a distributed lag model was implemented with population-based ASD data and weekly NO_2 exposures from Israel in order to identify critical windows of vulnerability. When mutually adjusted in a distributed lag model, postnatal exposures presented positive associations (more NO_2, more ASD) while prenatal associations varied by week of pregnancy, and gradually reached a negative, statistically significant peak around the end of the first trimester. We suggest that the negative associations do not represent protective effects of air pollution, but are the result of live birth bias.
Objectives: Explaining the causal structure and the assumptions needed for live birth bias to create biased negative associations between air pollution and ASD.

Methods: A directed acyclic graph (DAG) was built to represent the causal structure and the underlying assumptions.

Results: As presented in our DAG (see graphical abstract), live-birth bias could arise from the fact that ASD can only be assessed in live-born children, and many pregnancies do not end in a live birth. This inevitable selection of only live births into the analysis in question may lead to bias of the observed association from the actual causal association if a) air pollution is a risk factor for pregnancy loss, and b) there are other factors ("U", likely unmeasured, even unknown) that influence both pregnancy loss and ASD. In the causal inference terminology, the selective analysis of only live births opens the backdoor path: ASD <-- U --> Pregnancy Loss <-- Air Pollution, which creates an association between air pollution and ASD and biases the causal association in question, which is represented by the dashed arrow between Air Pollution and ASD.

Conclusions: We suggest that live-birth bias can create an observed negative association between air pollution and ASD. Several lines of evidence in the literature support the first assumption of air pollution as a risk factor for pregnancy loss. The second assumption is harder to assess, since U is undefined, but one possible example is prenatal stress: the existing literature supports its involvement as a risk factor for both pregnancy loss and ASD in the offspring. Thus, prenatal stress may be a possible example for our variable "U", although the suggested bias mechanism is not limited to this specific factor. This bias has implications for all air pollution-ASD studies, and it may also be relevant to other neurodevelopmental conditions. It could create an apparent protective association, and it could mask an increased risk.

2:52 **122.002** Social Determinants of Prevalence of Children with Autism Spectrum Disorder: A Population Level Study

A. Siddiqua*, E. Duku and M. Janus, McMaster University, Hamilton, ON, Canada*

Background: The presence of socioeconomic disparities in children's health, known as the socioeconomic gradient, is well established and there has been some research exploring the relationship between socioeconomic status (SES) and prevalence of Autism Spectrum Disorder (ASD). While there is mixed evidence regarding the association between individual-level SES and prevalence of ASD, the association between neighbourhood-level SES and prevalence of ASD remains largely unexplored. Nonetheless, regional differences in ASD prevalence are well established – it is

possible that children who are otherwise similar but live in different areas receive ASD diagnosis at different ages, not due to their individual characteristics, but to characteristics of the regions they live in. This may be the case in Canadian jurisdictions, where the process of diagnosis of ASD may vary across different health regions depending on the available resources.
Objectives: (1) To examine the association between neighbourhood SES and prevalence of kindergarten-aged children with ASD in Canadian provinces and territories, and (2) to determine the strength of this association across health regions in each province/territory, which represent clusters of neighbourhoods in each jurisdiction.

Methods: This project will use data from a large, population-wide database of child development in kindergarten, measured with the Early Development Instrument (EDI). The EDI is completed by kindergarten teachers, includes records of childhood health disorders and diagnoses, and has been administered at the population level in most Canadian provinces and territories. The EDI data for children with ASD have been merged at the neighbourhood level with close to 2000 SES variables (e.g. neighbourhood SES, rural/urban) from the Canadian 2006 Census, the 2011 National Household Survey, and 2005 and 2010 Taxfiler data. An SES index has been created using principal component analysis and includes a subset of 10 variables. Since the EDI has included information on children's medical diagnosis from 2010 and variables from the Canadian 2006 Census were used to construct the SES index, EDI data collected in 2010 – if available – were considered the most relevant. However, EDI data were not available in all provinces in 2010, thus those collected closest to 2010 for each province and territory will be used (Table 1). Multilevel modeling will be applied to examine associations between the SES index and prevalence of ASD at the neighbourhood and health region levels for each province/territory.

Results: The neighbourhood-level prevalence of ASD ranged between 0% and 5.3% among the provinces/territories (Table 2). In each province/territory, there were neighbourhoods with SES index z-score below average for that jurisdiction. The strength of association between neighbourhood SES and prevalence of ASD among the provinces/territories was weak. Results of the multilevel modelling will be presented at the conference.

Conclusions: Findings of this project will contribute meaningfully to the understanding of the relationship between neighbourhood-level SES and prevalence of children with ASD, as well as facilitate customized service planning according to different needs of jurisdictions. From a public health planning perspective, this is a pragmatic first step for reducing socioeconomic inequalities in health of children with ASD in different areas.

3:04 **122.003** Antidepressants during Pregnancy and Autism Risk: Evidence of Confounding

*H. Heuvelman[1], K. Franklin[2], A. Havdahl[3], H. Jones[4], J. Golding[1], G. Davey Smith[4] and **D. Rai**[5], (1)University of Bristol, Bristol, United Kingdom of Great Britain and Northern Ireland, (2)University of Bristol, Bristol, United Kingdom, (3)MRC Integrative Epidemiology Unit, University of Bristol, Bristol, United Kingdom, (4)Population Health Sciences, Bristol Medical School, MRC Integrative Epidemiology Unit, Bristol, United Kingdom, (5)Population Health Sciences, Bristol Medical School, Centre for Academic Mental Health, Bristol, United Kingdom*

Background: A number of studies have reported associations between maternal antidepressant use during pregnancy and childhood autism. The causal meaning of these associations is still unclear. The possibility of genetic confounding and confounding by severity of underlying depression (the indication for the medications) has been hypothesised but has not been directly investigated to date.
Objectives: In a large population-based cohort we aimed to assess whether mothers with greater genetic risk for autism are more likely to take antidepressants during pregnancy and whether severity of depression is associated with autism risk

Methods: We used data from the Avon Longitudinal Study of Parents and Children (ALSPAC), a birth cohort study in England which recruited 14,541 pregnant women in the Bristol area in 1991-1992, resulting in 14062 live births. Medication use was ascertained prospectively via questionnaires and coded into WHO Anatomical Therapeutic Classification codes by a pharmacologist. Children with an ASD diagnosis were identified by record linkage with health and education records and parental reports. Autism related traits were ascertained by 4 scales that independently predict ASD in ALSPAC: the Social and Communication Disorders Checklist, the Children's Communication Checklist (coherence subscale), a repetitive behaviour measure, and the Emotionality, Activity and Sociability temperament scale (sociability subscale). These measures were dichotomised, with approximately 15% defined on each scale as having highest autistic traits. Maternal polygenic risk scores (PRS) for autism were constructed using summary data from the Psychiatric Genomics Consortium GWAS. Maternal depression was assessed prospectively at 18 and 32 weeks gestation using the Edinburgh Postnatal Depression Scale.

Results: Mothers in the top decile of an optimal polygenic risk score for autism (p-value threshold 0.05) had a 2-fold odds of taking antidepressants during pregnancy [Odds Ratio 1.97 (95%CI 1.05-3.70)] and for having a child with autism [2.19 (1.30-3.68)] as compared to those in the lower 90 percentiles. There was no evidence of an association between the mother's autism PRS and severity of depression (assessed both by continuous EPDS scores and in quintiles). A dose response association was observed between higher severity quintiles of maternal depression during pregnancy and social communication, speech coherence and repetitive behaviours but not with a diagnosis of autism.

Conclusions: The results demonstrate the potential for a significant contribution of genetic confounding, and confounding by severity of indication in the associations between antidepressant use during pregnancy and offspring autism. The implications of these findings to the wider literature will be discussed.

3:16 **122.004** Measuring Quantitative Autism Traits in Families Using the Social Responsiveness Scale: Informant Effect or Intergenerational Transmission?

__W. De la Marche__[1], I. Noens[2,3], S. Kuppens[4], J. L. Spilt[5], B. Boets[6] and J. Steyaert[6], (1)Youth Department, OPZ Geel, Geel, Belgium, (2)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium, (3)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (4)Erasmus School of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, Netherlands, (5)KU Leuven, School Psychology and Child and Adolescent Development Research Unit, Leuven, Belgium, (6)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium

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Background:
Autism spectrum disorders (ASDs) have a high degree of heritability, but there is still much debate about specific causal genes and pathways. To gain insight into patterns of transmission, research has focused on the relatedness of quantitative autism traits (QAT) between family members, mostly using questionnaires. Yet, different kinds of bias may influence research results.
Objectives:

To examine possible informant effects in an ASD family study using the Social Responsiveness Scale (SRS) as a QAT measure, and, taking these into account, assess possible intergenerational transmission of QAT.

Methods:

We used multiple informant data retrieved via the Social Responsiveness Scale from 170 families with at least one member with ASD. Using intra class correlations (ICCs) and mixed model analyses we investigated inter-informant agreement and differences between parent and teacher reports on children and between self- and other-reports on adults. Using structural equation modelling (SEM) we investigated the relatedness of QAT between family members in ASD families.

Results:

Parent-teacher agreement for social responsiveness was modest (ICC total sample = .55), but poor for children with ASD (ICC = .06-.09). Agreement between parents was moderate to strong for affected (ICC = .52) and unaffected (ICC = .80) children. Agreement between self- and other-report in adult men was good (ICC = .70), but only moderate in women (ICC = .57). Agreement did not differ between adults with and without ASD. While accounting for informant effects, our SEM results corroborated the assortative mating theory and the intergenerational transmission of QAT from both fathers and mothers to their offspring. In a post-hoc analysis, however, this association appeared to be insignificant from fathers to their affected offspring (β=.03, *p*=.880).

Conclusions:

Since we demonstrated that the inter informant agreement varies depending on the diagnostic status of the participants, we state that the SRS, and possibly also other questionnaires, should be used cautiously when researching familial correlations and transmission of QAT in clinical populations. Furthermore, the the context of the use of the questionnaire (screening vs diagnostic assessment; family research with risk of contrast effect) may influence the results. Our findings also support intergenerational transmission of QAT as measured by the SRS.

Oral Session -
Invited, Keynote Speakers, Awards
123 - INSAR Awards Ceremony
4:00 PM - 5:30 PM - Grote Zaal

4:00 INSAR Awards Ceremony.

Oral Session -
Invited, Keynote Speakers, Awards
124 - Advocate Awardee Address
5:00 PM - 5:10 PM - Grote Zaal

5:00 Advocate Awardee Address.

Oral Session -
Invited, Keynote Speakers, Awards
125 - Lifetime Awardee Address
5:10 PM - 5:30 PM - Grote Zaal

5:10 Lifetime Awardee Address.

Poster Session
126 - Adult Outcome: Medical, Cognitive, Behavioral
5:30 PM - 7:00 PM - Hall Grote Zaal

1 **126.001** "It's Not As Bad As All That": The Psychosocial Outcomes of Adult Autistic Women in Comparison to Their Neurotypical Peers

__F. R. Sedgewick__[1], E. Pellicano[2] and V. C. Hill[3], (1)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland, (2)Macquarie University, Sydney, Australia, (3)Psychology and Human Development, UCL Institute of Education, London, United Kingdom

Background:

Research has repeatedly found that autistic individuals have worse psychosocial outcomes in adulthood than their neurotypical peers. These studies, however, have generally focused predominantly on male participants, and therefore may miss the specific experiences of autistic women, particularly women who are diagnosed later in life and have therefore had to navigate the world without the supports now often provided to young autistic people.

Objectives:

This research sought to examine the psychosocial outcomes of a group of autistic women in direct comparison to a group of neurotypical women, of similar age and intellectual ability. These outcomes included psychosocial outcomes, such as employment status and relationship closeness, alongside mental health issues and overall life satisfaction.

Methods:

We recruited 19 autistic women (M age = 30 years 2 months) and 19 neurotypical women (M age = 28 years 8 months) and assessed them on demographic factors, the Unidimensional Relationship Closeness Scale (URCS: rating their most significant relationship); the General Anxiety Disorder-7 (anxiety: GAD-&); the Patient Health Questionnaire-9 (depression: PHQ-9); the Zohar-Fineberg Obsessive Compulsive Screen (OCD: Z-FOCS); the SCOFF (disordered eating); the CAGE (problematic drinking); and the Satisfaction with Life Scale (overall life satisfaction: SWLS).

Results:

The majority of autistic women were in work or education (n=14, 74%) and enjoyed close relationships with friends and romantic partners. Indeed, there were no group significant differences in the degree of perceived closeness of their most significant relationship. The findings on mental health outcomes were more mixed, however. While autistic women were significantly more likely to have clinical levels of anxiety and depression than neurotypical women, and to screen positively for obsessive compulsive disorder, there were no significant group differences in terms of problematic drinking or disordered eating. Autistic women nevertheless rated themselves to be significantly less satisfied with their current life circumstances than neurotypical women, and this was significantly correlated with their higher depression scores.

Conclusions:

In contrast to much earlier research which has found poor adult outcomes for autistic individuals, this study shows, rather encouragingly, that late-diagnosed autistic women may achieve lives which are very like those of their neurotypical peers in terms of employment and long-term relationships. Autistic women, however, faced more mental health difficulties than neurotypical women. This latter finding may partly explain why autistic women rated themselves as less satisfied with their current life circumstances, regardless of their employment and relationship status – and suggests that improving the mental health support available for autistic women could yield concomitant improvements in their quality of life.

2

126.002 - the Periodic Risk Evaluation: A Tool to Identify Risk for Unwanted Outcomes Among Adults with Autism

L. Shea[1]*, S. Nonnemacher*[2]*, P. F. Turcotte*[3] *and C. J. Newschaffer*[4]*, (1)A.J. Drexel Autism Institute, Philadelphia, PA, (2)Pennsylvania Bureau of Autism Services, Harrisburg, PA, (3)Drexel University, Philadelphia, PA, (4)AJ Drexel Autism Institute, Philadelphia, PA*

Background: Clinicians and providers who deliver services have a limited array of valid and reliable assessment tools to assess service needs of adults with autism. The lack of tools is especially concerning with respect to identifying those with the most complex needs that, if unidentified and unaddressed, escalate to crises such as hospitalization, homelessness, and police interactions. The Periodic Risk Evaluation (PRE) was designed to detect adults with autism having complex needs in order to flag them for additional services and intervention.

Objectives: This presentation will define the process used to design the PRE and demonstrate initial results, including sensitivity and specificity, of the PRE in identifying adults with autism with complex needs.

Methods: The PRE was established by clinical experts who identified conceptual clinical domains predicting characteristics of adults with autism who were complex cases in crisis, and/or need of additional services and support. Domains were organized into discrete question areas with scoring criteria and feedback from service providers on PRE content and design was solicited. The PRE was implemented by two Medicaid-funded programs administered by the Bureau of Autism Services in Pennsylvania, the Adult Autism Waiver and Adult Community Autism Program, which included 794 adults over age 21 with autism. The PRE questionnaire was completed by 530 individuals from January-July of 2017. ROC curves were used to determine optimal scoring cutoffs for identifying complex cases in a training sample and tested in a single validation sample. Analyses utilizing random forests to a best possible subset of classifying items are underway.

Results: The PRE was completed on a training sample of 86 adults with ASD. Gold-standard outcome designation (complex or non-complex service needs) was completed by the Clinical Team at the Bureau of Autism Services, who operate with individual-level knowledge of each program participant and were blind to PRE score. An ROC curve indicated a score of 13 yielded a sensitivity of 86% and a specificity of 84.8%. Using the initial cut point of 13 in a validation sample of n=530, the PRE with the initial cut point of 13, yielded sensitivity of 54.2%, specificity of 86.8%, positive predictive value of 43.3%, and negative predictive value of 91.1%. Additional analysis with approximately 300 additional participants and added time points employing random forest models with cross-validation are underway to determine if there is a better performing classification approach.

Conclusions: The PRE represents the first effort to establish a tool for adults with autism to identify individuals with complex service needs. The relatively large sample size in a government-funded program provides a natural laboratory to develop, test, and implement the PRE. Once optimal scoring for the PRE is established, testing of the PRE in additional programs, including those not funded by Medicaid, and expanding the age range are immediate priorities and would support generalization of the tool.

3

126.003 A Danish Pilot Study Investigating Effects of a Psychosexual Training Program for Adolescents with Autism Spectrum Disorder

L. S. Thomsen[1,2]*, K. Bøtkjær*[1]*, L. Pedersen*[1]*, G. M. Hald*[3]*, S. Tellier*[2] *and J. Christiansen*[1]*, (1)Centre for Autism, Herlev, Denmark, (2)School of Global Health, University of Copenhagen, Copenhagen, Denmark, (3)Institute of Public Health, University of Copenhagen, Copenhagen, Denmark*

Background:

Current literature emphasises the need for guidance of adolescents with ASD in stimulating healthy psychosexual development and preventing potential inappropriate sexual behaviour. This requires specific knowledge and skills in all domains of psychosexual functioning (i.e. sexual behaviour, sexual selfhood, and sexual socialization).

Objectives:

Hence, we assessed the utility of the individual Tackling Teenage Training (TTT) intervention program to provide psychosexual-education and practice skills related to puberty, sexuality and relationships.

Methods:

This pilot study systematically investigated the effect of the TTT intervention program on primary outcome (i.e. psychosexual knowledge) and secondary outcomes (i.e. self-concept and sexual behaviour problems) in adolescents with ASD (69 % male, mean age = 15.1 years, mean intelligence index = 100,6) in Denmark. The outcomes were assessed using self-report and parent-report questionnaires at baseline (T1), posttreatment (T2; after 6 months), and follow-up (T3; after 12 months).

Results:

Findings of this study show a strong primary outcome effect, which validates the TTT intervention program. Thus, the study found a statistical significant increased level of psychosexual knowledge from T1 (M = 21.2) to T2 (M = 30.4), and from T1 to T3 (M = 31.2), but not from T2 to T3. Second, it is concluded from the findings, that the secondary outcome, level of positive self-concept, statistical significantly increased in the participants from T1 (M = 44.0) to T2 (M = 50.3), but not from T2 to T3, and T1 to T3. Third, results from this study, indicate that the level of sexual behaviour problems in the participants decreased from T1 to T3.

Conclusions:

It seems quite reasonable to conclude that the effect of the TTT program in 12-17 years-old adolescents with ASD in a Danish context, are a significantly increased level of psychosexual knowledge and positive self-concept, as well as a significantly decreased level of sexual behaviour problems. This is reasonable, even without a control group. These preliminary findings indicate that the TTT program might be an important step towards improving psychosexual functioning in adolescents with ASD in Denmark.

4

126.004 Academic Achievement during Early Childhood As a Predictor of Adult Outcomes in ASD: Longitudinal Follow-up from Age 2 to 26 Years

***N. Benrey**[1], Y. B. Choi[2], L. A. Pepa[3], C. Lord[4] and S. H. Kim[5], (1)Weill Cornell Med School, New york, NY, (2)Psychiatry, Weill Cornell Medical College, White Plains, NY, (3)Weill Cornell Medicine, White Plains, NY, (4)University of California Los Angeles, Los Angeles, CA, (5)Psychiatry, Center for Autism and the Developing Brain, White Plains, NY*

Background: Recent research highlights the wide variability in outcomes during adulthood in individuals with ASD (Howlin, 2004). Academic skills are associated with behavioral and mental health outcomes in typically developing children (Bond et. al, 2007); however, we know little about the link between early childhood academic skills and adult outcomes such as independent living, employment, and quality of life in individuals with ASD.

Objectives: Given our previous findings that children with ASD demonstrated relative delays in achievement compared to IQ (Kim et al., 2017), we examined if achievement levels relative to cognitive skills at age 9 would predict adult outcomes at age 26.

Methods: Participants included 111 children referred for possible ASD at age 2 (n=76 with a final diagnosis of ASD). Academic achievement was measured by the Wide Range Achievement Test (WRAT). Difference scores between achievement and full-scale IQ (FSIQ) were calculated for reading, spelling, and arithmetic domains. At age 26, the following outcomes were measured: Employment (full/part time paid job vs. no paid job); Independent Living (living independently vs. living with parents/in group homes); Driving (yes vs. no); Vineland Adaptive Behavioral Scale (VABS), and Psychological Well-Being Questionnaire (WBQ; Table 1). Regression analyses were used to examine if the achievement-FSIQ difference scores at age 9 would predict age 26 outcomes.

Results: Relative delays in achievement in reading, spelling, and arithmetic compared to FSIQ at age 9 predicted age 26 employment, independent living, and driving status, while controlling for age, gender, maternal education, and ASD diagnosis. Relative delays in achievement in reading, spelling, and arithmetic compared to FSIQ also predicted more impairments in the VABS Socialization, Communication, and Daily Living domains and lower scores for psychological well-being (WBQ). When FSIQ was controlled, relative delays in spelling compared to FSIQ at age 9 still remained as a significant predictor of lower scores for psychological well-being (WBQ). All $p<0.05$.

Conclusions: Results based on a longitudinal cohort of children with ASD followed from age 2 to 26 suggest that the patterns of academic achievement at age 9 have significant, longer-term impacts on adult outcomes. Results highlight the importance of developing effective interventions tailored to improving academic skills in individuals with ASD during early childhood, which would have cascading effects on their quality of life and well-being during adulthood.

5

126.005 Adult Medicare Beneficiaries with Autism Spectrum Disorder: Case Identification and Characterization of Young Adults in the 2010 Limited Data Set Medicare Claims

***T. Benevides**[1], H. J. Carretta[2] and K. Graves[3], (1)Augusta University, Martinez, GA, (2)Behavioral Sciences and Social Medicine, Florida State University College of Medicine, Tallahassee, FL, (3)School of Physician Assistant Practice, Florida State University College of Medicine, Tallahassee, FL*

Background: Although Medicaid is the most well-known public insurer of individuals with ASD it is limited to individuals who can meet eligibility and means testing rules, and Medicaid covered services differ by state. Although less well known, persons younger than 65 are eligible for Medicare if they receive a disability determination. Approximately 25% of all beneficiaries in the 2008-2010 Medicare fee-for-service (FFS) files are younger than 65 and are eligible by virtue of their disability status.

Objectives: A challenge in using claims data is identification of ASD cases to ensure accurate characterization. In pediatric validation studies, some work suggests that relying on 1 claim could reliably identify probable ASD (e.g. Burke et al., 2014). The purpose of the current study was to compare the demographic characteristics and number of ASD cases identified using one claim versus a two claim case identification criterion in FFS Medicare files.

Methods: Claims files for Medicare Limited Data Sets for 2008-2010 were used. See Figure 1 for case identification process and exclusion criteria. After case identification, unique beneficiaries in the last claim year of 2010 were classified as having at least 1 ASD claim (1+ sample), or at least 2 ASD claims (2+ sample); intellectual disability (ICD9-CM 317.xx-319.xx) was also used to classify beneficiaries. We conducted univariate and bivariable descriptive statistics on each sample using Stata V14.1 (StataCorp, 2015). Proportions and exact binomial 95%CI for sample characteristics (age, gender, race, ethnicity, ACG® concurrent risk score, Medicaid state buy-in months) for ASD individuals with and without intellectual disability (ID) were produced and differences were examined with the two-sample test of proportions. Significance was set at $p<.008$ after Bonferroni correction.

Results: A total of 5,547 young adults with at least 1 ASD were identified, of whom 63% (n=3,499) had no ID claim, and 37% (n=2,048) had both an

ASD and ID claim. When restricting the sample to those with a minimum of 2 claims, a total of 2,816 young adults with ASD were identified, of whom 66% (n=1,847) had no ID claim, and 34% (n=969) had both ASD and ID claims. No differences were found in proportional demographic characteristics for the 1+ versus the 2+ groups (Table 1). For both the 1+ and 2+ claim analyses, the ASD and ID group was more likely to be older, Hispanic, non-white, and have 12m of Medicaid state-buy in than the ASD-only group. Additional analyses (not presented) will be shared regarding differences in predictive models analyzing the impact of using 1 versus 2 claims for service utilization analyses.

Conclusions: Researchers, policy makers, and service providers need to be aware of the availability and types of utilization afforded by Medicare. This study is the first step in validating the identification of a national sample of publicly insured adults with autism. Implications of using the 1 versus 2 claim criteria for claims analysis using Medicare to understand service utilization will be discussed, along with comparisons of models which predict service utilization when using the 1 or 2+ criteria.

6 **126.006** Priority Setting Among Autistic Adults to Develop a Research Agenda to Address Health Outcomes

T. Benevides[1], *S. Shore*[2] *and A. Lesko*[3], *(1)Augusta University, Martinez, GA, (2)Adelphi University, Newton, MA, (3)Gobal Autism Consulting Organization, Pensacola, FL*

Background: Evidence about the healthcare experiences among autistic adults and their caregivers is minimal and lacking (e.g. Nicolaidis et al., 2012). Given that this group has been marginalized and under-represented in research, it is imperative to provide voice to the priorities that the adult autism community see as next research steps. To accomplish this purpose, this Project Team, comprised of 3 autistic investigators and 2 neurotypical investigators, implemented a participatory action research approach.

Objectives: 1). Discuss the initial process of priority setting a research agenda with a small group of autistic adults (n=16), family members (n=8), and research/educational community members (n=14); 2). Discuss specific recommendations for improved researcher-autism community relationships.

Methods: Participatory action research methods were used, and included: large group meetings with stakeholders, small meetings with community members, and action steps driven by previous community preferences. Initially, large group and small group face-to-face meetings were conducted during a 1-day conference to discuss gaps and next steps for addressing needs of autistic adults. Member checking through reporting meeting outcomes and requesting feedback from a 15 member community council of autistic adults resulted in additional clarification of priorities. Continued use of face-to-face and social media engagement has informed actions and decisions.

Results: Attendees at the large group meeting reported that lack of mutual respect and trust inhibited participation and involvement in research activities for adults with autism. Actions which undermined trust included: lack of reporting results in a way that the autism community could understand or benefit from, lack of adequate compensation to be involved as research collaborators or participants, and lack of involvement in research decisions, including the development of what research questions are important. Preferred allocation of hypothetical research dollars for adult needs among meeting participants included: mental health interventions and outcomes (33% of funding), improving social well-being (24%), improving access to services (24%), addressing knowledge/skills/attitudes of providers and environments where care occurs (13%), addressing physical health outcomes (10%), and injury and mortality risks (5%).

Conclusions: As a result of this process, a Compensation Guide was drafted to outline roles and associated guidelines for compensation of autistic individuals. Collaborations with mental health providers and organizations are being developed and discussing findings with researchers are underway. More work needs to be done to fully include the autism community in defining the funding priorities, researcher activities, and approaches to ensure equitable participation in the research process. The current work represents a fraction of the autistic adult community, however, provides an initial framework for exploring more specific needs of this group.

7 **126.007** An Optimistic Outlook Concerning Employment: High Tech Meets Autism Spectrum Disorder

D. Hedley[1], *J. Spoor*[2], *M. Uljarevic*[3,4], *R. Y. Cai*[1,5], *S. Moss*[6], *A. L. Richdale*[1,5], *T. Bartram*[2] *and C. Dissanayake*[1], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)La Trobe Business School, La Trobe University, Melbourne, Australia, (3)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (4)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (5)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Australia, (6)Charles Darwin University, Darwin, Australia*

Background: Individuals with ASD face some of the highest rates of underemployment and unemployment of all disability groups (Shattuck et al., 2012). When successful at gaining employment, outcomes can still be poor if appropriate workplace supports are not in place (Hedley et al., 2017). However, there are advantages to hiring people with ASD. Many individuals exhibit high intellectual ability (Happe & Frith, 2006), or specific skills and interests that may help them thrive in particular occupations and roles (Donovan, 2008). Employees with ASD tend to be reliable, trustworthy and conscientious, often completing work to a high standard (Hagner & Cooney, 2005; Hillier et al., 2007). Research is needed to better understand strategies that support the success of adults with ASD at work.

Objectives: The present study employed qualitative methodology to examine the work experiences (past and current), expectations, and perceptions concerning a modified recruitment and selection process, of individuals with ASD who were employed in the Dandelion Program. This program is aimed at employing people with ASD in information technology (IT) positions. Work colleagues, support workers and family members also participated in the study.

Methods: Twenty-eight people, including nine employees with ASD (89% male; M_{age} = 23.97, SD = 3.00), seven support staff (29% male; M_{age} = 36.83, SD = 8.52), six co-workers (67% male; M_{age} = 42.21, SD = 6.46), and six family members (33% male; M_{age} = 43.92, SD = 13.89), participated in the study. Employees with ASD provided written evidence of their diagnosis by a medical professional when they applied for the program, and additionally self-reported a formal diagnosis of ASD and completed the Autism Spectrum Quotient (AQ). Seven focus groups were conducted using a semi-structured approach with set questions. Data were analyzed following established consolidated criteria for reporting qualitative research to identify themes (thematic analysis).

Results: Four themes associated with work experiences and program implementation were identified: Limitations in Previous Work Experiences (Theme 1), Pessimistic Expectations (Theme 2), Recruitment and Selection Adaptations (Theme 3), and Training and Transition (Theme 4). The themes that emerged from the focus groups demonstrated that individuals with ASD were motivated to work but experienced difficulty finding and maintaining suitable and interesting employment. Previous failures in obtaining meaningful work had led to a mood of pessimism regarding the future. The results indicated specific strengths of the program, particularly the revised human resource protocols and support provided to the trainees. The alternate pathway in to employment provided individuals with an opportunity to demonstrate their abilities over a lengthened time.

Conclusions: This study examined the perspectives of employees with ASD who were participating in a supported employment program. On the basis of these findings we can conclude that alternate approaches to entering the workplace, support when needed, and co-worker training can contribute to workplace success. Our results also suggested improvements to the program, for example, by personalization of support based on individual abilities. Employment programs that include appropriate modifications for people with ASD may help to promote a more optimistic outlook among participants.

8 **126.008** Changes from 2001 to 2012 in the Characteristics of Youth on the Autism Spectrum Receiving Special Education Services in the U.S.

P. Shattuck[1], *J. Rast*[1], *A. Roux*[2], *K. Anderson*[3], *C. M. Kerns*[4], *T. Benevides*[5] *and E. McGhee Hassrick*[1], *(1)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (3)Life Course Outcomes Research Program, Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (4)University of British Columbia, Vancouver, BC, Canada, (5)Augusta University, Martinez, GA*

Background: The autism spectrum encompasses a range of abilities and challenges. In childhood, lower rates of intellectual disability and impairment severity have been documented in more-recent cohorts. However, we know very little about corresponding changes in the distributions of characteristics and needs among the population of transition - age youth and young adults which hinders development of effective services, policies and practices for this vulnerable population .

Objectives: Describe how the characteristics of the identified population of high school students in the autism special education category changed from 2001 to 2012. Dependent variables included impairment and health characteristics, youth demographics, household and family characteristics.

Methods: We used secondary data from two related cohort studies that were funded by the U.S. Department of Education and conducted 10 years apart: Wave 1 (2001-2002) of the National Longitudinal Transition Study-2 and the National Longitudinal Transition Study-2012. Both studies were designed to yield nationally representative estimates of the characteristics and experiences of youth with special needs who received special education services. We limited analyses to youth who were ages 13 to 17 years. We used logistic regression to estimate differences in cohorts for each variable, while controlling for weights and sample characteristics. Rates of missing data per variable ranged from 0% to 12% across both surveys. We imputed missing data using multivariate imputation by chained equations (MICE) methods to create 50 implicates.

Results: The 2012 cohort was less racially diverse than the 2001 cohort (78% White v. 65%) and included more households receiving food stamps (19% in 2012 vs. 8% in 2001). Reported age when disability or concern was first noted was older, on average, among the more-recent cohort (3.0 years vs. 2.3 years). On average, members of the recent cohort had less severe communication impairments. For instance, in response to a question about how well youth could carry on a conversation, parents of 35% of recent cohort members said “Not at all” or “With a lot of trouble” vs. 55% of the 2001 cohort members. The recent cohort had higher scores on most functional skills measures. For instance, 58% were able to get to places outside the home “Very well” or “Pretty well” compared to 47% for the earlier cohort. Sex ratio, overall health, and the rate of psychotropic medication use were comparable across cohorts.

Conclusions: The average severity of parent-reported functional and communication impairments among youth identified with autism decreased from 2001 to 2012. Members of the recent cohort of teens served in the autism special education category are, on average, diagnosed later, are less impaired and have higher functional skills across a variety of survey questions asked of parents. The design of services and policies need to become more nuanced and specific to particular subpopulations because there can be no one-size-fits-all solutions for such a diverse and changing population.

9 **126.009** Assessing and Comparing Health-Related Independence for Physical and Mental Health Conditions in Youth with Autism Spectrum Disorder

N. C. Cheak-Zamora[1] *and A. Maurer-Batjer*[2], *(1)Health Sciences, University of Missouri, Columbia, MO, (2)University of Missouri, Columbia, MO*

Background: Physical and mental health conditions are prevalent among youth with Autism Spectrum Disorder (YASD). Youth’s ability to management their health care needs is imperative as YASD transition to adult health care services. It is unclear what health care management skills YASD have, including describing and seeking care for their health and mental health needs.

Objectives: This study aimed at increasing our understanding of health-related independence and transition needs by examining YASD’s ability to describe and seek care for their physical and mental health conditions and conducting the first analysis to examine what predicates describing and care seeking behaviors for YASD.

Methods: Caregivers (n=500) from five distinct Autism Treatment Network centers participated in a survey examining Health-Related Independence. Eligibility criteria for caregivers included being the primary caregiver/guardian of a youth age 16-25 with a diagnosis of ASD and being English speaking. YASD diagnosis and age were verified through chart records. Unadjusted and adjusted analyses determined 1) prevalence of physical and mental health conditions within the population; 2) associations between describe and care seeking behavior for physical and mental health conditions; and 3) potential predictors of describing and care seeking behaviors for both physical and mental health conditions.

Results: Ninety percent of caregivers who completed the survey were female, with just over 40% having a bachelor or higher-level education. The majority of caregivers lived in two-person households (77%) with moderate to high incomes ($50,000 or more) (71.2%). The average age of YASD was 19 years, with the majority being male (79%) and white non-Hispanic (82%). Most caregiver reported their youth as having Autistic (35%) or Autism Spectrum Disorder (28%) with moderate daily limitations (57%).

The majority of caregivers reported their youth had or currently have mental health conditions (90%) with 43% reporting 3 or more (e.g., ADHD, anxiety, and depression). Less than half of caregivers reported their youth needing mental health services (46%) within the last 12 months, over 90% received the mental health services they needed. Caregivers reported that 53% of YASD were able to describe their physical health condition and 45% were able to seek care for them. Regarding mental health conditions, caregivers reported 45% of YASD were able to describe their condition and 33% were able to seek care. Describe and care seeking behavior was significantly higher for physical versus mental health conditions (p<.001). Regression analysis showed similar predictors for describing and seeking behaviors regardless of whether the condition type. Intellectual disability was a strong predictor of each outcome (p>.005), while demographic and family-level variables accounted for little variance.

Conclusions: YASD have high rates of mental health conditions but are less like to use, describe, and identify mental health service/needs compared to physical health services/needs. These finding can inform much needed health care transition and YASD empowerment interventions focusing on both physical and mental health conditions.

10

126.010 Association of Activity Engagement with Severity of Depressive Symptoms in Adults with ASD

*P. Radoeva[1], K. Ballinger[1], S. J. Webb[2] and **G. Stobbe**[3], (1)University of Washington, Seattle, WA, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)Psychiatry & Behavioral Medicine, Seattle Children's Autism Center, Seattle, WA*

Background: Adults with Autism Spectrum Disorder (ASD) are at a higher risk for having comorbid mental health conditions, such as depression and anxiety. The patient health questionnaire-9 (PHQ-9) is a widely used self-administered questionnaire used to screen for depression and measure severity of depressive symptoms, identifying mild to severe depressive symptoms. Community participation has been associated with reduced risk of depressive symptoms in certain subpopulations (e.g., in older women in the general population (Ahern and Hendryx, 2008) or post-stroke (White et al., 2014)). In individuals with ASD, community participation has been found to decrease significantly during the transition from adolescence into adulthood (Myers et al., 2015).

Objectives: Our goal was to determine which factors are associated with severity of depressive symptoms in adults with ASD.

Methods: Using retrospective medical record chart review study design, we abstracted data for adults with prior clinically established ASD diagnosis, who presented for initial evaluation at the UW Medicine Adult Autism Clinic between January and August 2015, and had completed a PHQ-9 at the initial visit (n=32). ANOVAs were conducted using PHQ-9 as the dependent variable, and each of the following binary categorical variables as independent variables: sex, family history of anxiety and/or depression, engagement in community/recreational/educational activities, current employment/school status, change in living arrangement (over the preceding year) or current psychotherapy.

Results: Engagement in community/recreational/educational activities was associated with severity of depressive symptoms: PHQ-9 scores were lower (less depression) in patients engaged in one or more activities (M=9.5 SD=5.7) compared to patients not involved in activities (M=15.5 SD=5.8) (F=6.6, p<0.05). Individuals who were currently receiving psychotherapy had significantly higher depression scores (M=14.3 SD=5.4) compared to those who were not (M=8.4 SD=5.7) (F=8.7, p<0.01). Adults with family history of depression and/or anxiety had higher depression scores (M=13.0 SD=6.2) as compared to individuals without reported family history of depression and/or anxiety (M=8.4 SD=5.4) (F=4.8, p<0.05).

Conclusions: Our finding of association between current psychotherapy and severity of depressive symptoms likely reflects that patients with higher depression scores have an indication to receive psychotherapy (e.g., ongoing depressive episode). The association between depressive symptoms and involvement in activities (community participation, recreational and/or educational activities) suggests an important relationship between co-morbid depression symptoms in adults with ASD and ability to engage in activities of adulthood. While a causative relationship cannot be determined through our current methods, our results suggest that access to community participation, recreational, and/or educational activities is related to lower depressive symptom severity. It will be important to understand the direction of this finding as promotion of community-based, educational and recreational activities for adults with ASD may be an important component of treatment plans for depression in ASD.

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126.011 Better at How but Worse at Why: Comparing Writing Produced By Autistic College Students and Non-Autistic Mentors

***E. Hotez**[1], A. Riccio[2], N. Gaggi[3], D. DeNigris[4], M. C. Zajic[5] and K. Gillespie-Lynch[6], (1)City University of New York, Hunter College, New York, NY, (2)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (3)College of Staten Island, Staten Island, NY, (4)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (5)University of California at Davis MIND Institute, Davis, CA, (6)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: Although a rapidly growing literature focuses on the social, executive functioning and self-advocacy needs of autistic college students (Gelbar et al., 2014), the writing skills and writing self-efficacy of autistic college students have received almost no empirical attention (Gerstle & Walsh, 2010). This is surprising given that writing is essential for success in college and professional workplaces ("The Neglected R", 2003). In addition, discrepancies between often high cognitive skills and variable writing skills have been documented since the earliest accounts of autism (Asperger, 1991). Autistic school-age children and adolescents demonstrate difficulties with both transcription and translation abilities (Brown et al., 2014; Griswold et al., 2002; Mayes et al., 2017; Zajic et al., 2016), but the nature of these difficulties is not well understood (e.g., Asaro-Saddler, 2015). Difficulties associated with autism may impact writing skills; anecdotal evidence from one autistic college student suggests that some autistic college students may struggle with writing for an audience due to Theory of Mind (ToM) challenges (Jurecic, 2007).

Objectives: Our primary aims were to determine if: 1) autistic college students face unique writing difficulties and 2) challenges associated with autism, such as difficulty understanding others' perspectives and/or generating and organizing ideas, contribute to writing difficulties.

Methods: Autistic college students in a mentorship program (*n* = 27) and non-autistic mentors (*n* = 14) completed the Social Responsiveness Scale-2; Woodcock Word Comprehension; Reading the Mind in the Eyes, a writing self-efficacy measure (MacArthur et al., 2016); the Test of Nonverbal Intelligence; measures of generativity (e.g., how many uses for a brick and a bottle they could generate in a minute each), a verbal fluency measure (Jolliffe & Baron-Cohen, 2000), and a personal essay, wherein they were asked to share something interesting they had learned recently. A subset of participants also completed fictional (ASD = 19; non-ASD = 7) and persuasive (ASD = 14; non-ASD =9) writing tasks. After obtaining reliability, independent coders blind to diagnosis coded writing samples for perspective taking, contextual information, and elaboration. We used paper.rater.com to assess length (number of sentences), errors (number of grammar errors), and quality (AutoGrader).

Results: Autistic students reported heightened belief in writing conventions (e.g., "Good writers don't make errors in grammar"), less frequently provided a reason for another's perspective in their personal essays and fiction, and exhibited *better* grammar in their personal essays relative to mentors (Table 1; *p*s < .05). Among autistic students, lower belief in writing conventions and greater word comprehension, generativity, and ToM were associated with higher quality personal essays.

Conclusions: Findings suggest that the writing skills and writing self-efficacy of autistic college students are highly variable; few differences between autistic and non-autistic students were observed. Autistic students reported more perfectionistic attitudes toward writing and produced fewer grammatical errors than non-autistic students. Despite often high quality writing, they exhibited subtle difficulties using ToM in their writing. Low-stakes multimodal writing assignments wherein students can practice generativity and address others' perspectives through enjoyable activities are likely to be beneficial for autistic college students.

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126.012 An Evaluation of the Tackling Teenage Training Program and Its Effects on Achieving Healthy Psychosexual Functioning in Adolescents with High Functioning Autism

O. Healy[1]*, J. Summerville*[2]*, K. Visser*[3]*, K. Greaves-Lord*[4]*, F. Boudesteijn*[5] *and J. Holloway*[6]*, (1)School of Psychology, Trinity College Dublin, Dublin, Ireland, (2)Trinity College Dublin, Dublin, Ireland, (3)Yulius, Barendrecht, Netherlands, (4)Erasmus MC, Rotterdam, Netherlands, (5)Yulius Academy, Barendrecht, Netherlands, (6)Psychology, National University of Ireland Galway, Galway, Ireland*

Background: The main characteristic difficulties facing a person with Autism Spectrum Disorder (ASD) are impairments in social interaction: poor social development, especially interpersonal development; deficits in language and communication, both verbal and non-verbal, and repetitive behaviours. These difficulties can be especially compounded during the adolescent years (Sullivan & Caterino, 2008). Adolescence is considered a difficult period in ASD with problems often arising in relation to psychosexual functioning. It has been proposed that such problems may originate in limited knowledge and skills related to appropriate psychosexual functioning (Dekker et al., 2014; Stokes et al., 2007; Stokes & Kaur 2005; Sullivan & Caterino 2008). Recently, an individualised training program has been developed, specific to adolescents with ASD, to fully cover psychosexual development and the challenges that may arise- the Tackling Teenage Training (TTT) Program. Pilot results of this training program point to positive effects, in adolescents with ASD in the Netherlands. Specifically, significant increases in psychosexual knowledge was shown for those participants who received the training (Dekker et al., 2014).

Objectives: This presentation will examine the findings of a pilot study currently underway in Ireland, examining the effects of the TTT program on the psychosexual development of adolescents with ASD.

Methods: Thirty five adolescents and their parents participated in this study. We assess the participants on measures of psychosexual knowledge, sexual functioning, anxiety and behavioural and emotional problems. Self-report and parent-report on measures, across three time points during intervention are gathered, at baseline (T1), post-treatment (T2 18 weeks), and follow-up (T3 6 months post-intervention).

Results: Outcomes have been analysed in relation to changes on measures across the three time points of the study. Additional analyses have been conducted on age and trainer-reported difficulty of the adolescent during intervention, on changes in psychosexual knowledge and sexual functioning, as a result of receiving the training program.

Conclusions: Results are discussed in relation to current research and theory in the area of sexual functioning and psychosexual development during adolescence in ASD.

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126.013 Clinical Characterizations of Women and Men with ASD, Diagnosed As Adults.

A. Backman[1,2] *and T. Hirvikoski*[2,3]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden, (2)Habilitation & Health, Stockholm County Council, Stockholm, Sweden, (3)Karolinska Institutet, Stockholm, Sweden*

Background: Although based on but a few studies, it has been suggested through both clinical trials, in population-based studies, as well as expert testimonials that ASD is associated with long-term impairments in major life activities, also regarding intellectually able individuals with ASD. These include areas such as mental well-being, education, occupation, living situation, and coping with everyday hassles. Many of these studies have primarily focused on the situations of male individuals with ASD (diagnosed as children), leaving a gap in the knowledge regarding females with ASD and possible extant gender differences.

Objectives: The focus of the study is to explore the clinical characteristics of a clinical cohort of young women and men with ASD, diagnosed as adults. The characteristics involve psychiatric comorbidity, cognition, and adult life outcomes (relationships, education, employment, and living situation). Potential gender differences will be analysed.

Methods: Between 2001 and 2013, 830 adult patients were enrolled in the study at a tertiary outpatient clinic in Stockholm, Sweden. Out of these, n=348 patients were diagnosed with ASD. Patient's case files and life situation questionnaire were used as data sources regarding life outcomes. Comprehensive neuropsychological testing was conducted to assess general intellectual ability, and cognitive profile and clinical interviews were conducted to assess psychiatric co-morbidity.

Results: Of the n=348 adults diagnosed with ASD, out of these a sizeable proportion were female (ASD-ID, n=104; ASD+ID, n=19). At least one additional lifetime DSM-IV diagnosis was established in 84% of the individuals with ASD. Most common were additional neurodevelopmental disorders and mood disorders followed by anxiety disorders. Mood disorders were more prevalent among women with ASD, as compared to men with ASD. Otherwise, no significant gender differences were seen with regard to psychiatric comorbidity. The analyses regarding cognitive profile and current life situation are in progress.

Conclusions: It is very common among individuals with ASD diagnosed as adults to also have psychiatric comorbidity from a broad spectrum of disorders, especially additional neurodevelopmental disorders and mood disorders.

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126.014 Correlates of Quality of Life in Adults with ASD: A Systematic Review and Meta-Regression Analysis

S. Y. Kim*, K. Bottema-Beutel and S. Crowley, Lynch School of Education, Boston College, Chestnut Hill, MA*

Background: Quality of life (QoL) is a multi-dimensional construct that includes subjective well-being, personal characteristics, and environmental variables (Schalock, 2004). When applied to individuals with ASD, QoL provides a criterion by which to assess satisfaction with various domains of their life as an outcome measure. Previous studies on the relationship between personal and contextual factors and QoL of individuals with ASD have provided inconclusive results (Chiang & Wineman, 2014). As improvement of QoL is one of the main objectives in interventions and social services of adults with ASD (Hong et al., 2016), it is important to identify factors associated with a favorable QoL to develop services that effectively support this goal.

Objectives: This study is a structured literature search and meta-analysis. The goal of this exploratory meta-analysis study was to synthesize the extant research to investigate the following hypotheses:

1. Are IQ, social functioning, and autism severity positively associated with QoL?
2. Is the correlation between QoL and social functioning higher than those between QoL and IQ or autism severity?
3. Is there a relationship between age and QoL?

Methods: This study used a structured search in ERIC, ERC, Medline, PsychINFO, and ProQuest Dissertations and Theses databases to locate studies that included correlations between QoL and (a) age, (b) IQ, (c) autism severity or (d) social functioning of adults with ASD (over 18 years). The first and third author independently reviewed the 117 articles in full, and two studies were included (Figure 1). Reliability of decisions on inclusion/exclusion was 100%. The authors of 22 studies that included measures of interest but did not report Pearson's r or partial r were contacted, and 14 provided the requested information. The first and third authors independently coded the email correspondences. For continuous variables, the average ICC was .855 (range 0.74–0.95). For categorical variables, the average agreement was 85.48%. This analysis utilized a robust variance estimation approach to meta-analysis and meta-regression using the ROBUMETA macro in Stata (StataCorp, 2013).

Results: The meta-analysis was conducted on a total of 80 effect sizes (16 studies), which represented 1000 participants with ASD (mean age= 29.6; male= 83.55%). A total of 14 reports and 75 effect sizes were gathered from unpublished sources. The coefficients in the simple meta-regression for age, IQ and autism severity were close to zero and statistically insignificant while the coefficient for social functioning was statistically significant (p=0.0476), and with coefficient 0.259. See table 1 for coefficients and p-values.

Conclusions: The meta-analysis shows that social functioning is more highly correlated with QoL than age, IQ and autism severity. The strong relationship between social functioning and QoL suggested by this study has implications for future studies to target social functioning to effectively support better QoL of adults with ASD. Increasing awareness and acceptance on the part of neurotypical individuals and improving social support are discussed as methods to improve social functioning.

Table 1. Summary effect sizes in unconditional models

Correlate constructs	Coefficient	P-value
Age	-0.0337	0.5934
IQ	-0.008	0.9602
Autism severity	-0.003	0.9639
Social functioning	0.259	0.0476

15 **126.015** Dating Experience and Subjective Wellbeing in Autism Spectrum Disorder

M. A. Stokes[1]*, G. Hancock*[1] *and L. Pecora*[2]*, (1)Deakin University, Burwood, Australia, (2)School of Psychology, Deakin University, Burwood, VIC, Australia*

Background:

Research and clinical accounts both suggest that many individuals with ASD express a clear desire for relationships with others. However, they experience difficulties establishing such relationships. Previous systematic reviews and meta-analyses suggested that difficulties in this area are more commonly experienced by individuals with ASD compared to typically developing (TD) individuals (Hancock, Stokes, Mesibov, 2017). However, there is very little empirical evidence concerning the impact of ASD on the establishment of romantic relationship. Understanding of this would assist in providing well-informed and effective supports for adolescents with ASD in transition to adulthood and for adults with ASD who are seeking support around relationship difficulties.

Objectives:

The aim of this study was to contrast those with ASD to TD individuals for 1/. the level of interest in relationships, 2/. the rate of dating experience, and then 3/. the subsequent difficulties establishing a relationship. If differences between groups were found, the clinical impact of these difficulties was to be explored by assessing whether the association between ASD symptomology and overall wellbeing was moderated by the relationship difficulties.

Methods:

An online questionnaire comprising of the Sexual Behaviour Scale – third edition (SBS-III; Hancock, 2017), a measure of socio-sexual functioning validated by item response analysis, the Autism Quotient (AQ), and the Personal Wellbeing Index (PWI) was completed by 232 individuals with ASD (Age M=25.13, SD=7.96) and 227 TD individuals (Age M=22.16, SD=5.25).

Results:

Compared to TD individuals, individuals with ASD did not differ to the degree that they were interested in having a relationship (*p*=ns). However, those with ASD more commonly reported having never been on a date, *t*(411)=2.15, *p*<.05, Cohen's *d*=0.30, and having had difficulties establishing a relationship, *t*(437)=4.58, *p*<.001 Cohen's *d*=0.62. A regression model of the relationship between level of ASD symptomology and level of wellbeing, moderated by difficulty establishing relationships was significant, *F*(3,451)=43.44, *p*<.001, R^2=.22, with the moderator providing significant explanation of this relationship, *b*=-.64, *t*=-2.35, *p*<.05.

Conclusions:

Individuals with ASD have the same level of interest in relationships as TD individuals, however are less likely to have been on a date and if they have, they are more likely to have difficulty establishing a relationship. Results also demonstrated that the impact of ASD symptomology on one's wellbeing is moderated by these difficulties establishing romantic relationships. For clinicians, these findings suggest that primary interventions and supports in this domain should focus on understanding and skills related to the initial stages of meeting a potential partner and building a relationship. This is of particular importance given that difficulty in this area can reduce subjective wellbeing for those on the autism spectrum.

16 **126.016** Developing a Research Protocol to Investigate Stress, Workload, and Driving Apprehension during Driving Lessons in

Young Adults with an Autism Spectrum Disorder: A Feasibility Study.

V. Ross[1]*, D. J. Cox*[2]*, M. Noordzij*[3]*, K. Geryl*[4] *and A. Spooren*[5]*, (1)School for Transportation Sciences, Transportation Research Institute, Hasselt University, Diepenbeek, Belgium, (2)Departments of Psychiatry, Internal Medicine and Opthalmology, Virginia Driving Safety Laboratory, University of Virginia Health System, Charlottesville, VA, (3)Department of Psychology, Health and Technology, University of Twente, Enschede, Netherlands, (4)Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium, (5)Faculty of Medicine and Life Sciences, Rehabilitation sciences, Hasselt University, Diepenbeek, Belgium*

Background:

Autism Spectrum Disorders (ASD) are known to impact quality-of-life (QoL). Driving can increase autonomy and QoL by enabling maintenance of work and social contacts. Research suggests people with ASD experience difficulties in complex driving situations. These difficulties may induce increased stress, workload, and driving apprehension (i.e., fear or worry), discouraging the pursuit of licensure and potentially interfering with safely learning to drive.

Driver instructors can be seen as key players in the development of safe driving skills, already during the learning phase. Internationally, attention went to the development of educational modules for driver instructors to learn how to deal with ASD learner drivers. Especially in the Netherlands, and recently in Belgium, several driving schools adopt a distinct approach for ASD learner drivers. However, effect evaluations often lack, neither has it been investigated whether these approaches lead to less stress, workload, and driving apprehension. Moreover, to avoid extra stress, too demanding research protocols are best avoided.

Objectives:

We conducted a feasibility study with wearable technology and questionnaires to determine levels of stress, workload, and driving apprehension during driving lessons. To this end, we developed a research protocol and asked a pilot sample to evaluate the procedure.

Methods:

The protocol included Q-sensor wristbands to indicate levels of stress and workload during driving lessons via measurement of electrodermal activity. We also included the Rating Scale of Mental Effort (RSME), together with the Driving Attitude Scale Parent-Report (DAS-PR) & Self-Report (DAS-SR) from Cox and colleagues as indicators for signs of apprehensive driving. Participants wore Q-sensors during each lesson and completed the RSME after each lesson, as their instructors also did. After the first, middle, and final driving lesson, participants and their parents completed the DAS questionnaires. Besides that, we included questionnaires to determine baseline levels of anxiety and ASD characteristics. We followed a similar procedure for participants that took a driving test. The pilot sample included 4 ASD diagnosed (1 male) and 2 control (1 male) learner drivers, age 18-25. Participants received the instructions once, at reception of the materials.

Results:

Procedures and measures were evaluated positively. However, to avoid incomplete or unusable data, special attention should go to clear enough instruction of the correct procedure. For instance, two participants wore sensors on the upper instead of the lower wrist, leading to unusable data. Furthermore, questionnaires were not always completed consistently. The non-parametric group comparison tests were not significant, probably due to the limited sample size. Only one ASD learner driver completed the driving exam during the study (i.e., one academic year).

Conclusions:

The developed protocol was evaluated positively and therefore can be used to investigate levels of stress, workload, and driving apprehension during driving lessons. However, sufficient attention to the instructions is warranted (e.g., inclusion of practice sessions and reminders). Finally, to include the driving exam, sufficient time allocation to the study is required.

17 **126.017** Getting from A to the Bahama's: An Exploratory Study of People with an Autism Spectrum Disorder

V. Ross[1]*, A. Neven*[1]*, K. Brijs*[1]*, E. Jongen*[2]*, V. Cops*[1] *and E. Hermans*[1,3]*, (1)School for Transportation Sciences, Transportation Research Institute, Hasselt University, Diepenbeek, Belgium, (2)Faculty of Psychology and Educational Sciences, Open University, Heerlen, Netherlands, (3)Department of Earth and Environmental Sciences, Division of Geography and Tourism, KU Leuven, Leuven, Belgium*

Background:

Most scientific studies on autism spectrum disorders (ASD) started from a medical perspective, investigating causes, prevention, and treatment. Recently, research started to focus more on the daily problems experienced by people with ASD, requiring the identification of specific barriers (Hamed, 2013). It appears that people with ASD are limited in autonomy and social inclusion (Ross et al., 2015). This, for example, due to possible impairments related to use of public transport and driving, but also to the less explored domain of tourism (Feeley et al., 2015; Hamed, 2013; Ross et al., 2015). To the best of our knowledge these three components were not yet combined in one single study.

Regarding public transport, a number of potential obstacles can be categorized in 3 main categories: social contact (buying tickets, interacting with other passengers), imagination (next stop, transfer), and communication (buying tickets, asking questions, asking to stop at the correct stop). Moreover, structural problems may complicate traveling, such as availability or infrastructure (pedestrian routes, traffic lights, traffic density, etc.). Research in New Yersey (Feeley et al., 2015) confirms the use of public transport entails various potential difficulties. Similarly, independent car driving is a complex task with several subtasks to be executed in parallel (e.g. shifting gears, steering, changing lanes, and keeping traffic rules into account). In addition, driving conditions are variable (e.g. traffic jams, road blocks, and detours). Driving thus depends on driving experience, perception, and cognitive abilities. ASD features, such as cognitive dysfunction can interfere with driving (Ross et al., 2015). Similar problems can arise in the area of travel and tourism since travel can be overwhelming for people with ASD, especially when routines change. The latter can result in fear, and sensory problems. Despite that, most tourism related publications concern children with physical or significant cognitive impairments, instead of ASD (Hamed, 2013).

Objectives:

This cross-sectional survey study explores possible problems related to autonomy and social inclusion. More specifically, we developed a questionnaire focusing on the use of public transport, driving skills, and tourism.

Methods:

Questionnaires were distributed via schools, ASD societies, and social media. Inclusion criteria were a certified ASD diagnosis, and a signed consent form. Respondents could participate from the age of 17 years since this is the age at which people are allowed to learn to drive in

Belgium.

Results:

A total of 87 respondents started the questionnaire. Exclusion of incomplete questionnaires resulted in a final sample of 50 respondents (52% male, age: 17-48). Data analysis is currently ongoing.

Conclusions:

Via this study, we hope to provide practical guidelines to stakeholders in the domains of public transport, driving, and tourism.

18 **126.018** Enhancing the Validity of a Quality of Life Measure for Autistic People

D. Mason[1]*, H. McConachie*[2]*, J. R. Parr*[3]*, D. Garland*[4]*, C. Wilson*[5] *and J. Rodgers*[3]*, (1)Institute of Neuroscience, Newcastle University, Newcastle-upon-Tyne, United Kingdom, (2)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (4)Northumberland, Tyne & Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (5)Autism advocate, Sunderland, United Kingdom*

Background: Quality of life (QoL) is an important outcome to measure in research and services. The World Health Organisation Quality of Life questionnaire (WHOQoL-BREF) is validated internationally and has been used in several studies with autistic adults. However, to date it has not been validated specifically for this use.

Objectives: (1) To develop additional items which address important quality of life issues for autistic adults. (2) To explore the validity of the WHOQoL-BREF (26 items), WHO Disabilities module (WHOQoL-DIS, 13 items), and additional items with a sample of autistic adults.

Methods: Four focus groups of autistic adults were held to discuss the WHOQoL-BREF and WHOQoL-DIS (subscales are Autonomy, Inclusion and Discrimination). Eleven proposed items were developed from themes derived from transcripts from the recorded discussions. Fifteen cognitive interviews were carried out with autistic adults to assess the face and content validity of these items. A Delphi survey (N=374) was conducted over two rounds to refine the items and establish their importance and clarity. From this process, nine items (hereafter ASQoL) were carried forward for further testing.

309 participants (mean age=43.0 years, SD=13.8) took part in a validation study recruited via the Adult Autism Spectrum Cohort-UK (ASC-UK). Participants completed the WHOQoL-BREF, the WHOQoL-DIS, the ASQoL items, the Hospital Anxiety and Depression Scale (HADS), the Craig Hospital Inventory of Environmental Factors short form (CHIEF-SF), the Comprehensive Quality of Life Scale (COMQOL), and the Interpersonal Support Evaluation List-12 (ISEL-12). Measures were completed on paper and returned via post, or electronically via Qualtrics.

Results: *Construct validity*: Exploratory factor analysis (EFA) suggested a four factor model and confirmatory factor analysis showed acceptable fit overall (CFI=0.83, $p<.001$). *Criterion validity*: The COMQOL satisfaction subscale was significantly correlated with all WHOQoL-BREF domains (r_s 0.59-0.79, all $p<.001$). *Convergent/divergent validity*: The WHOQoL-BREF domain scores were significantly correlated with all measures but showed stronger associations with hypothesised subscales (e.g. CHIEF-SF scores correlated significantly more strongly with the Environmental domain than the Psychological domain; $z=5.63$, $p<0.001$; ISEL-12 scores correlated significantly more strongly with the Social domain than the Physical domain; $z=3.90$, $p<0.001$). *Discriminant validity*: QoL scores for all subscales were significantly lower with increased depression and anxiety (HADS). *Reliability*: Overall internal consistency was excellent ($\alpha=0.93$) and subscale consistency was acceptable to good (αs=0.68-0.87).

Conclusions: The findings on validity of the WHOQoL-BREF supports its use with autistic adults and strengthens conclusions from previous research. This is the first study to use the WHOQoL-DIS with autistic people, and alongside the proposed ASQoL items, makes a unique contribution to further representing, measuring and understanding their QoL needs.

19 **126.019** Evaluating a Health Service Intervention for Adults with Autism Spectrum Disorder

C. Koning[1]*, D. B. Nicholas*[2]*, E. L. Kelly*[3]*, A. Orimalade*[4]*, L. Zwaigenbaum*[5] *and F. Orimalade*[6]*, (1)Clinical Support, Glenrose Rehabilitation Hospital, Edmonton, AB, Canada, (2)University of Calgary, Edmonton, AB, Canada, (3)Communication Disorders, Alberta Health Services; Glenrose Rehabilitation Hospital, Edmonton, AB, Canada, (4)Psychiatry, University of Alberta, Edmonton, AB, Canada, (5)University of Alberta, Edmonton, AB, Canada, (6)FACS Forensic Assessment & Community Services, Edmonton, AB, Canada*

Background:

Adults with ASD and their families report difficulty locating knowledgeable medical professionals, and a lack of coordinated services and provider-patient communication. Based on needs assessments including input from community stakeholders, a model of service delivery for adults was implemented and evaluated. This intervention incorporated adult diagnostic services, primary care for adults with ASD, and health care monitoring and consultation for complex health and ASD needs. Evaluation aims included process outcomes and qualitative experiences of service users and program delivery personnel.

Objectives:

To examine intervention outcomes such as utilization and patient satisfaction patterns

To examine perceived impact of service provision for adults with ASD, families, community ASD advocates and stakeholders, and clinical service providers

Methods:

This intervention evaluation-based study drew on participatory action research methodology, with a mixed data collection methods (qualitative and quantitative measures). Self-advocates and families were central to this evaluation design and process. Quantitative indicators consisted of patient demographics, service utilization patterns, and patient satisfaction/impact survey data. Qualitative data consisted of videoethnography-based interviews, resulting in video footage from service constituents offering commentary about the perceived impact of this intervention, including the needs of adults with ASD and the extent to which these needs are addressed by the intervention. Evaluation data were subjected to appropriate quantitative or qualitative analysis. As an example, video data was subjected to coding, categorization of codes and the determination of themes based on identified domains of need, as indicated by self-advocates and their families.

Results:

Findings indicate strong stakeholder engagement of and value placed on diagnostic and consultation services for adults with ASD. Service needs and demands for this intervention have already outpaced current service availability thresholds. Accordingly, core services have been well-utilized and viewed as impactful, and self-advocates report high levels of satisfaction with the intervention, based on surveys. Intervention users appreciate and strongly endorse clinical services that entail an understanding of ASD and its manifestation in adulthood. Of note, 60% of referrals for adult diagnostic services have resulted in a confirmed diagnosis of ASD, thereby seemingly identifying a substantial cohort of adults with ASD in the community who have remained undiagnosed and likely under-served over time. Impact measures suggest that this model of coordinated adult health services addresses a critical need, including benefits of adult-based accessible diagnostic services, clinical expertise for complex health and mental health care, and continued community capacity building in ASD. The videoethnographic findings yield illustrative video commentary that convey key interventional learnings for program development. Outcomes including lessons learned, benefits and service gaps will be identified in this presentation.

Conclusions:

This intervention study informs accessible healthcare services for adults with ASD. For individuals with ASD and complex health and mental health needs, findings support a community-based 'medical home' approach, including accessible diagnostic and consultation services. Findings invite ongoing capacity building across the healthcare continuum to proactively address gaps such as support for transition to adulthood, resources for seniors with ASD, and employment and housing needs within this population. Recommendations for program implementation and evaluation will be offered.

20 **126.020** Evaluating the Psychometric Properties of Social Cognitive Tasks for Adults with Autism

N. J. Sasson*, K. E. Morrison and A. E. Pinkham, University of Texas at Dallas, Richardson, TX*

Background: Although social cognition offers a promising treatment target for adults with autism, this effort is hindered by a lack of well-validated measures of social cognition for use in clinical trials. Many tasks measure the same constructs (e.g., emotion recognition), and little work has been done to assess which measures are the most reliable and valid for identifying social cognitive impairments in adults with autism.
Objectives: Similar challenges in the schizophrenia literature prompted the Social Cognition Psychometric Evaluation (SCOPE; Pinkham et al., 2015), which evaluated the psychometric properties of common social cognitive tasks and provided recommendations regarding their future use. Because related deficits in social cognition characterize autism (Sasson et al., 2011), we tested the reliability and discriminant validity of measures examined in SCOPE for use with adults with autism.

Methods: Adults with autism (n=103; Age: M=24.28; IQ: M=105.64) and typically-developing (TD) controls (n=94; Age: M=24.04; IQ: M=107.80) completed eight tasks from the SCOPE study spanning four domains of social cognition: 1) the Ambiguous Intentions and Hostility Questionnaire (AIHQ) measured hostile attribution style; 2) social appraisal was measured by a) The Awareness of Social Inference Task (TASIT), b) Hinting Task, and c) Reading the Mind in the Eyes; 3) emotion recognition was measured by a) Bell Lysaker Emotion Recognition Test (BLERT), and b) The Penn Emotion Recognition Test (ER-40); 4) social perception was measured with the Relationships Across Domains (RAD). Additionally, the Trustworthiness task was added as it overlaps with each domain. The Cartoon Theory of Mind Task (CToM), which measures non-verbal inferences of intentionality, and the Benton Facial Recognition Test were also added for their relevance to autism.

Results: Reliability was assessed using Cronbach's alpha. Social appraisal, social perception, and emotion recognition tasks showed moderate to strong reliability: TASIT (α=.86), Hinting (α=.74), CToM Attribution of Intention (α=.72), and Eyes (α=.73); Benton (α=.72) and RAD (α=.81); and BLERT (α=.72), ER-40 (α=.67). The Trustworthiness task also showed strong reliability (α=.92). The AIHQ Blame score showed high reliability (α=.87), but the Hostility (α=.48) and Aggression subscales (α=.43) did not.

We also tested the discriminant validity of the tasks for autism and TD groups. A MANOVA with Group (autism, TD) as a between subjects factor found significant differences across all measures (λ=.636, F(12, 173)=8.27, p< .001). TD adults preformed significantly better than adults with autism on all tasks (p's< .02) except for the AIHQ Blame (p=.86), Hostility (p=.48), and Aggression (p=.85) subscales, as well as the CToM (p=.58) and Trustworthiness task (p=.10).

Conclusions: Most of the social cognitive tasks assessed demonstrated strong internal consistency and were sensitive at revealing impairments in the autism group relative to the TD group. Specifically, the BLERT, Hinting, ER-40, Eyes, TASIT, RAD, and Benton performed well and are recommended for use with adults with autism. Although further psychometric evaluation is warranted, these findings are largely consistent with SCOPE (Pinkham et al., 2015) and indicate many tasks developed for evaluating social cognitive impairments in schizophrenia are equally applicable to autistic adult populations.

21 **126.021** Evaluation of a Mentorship Program for Undergraduates with ASD

***D. A. Trevisan**[1], S. Leach[2], G. Iarocci[3] and E. Birmingham[1], (1)Faculty of Education, Simon Fraser University, Burnaby, BC, Canada, (2)Simon Fraser University, Centre for Students with Disabilities, Burnaby, BC, Canada, (3)Simon Fraser University, Burnaby, BC, Canada*

Background:

The prevalence of students with ASD in university is rising (White et al., 2011), necessitating universities to offer support systems for promoting academic success and degree completion.

Objectives:

This study evaluated the effectiveness of Simon Fraser University's (SFU) Autism Mentorship Initiative (AMI), a peer mentorship program that matches undergraduates with ASD with upper level undergraduates and graduate students from SFU in order to help them navigate the social, emotional and academic demands of university life.

Methods:

Participants included 23 undergraduates previously diagnosed with ASD or Asperger Syndrome (mentees), and 21 undergraduate or graduate neurotypical students (mentors) from SFU.

Mentors and mentees both completed program evaluation surveys assessing the educational and personal benefits they experienced as a result of their involvement with AMI.

Mentees also completed a number of questionnaires including: Behavior Assessment Scale for Children – Self-report, College (BASC-SRP-COL), Behavior Rating Inventory of Executive Function (BRIEF), Learning and Study Strategies Inventory (LASSI), and the Student Adjustment to College Questionnaire (SACQ).

Selected Results:

Table 1 provides descriptive data about the mentees who participated in AMI. The percentile rank scores represent the relative standing of the AMI mentees on each of these variables in comparison with the population norms.

Table 1

Variable	Measurement Tool	Directionality	Mean Percentile Rank
Internalizing Problems	BASC-SRP-COL	Higher percentiles indicate more problematic behaviors.	72
Inattention/Hyperactivity	BASC-SRP-COL		55
Emotional Symptoms Index	BASC-SRP-COL		77
Full Scale	BRIEF	Higher percentiles indicate *worse* executive functions.	76
Metacognition Index	BRIEF		92
Behavior Regulation Index	BRIEF		56
Anxiety	LASSI	Higher percentiles indicate *better* learning strategies.	45
Motivation	LASSI		53
Test Strategies	LASSI		42
Attitude and Interest	LASSI		23

Table 2

Pre-Post Gains in University Adjustment

SACQ Subscales	Semester 1 mean percentiles	Semester 2 mean percentiles	t-score	p-value	Cohen's d
Academic Adjustment	27	42	1.86	.085	.32
Emotional Adjustment	16	31	4.13	<.001	.36
Social Adjustment	18	31	3.29	.005	.59
University Adjustment (Full Scale)	18	34	4.25	<.001	.49

Table 3

Educational and Personal Benefits from Survey (Mentees)

Question	% Disagreement	% Neutral	% Agreement
AMI helped with socialization and meeting other students	6.25%	43.75%	50%
AMI helped me improve my study skills	25%	43.75%	31.25%
AMI has helped me improve my time management skills	0%	12.5%	87.5%
AMI has helped me manage anxiety	12.5%	50%	37.5%

Table 4

Personal and Professional Benefits (Mentors)

Question	% Disagreement	% Neutral	% Agreement
Learned more about Autism and Mentorship	9.09%	0%	90.91%
Benefitted Professionally	20%	20%	60%
Benefitted Personally and Enjoyed Involvement in AMI	9.52%	0	90.48%

Conclusions:

Compared to the general college population, our mentees displayed higher than average internalizing symptoms, lower executive functioning, poorer study strategies and lower college adjustment, highlighting the need for individualized support systems for undergraduates with ASD in universities. Mentees demonstrated significant pre-post improvements in college adjustment, and survey data revealed that both the mentors and mentees in our program experienced personal, educational and professional benefits from their involvement in AMI. Peer mentorship programs are an effective tool for supporting undergraduates with ASD, and provide important professional benefits for neurotypical mentors.

22 **126.022** Executive Function and Social Cognition Impairments in Autism Spectrum Disorder, Attention-Deficit/Hyperactivity Disorder and Comorbid Presentation

S. Lukito[1]*, O. O'Daly*[2]*, D. J. Lythgoe*[2]*, I. Cummings*[3]*, A. Galanopoulos*[3]*, M. Nyakunengwa*[3]*, K. Rubia*[4] *and E. Simonoff*[5]*, (1)Department of Child and Adolescent Psychiatry, Institute of Psychiatry, Psychology, and Neuroscience, King's College London., London, United Kingdom of Great Britain and Northern Ireland, (2)Department of Neuroimaging, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (3)The Adult Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism National Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (4)Department of Child and Adolescent Psychiatry, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (5)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

Background: Attention-deficit/hyperactivity disorder (ADHD) frequently co-occurs among people with autism spectrum disorder (ASD), prompting studies of individuals with the "pure" disorders and their "combined" (i.e., ASD+ADHD) form. Social cognition (SC) deficits were often reported in ASD. Furthermore, executive function (EF) deficits were often reported in individuals with ADHD and with ASD, although the latter finding might be associated with the co-occurring ADHD symptoms in the population. [1,2] To date, only one study of EF and SC in adults in this population have been conducted,[3] the findings of which were confounded by uneven distributions of sex and ADHD subtypes across groups.
Objectives: This study compared the EF and SC impairments of young adult males with ASD, ADHD, ASD+ADHD against those with typical development (TD). Medication intake and ADHD subtypes were balanced across groups with ADHD diagnoses. We expected the ADHD and the ASD+ADHD groups to be impaired primarily in EF, and the ASD in SC, relative to the TD group.

Methods: We tested 105 young adult males (age 20-27 years, FSIQ ≥ 70) with ASD (n = 26), ADHD (n = 27), ASD+ADHD (n = 27) against TD controls (n = 25) on a battery of computerized EF (response inhibition, sustained attention, visuospatial working memory, cognitive flexibility, temporal discounting) and SC tasks (theory of mind [ToM] and facial emotion recognition [FER]). Behavioral data were analyzed using omnibus MANOVAs and further explored using univariate ANOVAs with Group as a predictor. Analyses were conducted with and without IQ added as a covariate and contrasts were planned between each clinical group against TD.

Results: Omnibus MANOVAs revealed an effect of Group in EF ($p = .001$) and SC performance ($p = .002$). Univariate ANOVAs revealed that, relative to TD, the ASD, ASD+ADHD and ADHD groups were impaired on primary measures of response inhibition (commission errors), sustained attention (omission errors) and working memory ($ps \leq .03$), but these findings did not survive in the ASD group after IQ was covaried. Impairments in temporal discounting were specific to ADHD ($p = .03$), and remained when IQ was covaried. Cognitive flexibility did not differ across groups. The ASD and ASD+ADHD groups committed more errors during both SC tasks than the ADHD and TD groups, but only the FER errors in the ASD group ($p < .001$) remained after IQ was covaried.

Conclusions: Response inhibition, sustained attention, and working memory were not only impaired in the ADHD and ASD+ADHD, but also in the ASD group, although in the latter only when IQ was not included. Temporal discounting deficits was specific to ADHD and suggested the pervasive executive dysfunction in this population. SC impairments were found in the ASD and ASD+ADHD groups, although mostly did not survive when IQ was covaried. These demonstrate the associations between EF deficits and ADHD, SC deficits and ASD symptoms. There was some support for additivity of impairments in the combined diagnosis and the role of IQ as an explanatory factor for the variation of cognitive findings in adults in the populations.

23 **126.023** Neural Correlates of Unsuccessful Inhibition and Selective Attention in Young Adults with ASD, ADHD and Comorbid Presentation during the Modified Stop-Signal Task

S. Lukito[1]*, O. O'Daly*[2]*, D. J. Lythgoe*[2]*, S. Maltezos*[3]*, M. Pitts*[3]*, E. Simonoff*[4] *and K. Rubia*[5]*, (1)Department of Child and Adolescent Psychiatry, Institute of Psychiatry, Psychology, and Neuroscience, King's College London., London, United Kingdom of Great Britain and Northern Ireland, (2)Department of Neuroimaging, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (3)The Adult Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism National Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (4)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (5)Department of Child and Adolescent Psychiatry, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

Background:
Individuals with attention-deficit/hyperactivity disorder (ADHD) or with autism spectrum disorder (ASD) often demonstrate motor response inhibition deficits. Neurobehavioural findings in the ASD population suggest that these deficits could be associated with co-occurring ADHD symptoms.[1, 2] A recent study showed that boys with ASD showed over-activation in the bilateral inferior frontal gyri (IFG) in contrast to age-matched ADHD boys who demonstrate under-activation in the IFG instead.[3] To what extent the neural correlates of motor inhibition in individuals with combined presentation (i.e., ASD+ADHD) are similar or different to the "pure" condition is presently unknown, however.

Objectives:

This study investigated the neural correlates of motor response inhibition and selective attention in young adult males with ASD, ADHD, ASD+ADHD and typical development (TD) using the functional magnetic resonance imaging (fMRI).

Methods:

We tested 91 adult males (age 20-27 years, FSIQ ≥ 70) with ASD (n = 21), ADHD (n = 25), ASD+ADHD (n = 23) against TD controls (n = 22) on a modified stop-signal task, that included oddball trials to control for selective attention. Medication intake and ADHD subtypes were balanced across groups with ADHD diagnoses. The task comprised 200 "Go", 40 "Oddball" and 60 "Stop" trials and required participants to cancel responses already initiated upon the arrival of an infrequent stop signal. A tracking algorithm was implemented to adjust the stop-signal arrival time to ensure that task performance converged to 50% success rate. Analyses were undertaken using the Statistical Parametric Mapping (SPM8) software. The correlates of successful/unsuccessful response inhibition, controlling for selective attention, was studied by contrasting the successful/unsuccessful Stop *vs.* Oddball trials. Selective attention was examined by contrasting the Oddball *vs.* Go trials. Whole-brain comparison was conducted with univariate ANCOVAs (peak threshold $p < .001$ and extent threshold $p <.05$, family-wise error corrected) on these contrasts, covarying for volume-to-volume total movement. Significant clusters of activation across groups were extracted using MarsBaR toolbox for *post-hoc* pairwise comparison, Dunn-Sidak corrected.

Results:

Univariate ANCOVAs revealed significant group effects during unsuccessful response inhibition in left insula/IFG/superior temporal/middle temporal gyri ($p < .001$) and right insula/IFG/thalamus/parahippocampal gyrus ($p < .001$) with *post-hoc* pairwise comparison showing that the ASD+ADHD group was significantly under-activated (all *ps* ≤ .001) in these clusters compared to all other groups, which did not differ from one another. A group effect was also found during selective attention in right precuneus with the ASD and ASD+ADHD groups demonstrating over-activation relative to the TD and ADHD groups (all *ps* ≤ .01). The neural correlates of successful inhibition did not differ across groups. All results remained after covarying for IQ.

Conclusions:

During unsuccessful inhibition, young adults with comorbid ASD+ADHD demonstrate impairments in key regions of motor response inhibition typically found in boys with ADHD, which was neurofunctionally associated with error monitoring or late-arriving motor inhibition activation. The over-activation found in right precuneus in the ASD and ASD+ADHD groups could signify reduced de-activation of the default mode network, which is typically suppressed during task positive condition.

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126.024 Executive Functioning in Adults with Autism. Do They Have a Characteristic Brief-a Profile?

K. E. Jager*, M. L. Bezemer and E. M. Blijd-Hoogewys, INTER-PSY, Groningen, Netherlands*

Background:

Adults with ASD are known to have executive function (EF) problems, especially with cognitive shifting. EF research in ASD is mainly based on results from neuropsychological tests. However, this way of testing has its limits concerning the ecological validity and takes a considerable amount of time. The Behavior Rating Inventory of Executive Function for Adults (BRIEF-A) does not have these disadvantages. The BRIEF-A screens for potential problems, measured by nine nonoverlapping theoretically and empirically derived clinical scales: Inhibit, Self-monitor, Plan/Organize, Shift, Initiate, Task monitor, Emotional control, Working memory, and Organization of materials.

Various studies have shown that the BRIEF is able to identify EF problems in children with ASD, with the most profound elevation on the scale Shift. This could be considered a 'characteristic' ASD profile. Little research has been conducted on the existence of such a profile in adults with ASD. Research using the BRIEF-A informant version shows that adults with ASD have elevated scores on the scales Shift and Plan/Organize. It is unclear whether the same is true for the self-report version.

Objectives:

We want to investigate whether there is a characteristic BRIEF-A-score profile for adults with ASD.

Methods:

The sample consisted of 254 adults ($M = 34.28$, $SD = 12.05$ years; 181 men, 73 women). Trained clinicians diagnosed the participants with ASD, using the DSM-IV-TR criteria (N = 14 AD, N = 114 AS, N = 126 PDD-NOS). All participants filled in a BRIEF-A self-report questionnaire. T-scores were calculated for all eight scales. The normative sample of the Dutch BRIEF-A manual was used as a reference group.

Results:

The ASD group has significant higher BRIEF-A scores – indicative of more EF problems – than the normative group, on all nine scales ($M >= 50$, $p < .001$, $d = 0.75\text{-}1.60$). The scales Shift, Initiate, Working Memory and Plan/Organize even show a clinical elevation ($M > 65$, $p <= .001$, $d = 0.25\text{-}0.40$).

Concerning differences based on sex, women with ASD have significant higher scores than men on the clinical scale Shift ($M = 74.27$, $SD = 11.70$, $M = 68.41$, $SD = 12.56$ respectively, $t(252) = -3.435$, $p = .001$, $d = 0.48$) and Emotional control ($M = 64.15$, $SD = 11.62$, $M = 58.97$, $SD = 12.16$ respectively, $t(252) = -3.110$, $p < .002$, $d = 0.44$).

Conclusions:

Adults with ASD report the most profound EF problems with shifting, initiating, working memory, and planning/organizing. Women with ASD report more problems than men concerning shifting and emotional control. Note that the effect sizes are small. More research is warranted before conclusions can be made concerning a possible characteristic BRIEF-A profile for adults with ASD.

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126.025 Factors Associated with Post-Secondary School Independence Among Young Australian Adults on the Autism Spectrum

L. P. Lawson[1,2] *and A. L. Richdale*[3]*, (1)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background:

Limited research has been conducted examining transition to adult life among young people on the autism spectrum. Existing evidence has shown low levels of employment, post-secondary study, and independence in individuals on the autism spectrum regardless of intellectual functioning. However, most studies examine adults across a wide age range and the few that have focused on individuals that have recently transitioned from secondary school often rely on parent report. The Study of Australian School Leavers with Autism (SASLA) is the first Australian longitudinal study to examine the transition period from secondary school to post-secondary school using self-report measures.

Objectives:

The aim of this study was to evaluate the levels of employment, post-secondary study, and independence in a sample of Australian individuals on the autism spectrum that have recently transitioned from secondary school.

Methods:

Individuals aged 15-25 years were invited to complete an online questionnaire measuring a range of outcome variables. The current study focuses on individuals who have already transitioned from high school. To date 68 post-secondary school individuals (M (SD) = 20.1 (2.3) years) have completed the survey (seven with an associated Intellectual Disability). Participants were asked to answer a range of questions relating to their current employment/post-secondary study status, presence of comorbid conditions (e.g. anxiety and depression), and other demographic variables. The Vocational Index was used as a measure of independence, where higher scores indicate more independence. Participants also completed the Autism-Spectrum Quotient-Short (AQ), the Patient Health Questionnaire-9 (PHQ-9), and the DSM-5 Generalised Anxiety Disorder Dimensional Scale (GAD-D).

Results:

High proportions of the sample reported experiencing a current anxiety (62%) or depression (31%) disorder. Sixty-two percent of the sample reported that they were currently studying (55% full-time) and 30% were currently employed; 16% were both currently employed and studying. Twenty-three percent of the sample were neither studying nor currently employed and 46% reported they were currently looking for work. The mean vocational index for this sample was 7.48 (SD 2.66), indicating a high level of independence. Hierarchical linear regression models controlling for age, found no association between the vocational index and AQ, GAD-D, or PHQ-9 scores.

Conclusions:

The results from the current study illustrate that there is a high level of independence in this sample of post-secondary Australian individuals on the autism spectrum. A high proportion of the sample reported that they were either currently studying or working. Level of independence was not significantly associated with autistic traits or levels of anxiety or depression. However, this study is limited by the small proportion of individuals with intellectual disability included in the sample. Nevertheless, previous research has reported that levels of independence are also low among high-functioning individuals on the spectrum. This study provides preliminary evidence that level of independence is not associated with autistic traits, anxiety or depression among young adults on the spectrum.

26 **126.026** Factors Underpinning the Successful Employment of Adults with Autism

J. Dreaver[1,2], *S. J. Girdler*[2,3], *C. Thompson*[4,5], *S. Bolte*[5,6,7], *M. H. Black*[2,3] *and M. Falkmer*[1,8], *(1)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (4)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia, (5)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (6)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (7)Child and Adolescent Psychiatry, Center for Psychiatry Research, Stockholm County Council, Sweden, (8)Curtin University, Bentley, Australia*

Background:

While obtaining successful employment is a primary ambition for young adults as they transition to the post-secondary years, this aspiration too often remains unrealized for individuals with Autism Spectrum Disorder (ASD). Given its bio-psycho-social approach the International Classification of Functioning, Disability and Health (ICF) has particular utility in conceptualising the employment of people with ASD. The ICF supports a holistic view of the individual and consideration of the role of contextual factors relevant to employment and the abilities and strengths of individuals with ASD in the workplace.

Objectives:

This study explored factors facilitating the successful employment of individuals with ASD across Australia and Sweden, examining these in reference to the ICF.

Methods:

Twenty semi-structured interviews, guided by the ICF, were conducted with company directors and line managers with in-depth knowledge of at least one case of successful employment of a person with ASD from Australia and Sweden. 'Successful employment' was defined as an individual with ASD maintaining competitive employment for six months or more. Thematic analysis extracted meaningful concepts which were collapsed into common themes relating to factors associated with successful employment. Strategies and supports underpinning employment success were also identified. Meaningful concepts were subsequently linked to the relevant ICF core-sets for ASD domains and codes.

Results:

While the experiences of company directors and line managers in Australia and Sweden were subtly different, three interrelated and overarching themes emerged including 'Knowledge and Understanding of ASD', 'Work Environment' and 'Job Match'. This research also identified, across countries, those social, adaptive, cognitive, employment and vocational supports and strategies that facilitated successful employment outcomes for people with ASD. Secondary data analysis linked 1083 unique meaningful concepts to the ICF. The most frequently linked category in the Environment was e430 *Individual attitudes of people in positions of authority*, followed by e330 *People in positions of authority* and e325 *Acquaintances, peers, colleagues, neighbours and community members*. The most frequently discussed categories in Activity and Participation were d740 *Formal relationships*, followed by d570 *Looking after one's health*. Only one of the eight chapters of the Body functions component were discussed by participants with these linking to *Mental functions*. The most prevalent categories within this chapter included b156 *Perceptual functions*, b122 *Global psychosocial functions*, b126 *Temperament and personality functions*, b167 *Mental functions of language*, b130 *Energy and drive functions*, b140 *Attention functions*, b164 *Higher level cognitive functions* and b160 *Thought functions*.

Conclusions:

Findings from this study revealed that knowledge and understanding of ASD underpinned employers' ability to make appropriate workplace modifications and match individuals to jobs. Linking of meaningful concepts to the ICF highlighted the importance of environmental factors, including support and relationships and attitudes in the workplace, in underpinning positive employment outcomes. This research provides practical strategies and supports which facilitate the successful employment of people with ASD, providing a basis for the development of future interventions and models of service delivery.

27 **126.027** Feedback from College Students with Autism Spectrum Disorders on the Transition into College and on a Social Support Program for College Students with ASD

D. Davidson[1], *I. Misiunaite*[2] *and E. Hilvert*[3], *(1)Psychology, Loyola University Chicago, Chicago, IL, (2)Loyola University Chicago, Chicago, IL, (3)Loyola University, Chicago, IL*

Background: The transition into college for adults with Autism Spectrum Disorders (ASD) is a precarious life stage. Commonly cited challenges include a lack of structure, difficulty with new routines, social communication issues, and increased anxiety and depression (Cai & Richdale, 2015). As the number of students with ASD pursuing higher education is projected to increase substantially in the upcoming years (Government

Accountability Office, 2016), it is imperative that colleges and universities develop adequate supports for these students.
Objectives: The primary objectives of this pilot project were to obtain information from college students with ASD about (1) their unique college transition experiences; and (2) their feedback about the design of a social support program for college students with ASD, i.e., the College Excellence in Students with Autism program (CESA).

Methods: Fifteen college students with ASD from 11 different states participated in this study. Participants were recruited through the host university's Office of Services for Students with Disabilities, an additional local university, and postings on various websites (e.g., Autistic Self Advocacy Network). Through an online platform, participants completed a questionnaire that asked them about their college experiences, their access to academic and social services at their institutions, and their ideas about the CESA program.

Results: Overall, students with ASD rated their college experience as positive. However, 60% of students with ASD reported being overwhelmed by their transition to college. Additionally, we found that over 80% of students reported feeling anxious and/or depressed because of the social demands of college, whereas 73% of students reported feeling anxious and/or depressed because of the academic demands of college. Correlational analyses revealed a trend that students who were overwhelmed by the transition to college were more likely to report greater anxiety and depression because of the *social demands* of college. No relations were found between students' reports of difficulty transitioning to college and their feelings of anxiety/depression because of *academic demands*. Interestingly, 73% of participants reported receiving academic services (e.g., extra time on exams) at their institutions, but only 33% of students reported receiving non-academic services (e.g., social support groups).

With regards to the design of the CESA program (see Table 1), the majority of college students with ASD surveyed believe it would be beneficial to have monthly social support group meetings during the entirety of the school year. Moreover, they believe it would be beneficial for the support group to have designated topics for discussion and that the support group would serve as a helpful way to meet other students on the spectrum and improve their social networks.

Conclusions: Overall, our findings demonstrate the need for additional services that support the transition to college for students with ASD, specifically services that provide greater access to social supports and social networks.

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126.028 Highways to Happiness for ASD Adults: Perceived Causal Relations Among Clinicians

M. K. Deserno[1]*, S. Begeer*[2]*, D. Borsboom*[1] *and H. M. Geurts*[3]*, (1)Department of Psychology, University of Amsterdam, Amsterdam, Netherlands, (2)VU University Amsterdam, Amsterdam, Netherlands, (3)University of Amsterdam, Amsterdam, Netherlands*

Background:

Up until today, we lack sophisticated understanding of the potential causal pathways that channel the heterogeneity in adult outcome of the Autism Spectrum Disorder (ASD) population. The rapidly evolving toolbox of the *network approach* to psychological phenomena enables us to investigate the interrelation between ASD and well-being in a much more detailed manner. This toolbox additionally offers promising tools to quantitatively integrate the knowledge of clinical experts.

Objectives:

In this study, we present a novel approach by combining the Perceived Causal Relation (PCR) methodology and network analysis in order to (i) identify causal pathways in the well-being system in ASD, (ii) compare the results to validate the networks found in empirical data on well-being in ASD, and (iii) quantitatively integrate the knowledge of clinical experts in scientific endeavors.

Methods:

Trained clinicians (N=29) served as raters in a PCR task of 34 variables spanning different domains of daily functioning and well-being as well as ASD symptomatology. In this task, they were asked to complete 374 cause-effect ratings. In a follow-up question, we asked them to choose three targets of intervention in the resulting (averaged) network of their answers. Analyses included centrality analysis of the resulting cause-effect model and correlational comparisons with a network model of the exact same variables based on empirical data instead of ratings.

Results:

First, he PCR network reveals the causal model ASD clinicians adhere to: *reduced social insight* is seen as the underlying cause of most other ASD symptoms, i.e., *reduced empathy*, *reduced social contact*, *violations of social conventions* and *insistence on sameness*. A strong impact on domains of well-being and daily functioning was also attributed to *insistence on sameness*. Second, from all ASD characteristics, *sensory stimulation/motor stereotypies* was the one with least connections in the network as it was only rated as a cause for *problems associated with daily life*. Third, the clinicians' choices regarding their targets of intervention (depression, drug problems and aggressive behavior) were related to the respective centrality of these nodes.

Conclusions:

We found that the way clinicians perceive cause-effect relations between ASD symptoms, well-being and daily functioning is highly similar to the interrelatedness of these factors found in empirical self-reported data. In addition, we have provided the first validation of psychological network estimation procedures that have recently been energizing different clinical fields in psychological science. We have shown that the PCR methodology combined with network analysis is a promising tool to assess and include the knowledge of clinical experts.

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126.029 Hoarding in Adults with Autism; A Preliminary Study of Prevalence, Risk Factors and Protective Factors.

J. Acland[1]*, K. L. Ashwood*[2]*, C. M. Murphy*[2]*, S. Blainey*[3]*, F. Dekastrou*[4]*, K. Mehta*[4]*, E. L. Woodhouse*[5]*, V. Stoencheva*[6]*, R. H. Wichers*[2]*, M. Pitts*[7]*, A. Galanopoulos*[7]*, A. Nolan*[6]*, I. Broch-Due*[6]*, R. McNally*[6]*, S. Maltezos*[7]*, D. Robertson*[6]*, G. M. McAlonan*[6] *and D. G. Murphy*[8]*, (1)South London & Maudsley NHS Trust, Camberwell, United Kingdom of Great Britain and Northern Ireland, (2)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Forensic and Neurodevelopmental Sciences, IOPPN, Denmark Hill, United Kingdom, (4)FANS, IOPPN, London, United Kingdom, (5)Forensic & Neurodevelopmental Sciences, Institute of Psychiatry, Psychology & Neuroscience, London, United Kingdom, (6)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (7)The Adult Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism National Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (8)Department of*

Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom

Background: Hoarding includes difficulties with discarding, saving items, and accumulating large numbers of possessions or pets that result in clutter and adversely impact on daily-life. Hoarding disorder (HD) has been listed in DSM-5 as a standalone condition in 2013, affecting 1.5%-5.8% of the general population. In addition, there is preliminary evidence that some people with ASD and ADHD may have hoarding behaviours.
Objectives: Hoarding in adults with ASD and ADHD has had little investigation. It has been suggested that cognitive and behavioural difficulties may contribute to hoarding behaviour in people with ASD (restricted interests/difficulties with routine changes) and ADHD (poor attention/disorganization), respectively. The prevalence of hoarding/hoarding-type, risks associated with developing hoarding and factors protective against developing hoarding in adults with ASD/ADHD are unknown. Research is required into factors that influence HD in individuals with an ASC to aid in targeting effective psychological interventions.

Methods: We aimed to investigate hoarding in male and female adults with ASD, risk factors such as co-morbidity with ADHD symptomology, depression and anxiety disorder symptoms and, gender distribution.

We aimed to investigate hoarding in male and female adults with ASD, risk factors such as co-morbidity with ADHD symptomology, depression and anxiety disorder symptoms and, gender distribution.

Results: 53.47% of participants had high hoarding symptomology (score 6 or more). Gender distribution was, 40.5% male and 12.5% female with HHS, 29.8% male and 17.2% female with LHS. High HADS scores for depression were found with 59.5% and for anxiety with 59.7% with HHS. HHS also correlated with inattentive symptoms (63%) and hyperactive symptoms (61%) when compared to the LHS group ($p< .001$).

Conclusions: Males were 1.3 times more likely to be in the HHS group. The HHS group also exhibited a higher association with OCD symptoms, anxiety symptoms, social anxiety symptoms and depressive symptoms when compared to the LHS. The OCI-R hoarding subscales provide limited information regarding severity and other co-morbid factors. Further investigation using hoarding specific measures and focus groups would provide accurate results with regards to the severity of hoarding.

30 **126.030** Is Young Adulthood Really so Different for Young Adults with ASD? a Study Investigating Developmental Themes.

L. Mattys[1]*, I. Noens*[2,3] *and D. Baeyens*[4]*, (1)KU Leuven, Leuven, Belgium, (2)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium, (3)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (4)Thomas More University College/Catholic University Leuven, Antwerp, Belgium*

Background:
The description of emerging adulthood as a separate developmental phase between the ages of roughly 18 to 25 is a fairly recent one (Arnett, 2007).

During this important transition to adulthood, Taylor and Selzer (2011) reported that young adults with ASD are three times more likely to have no daytime activities if they have no intellectual disability, suggesting that current clinical practices fail to accommodate to the needs of this group. Following Arnett's definition of emerging adulthood, the Inventory of Dimensions of Emerging Adulthood (IDEA; Reifman, Arnett, & Colwell, 2007) was published to quantify the relevance of six prototypical developmental themes. This tool has, to our knowledge, never been used to study young adults with ASD before. As such, there is currently no frame of reference to understand developmental themes that are relevant for young adults with ASD specifically.
Objectives:

To further our knowledge about developmental themes that are relevant for young adults with ASD, we studied how an ASD diagnosis influenced the relevance of prototypical developmental themes.

To do so, we first assessed the IDEA's construct validity in a Flemish population.

Methods:

The IDEA (Reifman, Arnett, & Colwell, 2007) was included in an online questionnaire that was filled out by 570 young adults between 17 and 27 years old (220 males and 285 females), of which 65 (50 males and 15 females) had a diagnosis of ASD. An exploratory factor analysis was performed to assess the factor structure of the IDEA in a Flemish population and determine relevant scales for further interpretation of results. Consequently, means of the two participant groups were compared for each new scale.
Results:

Following results are preliminary. An exploratory factor analysis using principal axis factoring suggested a latent structure of which five factors were selected. Five new scales were calculated based on these factors, and named Experimentation and Possibilities, Feeling in Between, Negativity and Instability, Reflection, and Commitment.

Participants with ASD scored significantly lower on items assessing their perception of having possibilities ($U = 10105$, $p < .000$) and items that indicate commitment ($U = 13509$, $p = 0.019$). Participants with ASD reported significantly higher levels of negativity and instability ($U = 12225$, $p = 0.001$). Participants, however, did not differ significantly on items assessing the extent of feeling in between adulthood and adolescence ($U = 15795$, $p = .620$), as well as items assessing reflection ($U = 14604$, $p = .143$). Further analyses will investigate the effects of group differences and how these findings relate to quality of life observations.

Conclusions:

Preliminary results suggest that young adults with ASD show similarities with their peers. However, it seems that young adults with ASD are less optimistic about the opportunities they have, experience more negativity and instability, and are less occupied with commitment to their future adult lives. These findings can inspire clinical practice by targeting interventions on developmental themes, for example by discussing possibilities and opportunities with young clients with ASD.

31 **126.031** Life Quality and Challenges in Taiwanese Young Adults with Autism Spectrum Disorders: Combined Quantitative and Qualitative Approaches

Y. L. Chien[1]*, Y. N. Chiu*[1]*, W. C. Tsai*[1] *and S. S. F. Gau*[2]*, (1)Department of Psychiatry, National Taiwan University Hospital, Taipei, Taiwan, (2)Department of Psychiatry, National Taiwan University Hospital & College of Medicine, Taipei, Taiwan*

Background:
As the incidence of autism spectrum disorder (ASD) increases in Taiwan, the difficulties in the real life that adults with ASD face become a critical issue. Many of high functioning ASD stay home unemployed, or hardly maintain a regular job to earn their living. There is a significant gap between needs and services provided in adulthood. How the young adults with ASD view their quality of life (QoL) remains unclear, not to say the determinants for their QoL. Moreover, the concerns and worries of their parents, who are usually the main caregivers of Taiwanese young adults with ASD, are rarely investigated.

Objectives:

This study aims to quantitatively examine the subjective QoL in Taiwanese young adults with ASD, and investigate the determinants for different domains of QoL. Meanwhile, a qualitative approach was taken to explore the parents' concerns as the major life challenges of these young adults.

Methods:

The study comprised 65 young adults with ASD (mean age, 26.9 years, SD, 7.3; males 53, 81.5%). We used Taiwanese version of World Health Organization Quality of Life-BREF to measure QoL. Four domains of QoL were compared with 61 typically-developing controls, including physical, psychological, social, and environment. To identify the correlates of four QoL domains, we assessed IQ, personality trait, family support, anxiety/depression, autistic symptoms, and sensory symptoms by various questionnaires, and assessed their relationships with QoL by correlation analyses and model selection. On the other hand, focus groups were held to explore the difficulties and challenges of adults with ASD from parents' view of points.

Results:

Adults with ASD reported lower QoL in four domains of QoL compared to controls. In correlation analyses, we found that IQ was not correlated with any of QoL domains, whereas, autistic symptoms, harm avoidance, and family support were significantly associated with different domains of QoL. In model selection, males was associated with lower QoL. Poor support from father and depressive symptoms were associated with several domains of QoL including physical and psychological domains. The severity of autistic symptoms was associated with the social domain. Besides, anxiety and sensory symptoms were associated with the environment domain of QoL. As for parents' focus groups, the major concerns are four aspects, including (1) independence (e.g., basic life skills, self-care, self-sufficient, self-satisfaction, etc.), (2) negative emotions (e.g., sensitive to negative feedback, undifferentiated and prolonged negative emotions, etc.), (3) repetitive/stereotyped behaviors and rituals, (4) others (e.g., sexual needs, being taken advantage of, too eager for making friends, potential legal problems, etc). For adults with higher function, interviewing for a job and maintaining the job are usually a significant challenge.

Conclusions:

Our results suggest lower QoL in Taiwanese adults with ASD and its potential correlates, providing a hope that treating co-occurred symptoms may influence their QoL. Parents' concerns point out the needs of specific resources and services to assist independence, to coach coping strategy for negative emotions, and to establish an understanding environment for them to live in a happier and meaningful way.

32 **126.032** Life Satisfaction, Anxiety and Camouflage in Adults with and without a Diagnosis of ASD

***E. Milne**, The University of Sheffield, Sheffield, United Kingdom*

Background:
A growing number of people are being diagnosed with autism spectrum disorder (ASD) in adulthood. Relatively little is currently known about quality of life in people who are diagnosed with ASD in adulthood.

Objectives:

The aim of this work was to investigate subjective life satisfaction, anxiety, and trait-masking (camouflage) in people who have received a diagnosis of ASD in adulthood, and in individuals who self-identify with the autism phenotype but who do not have a clinical diagnosis.

Methods:

Eighty-nine people took part: twenty-nine had a diagnosis of ASD and sixty participants did not. The undiagnosed group represented a wide range of individuals including some people who strongly identified with the autism phenotype. Eighteen of the sixty participants in the undiagnosed group scored above the RAADS-R cut-off for ASD (hereafter referred to as undiagnosed high-trait group). Participants completed the Ritvo Autism Asperger Diagnostic Scale (RAADS-R), the Beck Anxiety Inventory – trait version and the Satisfaction with Life Scale (Diener et al. 1985). In addition to total scores, a "camouflage" variable was calculated by creating a composite score from the three questions in the RAADS-R that probe the extent to which respondents hide their autistic traits in order to 'fit-in'. Four factor scores, reflecting social-relatedness, circumscribed interests, sensory / motor issues and social anxiety, were created based on previous factor analysis of the RAADS-R.

Results:

Participants who obtained RAADS-R scores below the cut-off for ASD had lower anxiety and higher life satisfaction than both the autistic adults and the undiagnosed high-trait group ($p<.01$). Autistic adults had increased anxiety and higher RAADS-R scores than the undiagnosed high-trait group ($p<.05$). Levels of life satisfaction did not differ between these two groups ($p>.05$). In both the autistic adults and the undiagnosed group ($N = 60$), RAADS-R scores positively correlated with anxiety, and negatively correlated with life satisfaction (all $\rho >$ +/- .402). In the undiagnosed group, all four of the RAADS-R factor scores correlated with life satisfaction, whereas in the autistic group ($N = 29$) only the social-relatedness factor correlated with life satisfaction ($\rho = -.458$). In the undiagnosed group ($N = 60$), camouflage was significantly related to both anxiety and life satisfaction ($\rho = -.292$ and .277 respectively). This was not the case in the diagnosed group (all $\rho > -.1$).

Conclusions:

Reduced life satisfaction and increased anxiety are associated with the autism phenotype. In particular, the extent to which someone feels able to socially connect may impact life satisfaction in autistic adults. Camouflage of autistic traits is associated with increased anxiety and reduced life satisfaction in undiagnosed participants, but not in those with an ASD diagnosis. Anecdotal reports from some autistic participants indicated that one of the positive consequences of receiving an ASD diagnosis included greater acceptance which reduced the pressure and expectation to camouflage symptoms. This research suggests that diagnosis of ASD in adulthood can have a positive effect on life satisfaction and that improving social-relatedness could be one way to improve life satisfaction in autistic adults.

33 **126.033** Mapping Patterns and Correlates of in-Vivo Social Interactions of Adults with and without ASD Via Ecological Momentary Assessment

A. H. Gerber[1], *S. B. Scott*[2], *M. Finsaas*[2], *J. M. Girard*[3] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY, (3)Psychology, University of Pittsburgh, Pittsburgh, PA*

Background: Research suggests that adults with Autism Spectrum Disorder (ASD) have limited social interactions, both in number and in normative patterning of such interactions (i.e., socializing when others prefer to do so); however, these data are almost exclusively provided via caregiver interview (Orsmond, Krauss, & Seltzer, 2004). Indeed, to date virtually no research has directly examined whether adults with ASD have limited social contact. Ecological momentary assessments (EMA) collected via smartphone represent a method of enhancing reporting accuracy through reducing retrospective biases. Only one study has addressed the social interactions of individuals with ASD using EMA, indicating low levels of social participation relative to other activities (Chen et al., 2017). Caregiver report indicates that age, ASD symptom severity, and functional impairment significantly predict total social interactions for adults with ASD (Orsmond et al., 2004); likewise, recent work suggests that alexithymia may be a particularly strong predictor of social-emotional deficits in ASD (Cook et al., 2013).
Objectives: We investigated patterns and predictors of social interactions in adults with ASD over one week. We hypothesized that individuals with ASD would report fewer total social interactions. Additionally, we hypothesized that alexithymia and ASD severity would negatively relate with number of social interactions, while IQ (proxy for functional impairment) would positively relate with interactions, when controlling for age.

Methods: Seventy-seven adults (26 ASD, 34%), ages 18 to 47 years (*M*=22.50 years, *SD*=5.84; 34 male, 44%) completed an EMA protocol in which they reported all social interactions via their smartphone over one week. Participants received 12 random-interval reminders each day between 9 am and 9 pm. Participants completed measures of ASD symptomatology (AQ; Baron-Cohen et al., 2001), IQ (K-BIT; Kaufman & Kaufman, 2004), and alexithymia (TAS; Parker, Taylor, & Bagby, 2003) prior to the EMA period.

Results: Results demonstrated no difference in total number of social interactions between participants with ASD (M=50.25, SD=37.96) and those without ASD (M=48.04, SD=25.80), t(27.11)=0.24, *p*= .81. Nonetheless, participants with ASD appeared to have more variation in their total interaction counts (see Figure 1). Negative binomial regression was used to examine predictors of total interaction counts. Age, gender, IQ, ASD severity, and alexithymia severity were entered into the model. Results indicated that alexithymia and age were significant predictors of the total number of interactions (both *p*s <.04; see Figure 2).

Conclusions: This is the first study to map patterns of in-vivo social interactions of adults with ASD in comparison to typically developing adults. We found no difference in the total number of social interactions between adults with and without ASD; however, high variability among individuals with ASD suggests that individual differences may best account for anecdotal reports of reduced social interaction among those with ASD. Through use of a novel measure of social activity, findings extend recent research indicating alexithymia, not ASD symptom severity, may drive social isolation for individuals with ASD (Shah et al., 2016). Given the high levels of alexithymia in ASD (Hill, Berthoz, & Frith, 2004), pre-treatment levels are an important factor when implementing social skills interventions.

34 **126.034** Needs of Postsecondary Students with Autism Spectrum Disorder: Perspectives and Recommendations from College Professionals

S. L. Jackson, *L. A. Hart, J. T. Brown and F. R. Volkmar, Child Study Center, Yale School of Medicine, New Haven, CT*

Background: The number of students with autism spectrum disorder (ASD) entering into post-secondary academics is increasing (Shattuck et al., 2012). However, despite academic proficiency, students with ASD are less likely to graduate (39%) than the general student-body (52%), and students with other disabilities (41%; Gelbar, Shefcyk, & Reichow, 2015). As completion of a college degree is significantly related to positive adult outcomes in ASD (Newman et al., 2011), a better understanding of why these students are struggling is needed. Current literature on this topic has primarily relied on student or parental perspectives to address this question, overlooking the valuable insights of the post-secondary professionals who work directly with this student population.
Objectives: The current study aims to expand our understanding of the experiences and needs of college students with ASD by examining the insights and perceptions of college/university professionals who work with these students.

Methods: The current sample consists of 15 professionals (12 Disabilities Office staff, 2 Therapists/Counselors, and 1 Health-Care Provider), from a range of post-secondary institutions (3 from 2-year/Community Colleges, 6 from Public Universities, 6 from Private Universities) across the USA. All data was collected through an anonymous online survey (Qualtrics) and data collection is on-going.

Results: All college professionals surveyed either 'somewhat' or 'strongly' agreed with the statement that there has been an increase in students with ASD at their institution over the past few years. The number of registered students with ASD ranged from 4-280 (*M*=56.4, *SD*=72.2), with an average male:female ratio of 4.6:1. Surveyed professionals reported that the majority of students with ASD utilize at least one of the school-provided support services (*M*=76.7%, *SD*=32.8), but on average they reported these services as only slightly-moderately effective. In general, surveyed professionals somewhat-strongly disagreed with the statement that students with ASD were adequately prepared for their transition to college, with navigating social settings, conflict resolution, group work, and study habits/organization being identified as the areas of greatest need. All surveyed professionals noted psychiatric comorbidities as a prevalent issue, with the most commonly reported being ADHD, SAD, Depression, and GAD. Professionals from larger schools (10,000+ students) noted significantly greater difficulty with campus/community navigation for their students with ASD (*U*=10.5, *p*<0.05). Professionals from smaller schools (less than 10,000 students) noted significantly more problems with the personal hygiene and self-care of their students with ASD (*U*=6.5, *p*<0.05), however, this is thought to be related to easier recognition of such issues in a smaller student-body. As data collection continues, additional analyses will be performed.

Conclusions: In support of findings from student/parental perspectives, professionals working with college students with ASD believe the greatest challenges faced by this population generally stem from non-academic aspects of collegiate life. Greater transition preparation before embarking into postsecondary academics, improved and broader support services for students with ASD, and more specific trainings for college staff on ASD-related issues were all recommended by the study participants as ways to improve the outcomes for this student population. Additional research on how best to implement these suggestions is still needed.

35 **126.035** Needs of Spanish University Students, As Perceived By Their Relatives

***M. E. Merino**, ULIAZPI, San Sebastian, Spain*

Background:

The number of university students diagnosed with autism is increasing. Providing these students with effective support is crucial to ensure they have opportunities to attend and succeed at university. The European project “Autism and Uni” was designed and developed to broaden knowledge on the transition to adulthood, with a specific focus on the transition to university. Although previous projects have used case studies and assessments of counseling interventions to describe students’ anxiety about higher education, the literature about the on-going needs of autistic university students remains thin.

Objectives: To identify opportunities for improvement of support services that parents of autistic university students believe would promote postsecondary success for students with autism.

Methods: A survey of 48 parents in Spain inquired about parents’ perceptions of their autistic children’s needs at university and the type of support their students received throughout higher education. Parents also offered recommendations for solutions to challenges they've seen their students experience in adulthood.

Results: Responses from parents indicate that the types of support provided to university students with autism varied widely. Fully 31% of the respondents indicated their students with ASD did not receive any support during university study. However, 27% had a specific teaching assistant inside the college, 27% received adjustments to exams, 25% had a tutor outside of the university, and 8% had a support group or adaptations in coursework.

Moreover, 78% of the responding parents reported that meeting with the institution’s disabilities support team before starting at university was important to help the ASD student successfully transition to university. Campus visits were important for 73% of respondents, while 60% felt they needed information about getting assistance with lectures prior to the start date. Only about half (53%) of the parents, however, considered it important to raise awareness amongst other students about autism.

Overall, 75% of parents of university students with autism felt “quite” or “very” confident in the academic ability of their children, though 48% of the parents would have preferred that their children had stayed at home instead of moving to another city to study.

Conclusions:

Although most families felt confident about their child’s academic achievement, many parents worried about their child’s ability to live independently and integrate with peers at university. Other concerns related to helping their students set up their schedules and cope with unexpected changes that inevitably happen at university. To mitigate those concerns, families considered it particularly important to meet with the institution’s disabilities support team before students start at university. In particular, parents would have liked the universities to have an awareness of the common challenges linked to ASD, provide assistance with homework, and offer support for group projects. Results from this study, therefore, offer important guidance to both the families of college students with autism and the leaders of the postsecondary institutions they attend.

36 **126.036** Parent Characteristics As Predictors of Social Skills Outcomes Among Young Adults with ASD Following the UCLA PEERS® Intervention

***N. E. Rosen**[1], R. Ellingsen[2], M. Jolliffe[1] and E. A. Laugeson[1], (1)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA, (2)Psychiatry, University of California Los Angeles, Los Angeles, CA*

Background: The effectiveness of parent and caregiver assistance in social skills treatment programs has been established in studies with those with ASD from childhood (Frankel et al. 2010) through adulthood (Laugeson et al. 2015; Van Hecke et al. 2015). The durability of treatment gains following these parent- and caregiver-assisted programs has also been established months to years following intervention in studies with children (Mandelberg et al. 2014), adolescents (Laugeson et al. 2012; Mandelberg et al. 2014), and young adults with ASD (Laugeson et al. 2015). While research suggests that caregiver-assisted programs provide robust treatment outcomes for youth with ASD, the influence of parent characteristics on treatment outcomes has yet to be examined extensively across age groups. Although there is limited research investigating parent characteristics impacting treatment outcome for children and adolescents (Chang et al. 2014), the impact of these characteristics for young adults requires further examination.

Objectives: The present study examines parent characteristics including education level, ethnicity, and marital status as predictors of social skills outcomes among young adults with ASD following a 16-week caregiver-assisted social skills intervention.

Methods: Participants included 59 young adults (78% male; *M*=21.39, *SD*=2.59) and their caregivers. All young adult participants had clinically-elevated ASD symptoms, as determined by a total score ≥ 60 on the Social Responsiveness Scale-Second Edition (SRS-2; Constantino 2012) at baseline. Participants attended the UCLA Program for the Education and Enrichment of Relational Skills (PEERS®), a 16-week empirically-supported caregiver-assisted group social skills intervention for young adults with ASD. Baseline caregiver characteristics were assessed using demographic questionnaires prior to start of the program. Treatment outcome was assessed pre- and post-intervention using caregiver-reported change in frequency of social engagement on the Quality of Socialization Questionnaire (QSQ; Laugeson & Frankel 2010), social responsiveness on the SRS-2, and social and behavioral functioning on the Social Skills Rating System (SSRS; Gresham & Elliott 1990).

Results: Paired samples t-tests revealed that caregiver ethnicity and education level were not significantly related to change in frequency of social engagement on the QSQ, social responsiveness on the SRS-2, or social and behavioral functioning on the SSRS. Paired samples t-tests also revealed that caregiver marital status was not significantly related to change in frequency of social engagement or social and behavioral functioning. However, marital status was related to change in social responsiveness at trend-level significance ($t=1.835$; $p<.05$), such that caregivers with no marital partner reported greater improvement in young adult social responsiveness pre- to post-intervention.

Conclusions: Findings reveal that parent ethnicity, education level, and marital status are not predictive of improvement in social engagement, social responsiveness, or social and behavioral functioning among young adults with ASD following the PEERS® intervention. However, at trend-level significance, marital status was related to change in social responsiveness, such that caregivers with no marital partner reported greater improvement in young adult social responsiveness. These findings are useful in determining who is most likely to benefit from caregiver-assisted social skills interventions and the caregiver characteristics potentially impacting treatment outcomes.

37 **126.037** Peer Responses to Autism-Related Behaviors in a Postsecondary Classes: An Experimental Examination

***B. E. Cox**, Educational Leadership and Policy Studies, Florida State University, Tallahassee, FL; College Autism Network, Tallahassee, FL*

Background:

Fewer than 39% of postsecondary students with autism in the United States earn any form of postsecondary credential within 6 years of starting higher education (Newman et al., 2011). These students often struggle with classroom behaviors that negatively affect their course performance, particularly if classes include group assignments (Cai & Richdale, 2015; Freedman, 2010; Gobbo & Shmulsky, 2014). Moreover, because students with autism are strongly affected by their peers' acceptance of them academically and socially (Causton-Theoharis, & Malmgren, 2005), the challenges of working on group assignments are likely magnified when peers hold negative attitudes toward the students with autism. Although initial evidence (e.g., Butler & Gillis, 2011; Nevill & White, 2011) suggests college students are generally accepting of other students with autism, such openness appears to be conditional on the scenario in which the autism-related behaviors occurred and whether a study's respondents realized they were answering questions about a student with autism.

Objectives:

This study examined college students' attitudes towards other students who display autism-related behaviors in one of their classes and assesses how open college students are to working with their autistic peers. In doing so, the current study overcame several limitations in the related literature by employing an experimental design to assess the attitudes of a large sample (n=1,499) of diverse college students who reviewed randomly assigned vignettes that varied in two distinct ways.

Methods:

This study employed an experimental design in which participants were randomly assigned to view 2 vignettes that varied across two conditions: academic setting and respondent priming for ASD. The "Quiet_Neighbor" vignette presented a student displaying autism-related characteristics in a classroom setting, while the "Group_Gamer" vignette was situated in an out-of-class meeting about a group assignment. Version "A" of each vignette made no mention of ASD, whereas Version "B" insinuated the student might be on the autism spectrum. Vignette presentation order was randomly assigned.

Respondents' attitudes toward the students depicted in the vignettes were assessed using Likert-scale items adapted from Nevill & White (2011) and White et al. (2016) (e.g., "I would not mind this student in my classroom") via a series of ANOVAs.

Results:

Across all six questions measuring attitudes toward their autistic peers, a comparison of marginal means indicates the presence of main effects for both the vignettes and the priming conditions. Participants consistently responded more positively to a student displaying autism-related characteristics in the Quiet_Neighbor scenario than in the Group_Gamer scenario. Moreover, participants who were primed to think the behaviors on display in the vignettes were related to autism reported positive attitudes toward the students displaying those behaviors.

Conclusions:

Classroom peers are more accepting of and friendly toward college students with autism when they 1) don't have to interact with the autistic student directly, or 2) can attribute some autism-related behaviors to a diagnosis. Thus, students with autism may benefit from disclosure to peers *if* their autism-related behaviors are likely noticeable to other students, particularly if they have to work with peers on group assignments.

38 **126.038** Predictors of the Agreement between Diagnostic Instruments and Clinical Diagnosis of ASD in Adults without Intellectual Disability

***L. Fusar-Poli**[1,2], N. Brondino[2], M. Rocchetti[2], U. Provenzani[2], S. Damiani[2] and P. Politi[2], (1)Department of Clinical and Experimental Medicine, Psychiatric Unit, University of Catania, Catania, Italy, (2)Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy*

Background: Diagnosing autism spectrum disorders (ASD) in adulthood often represents a challenge. Clinical diagnosis should be supported by the use of standardized tools, such as the Autism Diagnostic Observation Schedule (ADOS) or the Autism Diagnostic Interview (ADI).

Objectives: To evaluate potential predictors of the agreement between diagnostic instruments (ADOS-2 and ADI-R) and clinical diagnosis in a population of adults who were formally diagnosed with ASD for the first time.

Methods: After an extensive clinical evaluation, 95 adults with an IQ ≥ 70 were diagnosed with ASD according to DSM-5 criteria. ADOS-2 was separately administered to all participants and 81 caregivers underwent ADI-R interview. Binary logistic regressions were conducted to find potential predictors of the agreement (gender, age, IQ, severity levels of criteria A and B of DSM-5).

Results: Female gender was a negative predictor of the agreement between ADOS-2 and clinical diagnosis ($B = -1.59$, $OR = 0.204$, $p = 0.03$). IQ seemed to negatively predict the agreement between ADI-R and DSM-5 ($B = -0.03$, $OR = 0.968$, $p = 0.04$), while people with higher severity levels at criterion B better agreed with clinical diagnosis ($B = 1.20$, $OR = 3.326$, $p = 0.03$).

Conclusions: Clinicians' training and experience remains of primary importance while assessing adults who could potentially belong to the autism spectrum. Women and individuals with higher IQ, in fact, seem to have more camouflaging strategies and less pronounced symptoms. In these subsamples, it is more difficult to correctly identify ASD only by means of standardized instruments.

39 **126.039** Psychological Predictors of Alcohol Use and Misuse in Adults with Autism Spectrum Conditions

***M. Bowri**[1], L. Hull[2], M. C. Lai[3,4,5,6], S. Baron-Cohen[4], C. Allison[4], P. Smith[7] and W. Mandy[2], (1)University College London, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan, (4)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (5)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (6)Centre for Addiction and Mental Health, Toronto, ON, Canada, (7)University of Cambridge, Cambridge, United Kingdom*

Background: Alcohol misuse is associated with a variety of adverse physical, psychological and social consequences. The limited existing research on substance use (including alcohol use) in adults with autism spectrum conditions (ASC) has yielded mixed findings, with some studies concluding that autism is a protective factor against substance use and others suggesting that autism may increase an individual's risk for

substance misuse. Qualitative and anecdotal evidence suggests that demographic factors, co-morbid mental health difficulties and autistic traits may contribute to alcohol use in this population.
Objectives: This study sought to quantitatively investigate psychological predictors of alcohol use and misuse in a sample of adults with ASC using a web-based cross-sectional survey.

Methods: Participants were 237 adults with ASC who were recruited via social media, internet forums and clinical databases. An online survey was used to obtain data on demographic information, autistic traits, depression, anxiety, social anxiety, mental wellbeing and alcohol use. All relevant constructs were measured using gold-standard, well-validated self-report measures. The sample was divided into three groups (non-drinkers, non-hazardous drinkers and hazardous drinkers) and multinomial logistic regression models were used to explore associations between alcohol use and independent variables.

Results: Thirty percent of participants were classified as non-drinkers, 54.8% as non-hazardous drinkers and 15.2% as hazardous drinkers. Using comparative data from the general population, the proportions of non-drinkers and hazardous drinkers among autistic adults were higher than those for neurotypical adults (20.9% and 14% respectively; $X^2(1)=69.15$, $p<.001$). Compared to autistic non-hazardous drinkers, autistic non-drinkers were more likely to be female (OR: 2.57; 95% CI: 1.32-5.00) and had higher levels of autistic traits (OR: 1.02; 95% CI: 1.00-1.04), depression (OR: 1.05; 95% CI: 1.00-1.09), anxiety (OR: 1.06; 95% CI: 1.01-1.12) and social anxiety (OR: 1.01; 95% CI: 1.00-1.02). Compared to autistic non-hazardous drinkers, autistic hazardous drinkers also had higher levels of autistic traits (OR: 1.02; 95% CI: 1.00-1.04), depression (OR: 1.09; 95% CI: 1.04-1.16), anxiety (OR: 1.10; 95% CI: 1.03-1.17) and social anxiety (OR: 1.02, 95% CI: 1.00-1.03) and lower levels of mental wellbeing (OR: 0.95; 95% CI: 0.91-0.99). These results demonstrate a U-shaped pattern among autistic adults, with both non-drinkers and hazardous drinkers scoring higher than non-hazardous drinkers on levels of autistic traits, depression, anxiety and social anxiety.

Conclusions: Non-hazardous use of alcohol is associated with fewer autistic traits and positive mental health outcomes in adults with ASC, while abstinence and hazardous alcohol consumption are associated with more autistic traits and higher levels of depression, anxiety and social anxiety. Alcohol use in adults with ASC is multifaceted and complex and this group should not be considered a homogenous population. Screening for alcohol use should form part of routine healthcare assessments for ASC given that a significant proportion of these individuals may be misusing alcohol. An individualised approach should be taken to explore the unique contribution of factors involved in alcohol use for those identified to be at-risk, paving the way for tailored treatment and support.

40 **126.040** Putting People on the Spectrum in the Driver's Seat of Their Own Lives: The Clinical Utility of a Goal-Setting Tool That Enables Genuine Self-Determination

*V. Tomkins[1] and **J. Ashburner**[2], (1)Research and Business Development, Autism Queensland, Sunnybank, Australia, (2)Autism Queensland, The University of Queensland, Sunnybank, Australia*

Background: Adolescent and adults on the spectrum often encounter barriers to genuine participation in person-centred planning, including difficulties communicating their aspirations due to social and communication challenges, and low expectations of self-determined behaviour on the part of professional staff and family members. With the aim of overcoming these barriers, we developed a picture-based card-sort goal-setting tool for people on the spectrum. A card-sorting process is inherently suitable for people on the spectrum, as it accommodates their preferences for information presented in a concrete pictorial format with minimal written text.
Objectives: The aim of this project was to (a) develop the *Adolescent/Adult Goal Setting Tool* (AAGST) using participatory action research, and (b) examine the clinical utility of using this tool to enable people on the spectrum to prioritise their goals.

Methods: Three cycles of action research were used to refine the goal items and the pictures and words on the cards. The cards were adjusted in response to feedback provided by over 100 adolescents and adults on the spectrum, and family members through a purpose-designed survey. The adaptive function of the participants on the spectrum was assessed using The *Adaptive Behaviour Assessment System, Third Edition* to ensure that the sample included participants on the spectrum with a wide range of abilities. A generic qualitative methodology was then used to explore the experiences of people on the spectrum, their families, and professional staff when they used the tool to set their goals. Participants on the spectrum were assessed using The *Kaufman Brief Intelligence Test, Second Edition* to examine the applicability of the AAGST to a range of individuals across the spectrum. The level of support required to support people with an intellectual disability to participate in the card-sort process was documented. Information on the benefits of using the AAGST and areas for potential improvement was gathered using semi-structured interviews of persons on the spectrum and family members, and a focus group for professional staff. The qualitative data was analysed using content analysis by two coders working independently.

Results: Seventy-two cards with pictures and minimal text were generated and refined through input from people on the spectrum, family members and professional staff. They are grouped into the following categories: (a) social relationships, (b) self-care/home living, (c) study/training, (d) work/employment, (e) health/fitness, (f) community participation, (g) communication, (h) managing finances, and (i) emotional wellbeing**.** The user sorts the cards into three piles including "*Yes – now*", "*Maybe"* and "*No – not now*", and then further prioritises goals within the "*Yes – now*" pile. People on the spectrum, their families and professional staff reported that card-sorting simplified the goal setting process. Participants on the spectrum reported feeling empowered and having greater ownership of the outcomes.

Conclusions: The AAGST has excellent clinical utility and is highly valued by people on the spectrum, their families and professional staff. As it enables people on the spectrum to prioritise goals that are meaningful and relevant to their lives, the AAGST enhances feelings of autonomy and engagement.

41 **126.041** Rates of Autism in a Population of Homeless Adults

*M. Ryder[1], A. Churchard[1] and **W. Mandy**[2], (1)UCL, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland*

Background:
It is well documented that people with autism spectrum condition (ASC, also known as 'autism spectrum disorder') are at high risk of having a number of problems adapting to adult life, such that they experience high rates of unemployment, social isolation and difficulties living independently. In the general population, these types of problem are risk factors for becoming homeless. This raises the question of whether

autistic adults experience elevated levels of homelessness. To date there has been no peer-reviewed research into whether or not ASC is associated with an increased risk of homelessness.

Objectives:

This study aimed to investigate systematically the rates of ASC in a long-term homeless population; and to increase understanding of the characteristics and needs of autistic homeless people.

Methods:

The entire caseload of a UK homeless outreach team was screened (n = 106). A new assessment tool, the 'DSM-5 Autistic Traits in Homeless Individuals' (DATHI) interview, was developed specifically for this study. This used reports from keyworkers to identify diagnostic features of ASC in their clients. The inter-rater reliability and criterion validity of the DATHI were evaluated.

Results:

The DATHI showed adequate inter-rater reliability (Kappa=.69). Criterion validity, assessed via agreement with the Autism Spectrum Disorder Adult Screening Questionnaire, was strong (r=.81, p=.01). The DATHI identified 13 individuals who showed strong evidence of meeting diagnostic criteria for ASC, which as a proportion of the overall sample was 12.3%, 95% CI [7.0%, 20.4%]. Compared to non-autistic homeless people, those with autistic difficulties showed higher odds of becoming homeless due to being unable to live independently (OR: 3.48, 95% CI [1.03,11.79]). Once homeless, they showed increased odds of consistently declining offers of statutory accommodation (OR: 2.79, 95% CI [1.04,7.48]) and of being socially isolated (OR = 4.62, 95% CI [3.66, 33.35]). Based on keyworker report, those with elevated autistic traits showed reduced odds of currently using drugs or alcohol (OR = 2.92, 95% CI [1.07, 7.98]).

Conclusions:

This study has provided initial evidence that rates of ASC are raised among homeless people, suggesting that ASC is a major risk factor for homelessness. Further, participants with autistic symptoms appeared to be a distinct subpopulation, with autism-specific pathways into homelessness and characteristics whilst homeless. As such they are likely to require tailored support, to reflect their autistic strengths and difficulties. More work is needed to understand the mechanisms whereby ASC confers risk for becoming homelessness, in order to inform the development of preventative strategies.

42 **126.042** Relationship between Co-Occurring Psychiatric Conditions and Adaptive and Cognitive Ability

K. J. Feldman[1]*, A. J. Fischer*[1]*, J. Davis*[2]*, H. Coon*[3] *and D. A. Bilder*[3]*, (1)University of Utah, Salt Lake City, UT, (2)Educational Psychology, University of Utah, Salt Lake City, UT, (3)Psychiatry, University of Utah, Salt Lake City, UT*

Background:

Adults with ASD commonly experience co-occurring psychiatric conditions, low adaptive abilities, and varying levels of cognitive functioning. Limited research reports mixed findings on the relationship between adaptive abilities and psychiatric conditions in adults with ASD. Anxiety and depression are common among adults with ASD and may impact functional outcomes such as employment and independence. Understanding the relationship between adaptive ability and psychiatric comorbidity may shed light onto why adults with ASD experience suboptimal life outcomes in relation to their cognitive functioning.

Objectives:

To explore the relationship between level of adaptive and cognitive ability and the presence of depression and anxiety in adults with ASD.

Methods:

Participants for this study (*N* = 304, aged 18-64, *M* = 32.20, *SD* = 10.47, 88.2% male) were identified from a larger sample of adults with ASD who were ascertained in childhood or during transition into adulthood. Inclusion in the analysis required the presence of (1) assessments for adaptive behavior and intellectual ability and (2) record of psychiatric conditions. Co-morbid anxiety/depression were determined through the presence of either corresponding electronic medical record diagnostic code data and/or an in-person Mini PAS-ADD assessment of psychiatric co-morbidity. The Vineland Adaptive Behavior Scales (Survey, First and Second Edition) were used to assess adaptive behavior. An individual's intellectual ability was identified using the most complete assessment of cognitive ability available in research records. The following categories of adaptive and intellectual ability were used: normal ≥ 70, mild = 50-69, and severe < 50. Logistic regression was used to predict anxiety and depression case status based on adaptive functioning/intellectual ability category with the normal category used as the reference variable.

Results:

Tables 1 and 2 report logistic regression results. Depression was less common among participants with severe and mild intellectual abilities (*b* = -1.47, *p* = 0.008; *b* = -1.09, *p* = 0.003) and severe impairment in daily living skills of adaptive ability (*b* = -1.11, *p* = 0.002). Anxiety had no association with severe and mild intellectual ability (*b* = 0.11, *p* = .82; *b* = .30, *p* = 0.39) but is predicted by adaptive functioning in the composite score, communication and social scales predicted anxiety (*b* = 0.83, *p* = 0.023; *b* = 0.70, *p* = 0.050; *b* = 0.90, *p* = 0.012).

Conclusions:

Depression was less commonly identified among individuals with severely limited daily living adaptive skills and mild to severe ID. This may reflect the challenge in identifying internalizing depressive symptoms in individuals with intellectual and adaptive impairment, necessitating exploration into the manner in which individuals with these impairments manifest their experience of depression. Limited composite adaptive and social abilities, predicted anxiety, though the cause and effect aspect of this relationship is unknown. Anxiety may be caused by increased challenges in daily functioning, or anxiety may interfere with learning adaptive skills when anxiety-provoking experiences are avoided. Alternatively, both may share a common underlying etiology. More research is warranted to clarify the nature of this association.

43 **126.043** Self-Determination in Young Adults with Autism Spectrum Disorder

K. White[1] *and T. D. Flanagan*[2]*, (1)National University of Ireland, Galway, Galway, Ireland, (2)Department of Educational and Counselling Psychology, McGill University, Montreal, QC, Canada*

Background: Autism Spectrum Disorder (ASD) is a lifespan diagnosis impacting opportunities into adulthood. Self-determination (SD), which refers to the “volitional actions that enable one to act as the primary causal agent in one’s life and to maintain or improve one’s quality of life” (Wehmeyer, 2005, p. 177), has been associated with positive adult outcomes such as education, employment, and quality of life. However, information about SD for young adults with ASD (without intellectual disability (ID)), including the factors that may impact and promote its development into adulthood, is scarce.
Objectives: The aim of this study is to investigate the possible factors and predictors that explain the levels of SD of young Canadian adults with ASD (without ID) using an online survey. Self-reported facilitators and barriers to developing SD will also be reported.

Methods: Participants were 125 young Canadian adults with ASD without ID. Female (*M* = 23.81, *SD* = 3.85), male (*M* = 22.62, *SD* = 3.39), and transgender (*M* = 22.33 *SD* = 2.57) participants all ranged in age from 18 to 30 years (*M* = 23.15, *SD* = 3.65). All participants were retained in the sample if their *AQ* total score was at or above 26 (*M* = 33.46, *SD* = 5.82, *range* = 26 - 46). Participants were recruited widely across Canada via flyers and letters of invitations. The comprehensive online survey included descriptives and brief indicators of ASD and SD, including the *Autism-Spectrum Quotient – Adult Version* (AQ; Baron-Cohen et al., 2006) and *Arc’s Self-Determination Scale* (*SDS*; Wehmeyer & Kelchner, 1995).

Results: The reported SD levels differed in relation to age and education. Using a median split (median age = 23) to designate older and younger age categories, an independent samples *t*-test showed that older (*M* = 87.63, *SD* = 18.80) young adults reported higher levels of SD, based on the *SDS*, than younger (*M* = 78.38, *SD* = 19.04) adults, *t* (123) = -2.73, p = .007. In regards to education, *SDS* total score increased from junior high (*M* = 71.00, *SD* = 1.41) to partial college (*M* = 81.95, *SD* = 19.93), and college/university (*M*= 90.15, *SD* = 18.08), *Welch’s F* (5, 27.530) = 10.10, *p* < .001. However, level of SD did not significantly differ in relation to gender, living situation, or employment status. Further, a hierarchical multiple regression analysis indicated that a person’s age (β = .20, *t* (118) = 2.63, p = .01), capacity (β = .51 *t* (118) = .61, p <.01), and level of SD importance (β = .15, *t* (118) = 1.98, p = .05) significantly predicted level of SD, explaining 50.1% of the variance. Finally, SD skills, mental health, societal perceptions about disability, support networks, opportunities, and early educational and life experiences were reported common facilitators and barriers to developing SD.

Conclusions: The knowledge gained from this study will allow researchers and practitioners a better window into the factors and predictors of SD, and will highlight invaluable information concerning effective and individualized support services.

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126.044 Self-Reported Sex Differences in High-Functioning Adults with Autism: A Meta-Analysis

***R. Moseley**, R. A. Hitchiner and J. A. Kirkby, Bournemouth University, Poole, United Kingdom*

Background: Sex differences in autistic symptomatology are believed to contribute to the mis- and missed diagnosis of many girls and women with an autism spectrum condition (ASC). Whilst recent years have seen the emergence of clinical and empirical reports delineating the profile of young autistic girls, recognition of sex differences in adulthood is far more limited. We chose to investigate these as they emerge in self-report screening instrument, the Ritvo Autism Asperger Diagnostic Scale-Revised (RAADS-R), which is recommended by the National Institute for Health and Care Excellence (NICE, 2016) for the identification of autistic adults in Great Britain.
Objectives: To compare autistic symptomatology, in autistic men and women, on RAADS-R domains of Social Relatedness, Circumscribed Interests, Sensory Motor (henceforth Sensorimotor), and Language symptoms.

Methods: The analysis employed a two-factorial design: by comparing autistic men and women to each other as well as to typically-developing (TD)men and women, it was possible to tease out normative sex differences in cognition which might or might not be present in autism. To supplement data gathered by our research group, we conducted a meta-analysis of studies which had used the RAADS-R, and obtained a total 961 datasets. Eventually, datasets from 137 TD men and 136 TD women (age-matched to autistic groups), 118 autistic men and 136 autistic women (age-matched to each other) were analysed. Analysis of variance (ANOVA) searched for the presence of main effects of Sex and Diagnosis and for interactions between these factors.

Results: In social relatedness and circumscribed interests, main effects of Diagnosis revealed that as expected, autistic adults reported significantly greater lifetime prevalence of symptoms in these domains; an effect of Sex, in circumscribed interests, also suggested that males generally reported more prevalent symptoms than females. An interaction of Sex and Diagnosis in language symptomatology revealed that a normative sex difference in language difficulties was attenuated in autism. An interaction of Sex and Diagnosis in the sensorimotor domain revealed the opposite picture: a lack of sex differences between typically-developing men and women and a greater prevalence of sensorimotor symptoms in autistic women than autistic men.

Conclusions: Not all childhood sex differences, such as the male overrepresentation in repetitive behaviours and interests and the female advantage in social skills, were reflected in adult self-reports. Where childhood sex differences failed to emerge in RAADS-R scores, several interpretations exist; it may be that sex differences are attenuated with age, but an inherent sampling bias may mean that only autistic women most similar to the male presentation are diagnosed and thus included in studies such as ours. The finding that sensorimotor symptomatology is more highly reported by autistic women is a finding requiring objective confirmation, given its potential importance in diagnosis.

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126.045 Sex Similarities and Differences in Autism Presentation in Adulthood

***E. Jarzabek**[1], B. Lewis[1], K. S. Ellison[1], J. Wolf[1], M. J. Rolison[1], T. Winkelman[1], T. C. Day[1], K. A. McNaughton[1], J. Foss-Feig[2] and J. McPartland[1], (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY*

Background: Previous research regarding the clinical autism phenotype across males and females reveals mixed findings. For instance, some studies indicate that females with ASD display more severe social and communication difficulties but fewer restricted and repetitive behaviors than males with ASD. Furthermore, research to date has focused on examining gender differences within the ASD group only. This is problematic given that many aspects of social functioning in typically-developing (TD) individuals are known to vary as a function of sex. Lastly, there is limited research examining self-perception and sex differences in adults with ASD.
Objectives: Examination of sex-differential cognitive and behavioral presentations of adults with ASD.

Methods: Collected as part of a larger study, the sample consists of 46 adults with ASD (34 males; Mean age=24.2) and 49 TD adults (31 males; Mean age=25.8). To examine cognitive profiles the *Wechsler Abbreviated Scale of Intelligence, 2nd Edition (WASI-II)* was used. Subjective perception of social functioning was assessed using the *Social Responsiveness Scale, Second Edition (SRS-2)–Adult Self-Report* and the *Autism Quotient Form (AQ).* Clinician-rated levels of social functioning were measured using the *ADOS-2, Module 4*.

Results:

Individuals with ASD demonstrated significantly lower verbal reasoning abilities (*WASI-II, Similarities*) and overall verbal skills (*WASI-II, VCI*) than the TD group [*F*(1,87)=3.74, *p*=.056; *F*(1,87)=4.22, *p*=.043, respectively]. There were no significant sex differences in cognitive profiles within or across diagnostic groups.

The *AQ* total scores were significantly higher in the ASD group compared to TD group [*F*(1,90)=57.89, *p*<.001]. Furthermore, there was a significant interaction between sex and diagnosis [*F*(1,90)=6.17, *p*=.015], reflecting that sex differences were larger in the ASD group. A subsequent *T*-test showed that ASD females self-reported more autism-related traits than ASD males [*t*(44)=2.16, *p*=.036; Female (*M*=29.1, *SD*=8.1) and Male (*M*=23.5, *SD*=7.5)]. Likewise, the *SRS-2* Total *T*-score and all subscale *T*-scores were significantly higher in the ASD group compared to TD group. Again, sex differences were significantly different by diagnostic group. In the ASD group, females reported significantly more deficits in *Social Cognition* [*t*(41)=2.57, *p*=.014], *Social Communication* [*t*(43)=2.55, *p*=.014], *Social Motivation* [*t*(43)=2.68, *p*=.011], and *Restricted Interests and Repetitive Behaviors* [*t*(43)=2.94, *p*=.005]. In the TD group, an opposite pattern was found with males reporting significantly more deficits than females with regard to *Social Awareness* [*t*(45)=-4.35, *p*<.001] and *Social Communication* [*t*(45)=-2.18, *p*=.034].

The *ADOS-2* subdomains total scores (i.e., Communication, Social Interaction, and Stereotyped Behaviors and Restricted Interests) were all significantly higher for the ASD group compared to the TD group. Significant sex differences were found in the ASD group, but not the TD group. Specifically, ASD males scored significantly higher than ASD females in the *Communication* domain [*t*(43)=-3.31, *p*=.001]. There were no significant sex differences in *Social Interaction* or *Stereotyped Behaviors and Restricted Interests Total* scores.

Conclusions: While women and men with ASD show many similarities, there also appear to be distinct differences in their clinical presentations. Notably, females with ASD self-reported higher levels of social-communicative difficulties, despite receiving lower clinical ratings of communicative impairment. Self-perception of individuals with ASD offers important insight and directions for further investigations.

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126.046 Sex-Specific Variations in Perceived Facial Masculinity/Femininity across Levels of Autistic-like Traits

D. W. Tan[1]*, M. T. Maybery*[1]*, M. Evans*[2]*, R. Di Lorenzo*[3] *and A. J. Whitehouse*[4]*, (1)School of Psychological Science, University of Western Australia, Perth, Australia, (2)University of Western Australia, Perth, Australia, (3)Utrecht University, Utrecht, Netherlands, (4)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia*

Background: Autism spectrum disorder (ASD) is two to four times more prevalent in males than in females. From a biological perspective, one hypothesis suggests that the male preponderance in ASD may be influenced by the exposure to elevated concentrations of testosterone *in utero*. A parallel stream of research found that heightened levels of prenatal testosterone derived from umbilical cord blood is related to facial morphology. During foetal development, the brain and the face evolve from the neural crest in synchrony. This has led to the speculation that facial morphology may hold crucial information to further our understanding of aberrant neurodevelopment. In our recent work, we reported hypermasculinised facial features among prepubescent boys and girls with ASD compared to children without ASD.

Objectives: The current study examined whether facial masculinisation extends to neurotypical adults with varying degrees of autistic-like traits.

Methods: A total of 1,995 undergraduate students completed the autism-spectrum quotient (AQ). Students aged between 18 and 25 years, and with an AQ score that fell in the bottom, middle and top 15% of the distribution were invited to participate further in this study. Seventy-two Caucasian men and 81 Caucasian women completed the study in which their facial photographs were obtained. Then, on a 100-point scale anchored by 'not at all masculine/feminine' and 'extremely masculine/feminine', the male faces were rated for masculinity and the female faces for femininity by a separate group of naive raters (n = 41; 23 females).

Results: For men, analyses revealed a significant U-shape relationship between facial masculinity ratings and levels of autistic-like traits. Specifically, men with mid-range level of autistic-like traits received lower masculinity ratings than did their counterparts with either low or high trait levels (see attached Figure). For women, a negative linear relationship was observed between facial femininity ratings and the degrees of autistic-like traits, that is, facial femininity ratings decreased across groups of women with low, mid and high levels of autistic-like traits respectively.

Conclusions: It appears that the relationship between perceived facial masculinity/femininity and autistic-like traits is sex-specific whereby a negative linear relationship is observed between facial femininity and levels of autistic-like traits in women whereas a U-shaped trend is found between facial masculinity and autistic-like traits in men. Findings in the present sample of post-pubertal women are consistent with masculinised facial features observed in prepubescent girls with ASD. However, the current outcomes for men are inconsistent with our previous findings. Taken together, these results suggest the facial structures associated with autistic traits may be stable across development for females but non-linear for males.

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126.047 Sexual Risk Profiles for Male and Female Adults on the Autism Spectrum

L. Graham Holmes[1]*, A. R. Nilssen*[2]*, D. S. Strassberg*[2] *and M. Himle*[3]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Psychology, University of Utah, Salt Lake Cty, UT, (3)University of Utah, Salt Lake City, UT*

Background:
Many adults with ASD are interested and engage in sex and relationships. However, research suggests they have lower sexual knowledge than neurotypical adults and learn about sex from questionable sources. For adults with ASD, lower sexual knowledge has been linked to higher probability of past sexual victimization, and with higher incidence of engaging in inappropriate courtship and/or sexual behavior. Beyond this, little is known about the sexual risk profiles of adults with ASD, including potential gender differences, complicating the provision of effective sex education and healthcare.

Objectives:

1. Examine gender differences in sexual orientation, prevalence of sexual activity, and relationships.
2. Investigate risks, including (a) sexual behavior and provision of sexual healthcare (e.g., STI testing), (b) technology-mediated sexual

behaviors (e.g., sexting, online dating, viewing sexually explicit material or SEM), and (c) sexual victimization.

Methods:

Adults with formal ASD diagnoses (*N*=216, *M* age=22.5, *SD*=3.17), recruited from a national database, completed an anonymous online survey about sexuality, relationships, health, and the Autism Spectrum Quotient (AQ). 32% of the participants identified as female (*n*=70), 5.5% as transgender (*n*=12), and 62.6% as male (*n*=137, 62.6%). Analyses included Pearson Chi Squares and logistic or linear regression models.

Results:

1. As expected, women were more likely than men to identify as LGB (30% vs. 11%) or asexual (20% vs. 11%, *p*=.001). Controlling for age and AQ score, women were 2.5 times more likely to report current relationship of >3 months duration (40% vs. 14% of men, *p*<.001) and rated romantic relationships as a more important priority (*p*<.01). Women were also more likely to report history of intercourse (53% vs. 25%, *p*<.001).
2. Sexual health: Among participants with history of partnered sexual behavior (*n*=94, 44%), few reported STI diagnosis (3%), yet only 52% had been tested due to anxiety ("too scared") or simple lack of knowledge. Only 41% reported using a condom at last intercourse for reasons including embarrassment and committed relationships. Technology-related risks: Participants engaged in normative technology-mediated behaviors, including sexting photos (25% vs. ~50% in neurotypical samples) and online dating (35%). While common, these carry risks easily addressed through education (e.g., 42% of participants who sexted did so as minors). While 92% of online daters reported positive experiences, some (*n*=9) experienced sexual coercion or assault. Similar to neurotypical samples, most participants (76%) had used SEM. Most reported no problems associated with SEM, but 13% of users reported SEM caused misunderstandings about sex and 26% found it difficult to stop using SEM. Sexual victimization: 8% of participants had first sexual contact ≤ age 14, and 16% reported unwanted first sexual contact (no gender difference; *p*=.07).

Conclusions:

Young adults with ASD are less likely to report history of partnered sexual behavior compared to neurotypical adults, yet are affected by various sexual health risks. These findings demonstrate the importance of healthcare providers, schools, and parents collaborating to provide evidence-based sex and relationship education that targets these specific risks and accessible healthcare. Finally, these gender differences suggest that sex research with male-only samples may not generalize to women.

48 **126.048** Symptom Profile and Mental Health Conditions in Older Adults with Autism Spectrum Disorder (ASD)

K. L. Ashwood[1,2], *E. L. Woodhouse*[1,3], *V. Stoencheva*[1], *R. H. Wichers*[1], *A. Galanopoulos*[4], *A. Nolan*[2], *I. Broch-Due*[2], *R. McNally*[2], *S. Maltezos*[4], *D. G. Murphy*[5], *D. Robertson*[2], *G. M. McAlonan*[2,6] *and C. M. Murphy*[1,2], *(1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (3)Forensic & Neurodevelopmental Sciences, Institute of Psychiatry, Psychology & Neuroscience, London, United Kingdom, (4)The Adult Attention-Deficit/Hyperactivity Disorder (ADHD) and Autism National Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (5)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Although Autism Spectrum Disorder (ASD) is a lifelong condition, few studies have examined age-related changes in symptom profile. This is important, as the prevalence of ASD in older adults (50 years +) can be expected to increase with an aging population. To improve service provision for older adults, there is first a need to assess whether ASD symptomatology changes with age and if co-occurring mental health conditions influence presentation.

Objectives: To conduct an exploratory analysis of ASD symptomatology and co-occurring mental health conditions of younger (18-49 years) and older (aged 50-75 years) adults with ASD, compared with gender and age matched clinical controls without ASD (nil ASD).

Methods: A retrospective review of the medical records of 330 patients assessed for ASD at a specialist adult ASD diagnostic clinic between March 2003 and July 2017 identified 171 older adults (ASD N=108, Nil ASD N= 63). A comparison sample of 159 younger adults (ASD N= 101, Nil ASD N= 58) attending the same clinic was randomly selected. The groups were balanced on diagnosis and gender (older: M:F= 124:47; younger M:F= 109:49). Patient clinical records included the Autism Spectrum Quotient (AQ: self-report and informant), Autism Diagnostic Observation Schedule Generic and 2nd Edition (ADOS-G/2), Hospital Anxiety and Depression Scale (HADS) and clinician identified current diagnoses (ICD-10). ANOVA and Chi-square analyses examined the effects of diagnosis (ASD vs nil ASD) and age (younger vs older), on autism symptoms (self-report, informant and clinician rated) and co-occurring diagnoses (number and type). Post-hoc correlation analyses were used where appropriate.

Results: There were significant main effects of diagnosis (ASD > nil-ASD) on the AQ [F(1,119)=472.64, p=.02] and social impairments [F(1,227)=121.23, p<.001], communication impairments [F(1,227)=96.10, p<.001] and repetitive and stereotyped behaviours on the ADOS-G/2 [F(1,224)=16.09, p<.001]. There was a significant main effect of age (older > younger) on social and communication impairments on the ADOS-G/2 [F(1,227)=70.39, p<.001, (F(1,227)=96.10, p<.001, respectively]. The diagnosis by age interaction was significant [F(1,227)=15.64, p<.001], revealing an age-related decline in communication difficulties and increase in social interaction impairments in ASD. There were no differences in the number of adults with mental health conditions (other than ASD). However, older adults were more likely to have anxiety and depression [*χ2*(1) = 6.31, *p* = .01, *χ2*(1) = 6.17, *p* = .01, respectively], whereas younger adults were more likely to have ADHD, [*χ2*(1) = 4.32, *p* = .04], regardless of diagnostic group. Older adults showed significant associations between social interaction impairments and self-rated HADS anxiety and depression scores [*r* = .31, *p* =.04 and *r* = .42, *p* < .001 respectively].

Conclusions: With increasing age in ASD, communication abilities improve but social interaction difficulties persist and worsen. Symptoms of anxiety and depression appear to contribute to greater impairment in older adults with ASD. More work is needed to confirm our findings and establish whether better identification and treatment of mental health conditions in older people with ASD will improve quality of life.

49 **126.049** Testing a Theoretical Model of Loneliness in Adults on the Autism Spectrum

D. Ee[1,2], *S. Arnold*[1,3], *Y. I. (. Hwang*[1,2], *S. Reppermund*[1], *K. R. Foley*[1,2], *P. Srasuebkul*[1] *and J. Trollor*[1,2], *(1)The University of New South Wales, UNSW Sydney, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Queensland, Australia, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia*

Background:

Loneliness is an experience of negative affect as a result of a discrepancy between the relationships one desires and what one perceives to have and, feeling a lack of intimacy. This is the first study to assess the experience of loneliness in adults on the autism spectrum in comparison to adults not on the spectrum. It is also the first study to examine a theoretical model of loneliness for adults on the spectrum based on a systematic literature review and an adaptation of the 1987 De Jong-Gierveld loneliness model.

Objectives:

The aims of this study were to assess the extent of self-reported loneliness in adults on the autism spectrum compared to other adults and to investigate the determinants of loneliness in adults on the spectrum based on a theoretical model of loneliness.

Methods:

Data was obtained from the Australian Longitudinal Study of Adults with Autism (ALSAA). Participants were recruited nation-wide to complete a self-report questionnaire. A total of 264 participants were included from the ALSAA: 156 adults on the spectrum aged 25 to 80 years (*Mean* (*M*)=42.8, *Standard deviation* (*SD*)=12.7), and 108 control participants not on the spectrum aged 25 to 77 years (M=42.8, SD=13.0). Variables including demographics, autistic traits, social support characteristics, depression, anxiety, and self-efficacy were assessed through regression models for their impact on loneliness, measured by the 8-item UCLA Loneliness Scale (ULS-8). The study was grounded in an inclusive research approach that involved a research advisory panel of adults on the spectrum providing feedback on questionnaire development and the interpretation of findings.

Results:

Adults on the spectrum scored significantly higher on the ULS-8 (M=23) than adults not on the spectrum (M=15, p<0.001). Adults on the spectrum had lower education and employment, and higher depression and anxiety compared to control participants. Having a diagnosis of autism spectrum disorder accounted for the greatest variance in loneliness in univariate regression analyses (B = 8.37, 95% CI [7.15, 9.59], p <0.001, R^2=0.41). In multiple regression analyses, social skill deficit and dissatisfaction with social support were associated with greater loneliness in both groups (p<0.05). Reduced frequency of contact with family was associated with loneliness only in the group on the spectrum (p=0.051), whereas female gender (p=0.02) was associated with loneliness in only the control group.

Conclusions:

Adults on the autism spectrum were significantly lonelier than adults not on the spectrum. While the determinants of loneliness in both populations were similar (social skill deficits and dissatisfaction with social support), their influence on loneliness was much greater in adults on the spectrum. Adults on the spectrum may rely less on friends for social support; support from and contact with family should be encouraged. Strategies to assist adults on the spectrum to improve their social skills should be developed. Future research could further explore the phenomenon of loneliness in adults on the spectrum, including adults with co-existing intellectual disability, to fill gaps in knowledge around social anxiety, depression, conceptual understanding of loneliness, and the change in these factors over time through longitudinal analysis.

50 **126.050** The Australian Longitudinal Study of Adults with Autism (ALSAA): Inclusive Research Protocol Development and Baseline Sample Characteristics

S. Arnold[1,2], *K. R. Foley*[1,3], *Y. I. (. Hwang*[1,3], *J. Trollor*[1,3] *and T. Autism CRC Program 3*[3], *(1)The University of New South Wales, UNSW Sydney, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Queensland, Australia*

Background:

There is a reported disconnect between autism researchers' aims and opinions, and those of adults on the autism spectrum. Including people on the spectrum in the execution of research is ethically important, and ensures findings are relevant to the autism community. Despite a growing body of literature on inclusive research with people on the spectrum, there are few protocols or guidelines, with none regarding longitudinal studies. Further, most autism research is focused on children. There is a need for longitudinal studies to understand changing needs and causality among adults.

Objectives:

The Australian Longitudinal Study of Adults with Autism (ALSAA) aims to contribute to a broad, rigorous understanding of adulthood, guided by adults on the spectrum. We describe the inclusive research protocol developed through consultation with a network of autistic advisors, that is used to guide on-going design, interpretation and dissemination of ALSAA research. We also describe the current baseline sample, and how participant feedback and other consultation processes were incorporated into subsequent data gathering.

Methods:

The ALSAA is a questionnaire based study incorporating a wide array of primarily standardised measures. Autistic advisors were recruited via advertisement and targeted invitation, such as members of the Autism CRC Research Academy, which focuses on training peer researchers. Topic areas were selected in consultation with autistic advisors, who also reviewed and piloted content to ensure comprehension for an autistic audience. Autistic advisors were tasked with identifying any ambiguous or inappropriate language, formatting issues, or potential for misinterpretation.

A voluntary sample of autistic adults and non-autistic controls living in Australia and aged 25+ were then gathered via targeted advertising with various autism organisations, other service or support providers, and online autism communities. Three versions of the questionnaire were developed: self-report, informant and carer/family member, to allow greater accessibility for people who are unable or do not wish to self-report. All specific findings are reviewed by autistic advisors, who are provided with a condensed, lay summary of findings and suggested interpretations and implications.

Results:

The ALSAA Inclusive Research Protocol has been reviewed by autistic advisors and operationalised. Autistic advisors have enhanced design and outputs from ALSAA, including: rejecting some potential scales, improved usage of literal language, advice on clearer, less visually overloading layouts, and providing additional, insightful interpretations and implications of specific findings.

As at October 2017, 267 autistic adults have participated in the ALSAA baseline, with 50 meeting criteria for intellectual disability. 129 neurotypical control participants and 102 carers participated to date. There is an over-representation of autistic females (50.2%), in common with other online autism research. The majority of autistic participants (63%) are satisfied or very satisfied with the questionnaire.

Conclusions:

Autism is a life-long condition with more focus needed on adulthood. Including people with autism in autism research ensures more relevant and valid findings. The ALSAA Inclusive Research Protocol could be applied to other studies striving to conduct inclusive research with adults on the autism spectrum.

51 **126.051** The Autism Spectrum Quotient in Mathematicians

C. Buckingham[1]*, V. Warrier*[1]*, P. Smith*[1]*, R. Kenny*[1]*, C. Allison*[2]*, H. Brunel*[1]*, R. Holt*[1] *and S. Baron-Cohen*[2]*, (1)University of Cambridge, Cambridge, United Kingdom, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background:

Previous studies have identified a higher number of autistic traits in mathematicians, and a higher rate of formal diagnosis of autism in mathematicians (Baron-Cohen and Wheelwright, 2007). The reason for this link between autistic traits/autism and mathematics may be because autistic traits/autism includes excellent attention to detail and a strong interest in patterns ("systemizing"). Here we measure the distribution of autistic traits using the Autism Spectrum Quotient (AQ) in maths students/graduates of mathematics with and without autism. We also tested a group of mathematicians who suspect they have autism but had not pursued a formal diagnosis.

Objectives:

Our study had the following three objectives: 1. To investigate if mathematicians score significantly higher on the AQ than the general population; 2. To investigate sex differences in AQ scores in mathematicians; 3. To investigate differences in AQ scores by diagnosis in mathematicians.

Methods:

1049 university students or graduates of mathematics from top mathematics departments worldwide completed an online version of the AQ. Participants were grouped as either mathematicians with ASC (n = 80 (63 male)), mathematicians with suspected ASC (n = 222 (158 male)), and mathematicians without ASC (n = 747 controls (433 male)). We included a general population sample for comparison (n=3466 (898 male)).

Results:

Male mathematicians without ASC scored significantly higher than general population males (p=0.00017), and female mathematicians without ASC also scored higher than general population females ($p=4.36x10^{-13}$). Unlike the general population (Ruzich *et al.,* 2015), where males score higher than females (means 17.89 and 14.88 respectively), male mathematicians without ASC (mean = 21.35, SD = 7.94) did not score significantly higher than their female counterparts (mean = 20.46, SD = 7.90). Mathematicians with ASC and mathematicians with suspected ASC did not differ from each other, but both scored significantly higher than mathematicians without ASC ($p < 2.2x10^{-16}$). The subdomain scores of female mathematicians without ASC were lower than the mathematicians with ASC and the mathematicians with suspected ASC on all subdomains except 'attention to detail', where there was no difference. Male mathematicians without ASC scored significantly lower than mathematicians with ASC (p<0.038) and mathematicians with suspected ASC (p<0.013) on the 'attention to detail' subdomain. No sex differences were observed within groups for AQ or on any subdomain scores.

Conclusions:

AQ scores are higher in mathematicians with ASC and suspected ASC compared to mathematicians without ASC, irrespective of sex, reflected by significantly higher scores in the subdomains of 'communication', 'social skills', 'imagination', and 'attention switching'. The typical sex difference in AQ in the general population is absent amongst all groups of mathematicians, just as it is absent or attenuated in people with ASC. The absence or attenuation of the typical sex difference may reflect biological factors such as prenatal sex steroids, which are elevated in those with ASC. This study confirms the strong association between autistic traits and mathematical talent. Ongoing research is exploring the basis of this association at a genetic level.

52 **126.052** The Relationship between Social Anxiety, Depression, and Levels of Empathy in Young Adults with ASD

A. Mendoza[1]*, R. Ellingsen*[2]*, E. Veytsman*[3]*, A. Ganel*[4] *and E. A. Laugeson*[5]*, (1)UCLA PEERS Clinic, Los Angeles, CA, (2)Psychiatry, University of California Los Angeles, Los Angeles, CA, (3)Graduate School of Education, University of California Riverside, Riverside, CA, (4)Psychiatry, UCLA PEERS Clinic, Los Angeles, CA, (5)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background:

Identification of other people's emotions through brief emotional expressions can be fundamental to many social processes (Clark, Winkielman, & McIntosh, 2008). Research has shown that individuals with Autism Spectrum Disorder (ASD) have difficulties with emotion processing regardless of gender and age (Clark, et. al. 2008). Previous research has shown a strong positive relationship between individuals with ASD and associated psychiatric symptoms, specifically depression (Sterling, Dawson, Estes, 2008). Additionally, it has been shown that empathy deficits are correlated with Major Depressive Disorder (Hoffman, Banzhaf, Kanske, Gartner, Bermpohl, & Singer, 2016). A relationship between higher levels of anxiety and lower levels of empathy was also shown in a study examining college students (Deardoff, Kendall, Finch, & Sitarz, 1977). Although this relationship has been studied extensively with typically developing young adults, there has yet to be a thorough exploration of the relationship between social anxiety, depression and empathy in young adults with ASD.

Objectives:

This study seeks to examine the relationship between social anxiety, depression and levels of empathy in cognitively able young adults with ASD.

It is hypothesized that young adults reporting higher social anxiety and higher levels of depression will exhibit lower levels of empathy.

Methods:

Thirty-three young adults ranging from 18 to 27 years of age (*M*=20.42; *SD*=2.03) presenting for social skills treatment as part of the UCLA PEERS for Young Adults program participated in this study. In order to examine the relationship between social anxiety, depression and empathy, young adults completed the Social Anxiety Scale (SAS-YA; La Greca, 1999), the Empathy Quotient (EQ; Baron-Cohen & Wheelbright, 2004), and the Major Depression Inventory (MDI-YA; Bech, Rasmussen, Olsen, Noerholm, Abildgaard, 2001) prior to treatment. Pearson correlations were calculated to examine the relationship between ratings of social anxiety on the SAS and levels of depression on the MDI in comparison to levels of empathy on the EQ.

Results:

Pearson correlations revealed a significant negative relationship between the Social Skills Subscale of the EQ and social anxiety as measured by the SAS ($p<.05$). In particular, the Social Skills Subscale of the EQ was negatively correlated with the SAS subscale of Social Avoidance and Distress-General (p<.05), and negatively correlated at trend levels with the SAS subscales of Social Avoidance and Distress-New ($p<.10$) and Fear of Negative Evaluation ($p<.10$). The Social Skills Subscale of the EQ was also negatively correlated with depression as measured by the MDI at a trend level ($p<.10$). There were no significant associations between the other EQ subscales (Cognitive Empathy & Emotional Reactivity) with the SAS or MDI.

Conclusions:

Findings support the original hypothesis that young adults reporting higher social anxiety exhibit lower levels of empathy. There also appears to be a relationship between empathy and depression, but this correlation was not significant. These findings are important in that they suggest that the difficulties with empathy that individuals with ASD experience may be exacerbated by symptoms of social anxiety and/or depression.

53 **126.053** Transition of Students with Autism Spectrum Disorder to Higher Education

T. C. Bakker[1], *S. Begeer*[2], *A. C. Krabbendam*[3] *and S. Bhulai*[4], *(1)Vrije Universiteit Amsterdam, Amsterdam, Netherlands, (2)VU University Amsterdam, Amsterdam, Netherlands, (3)Clinical Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, (4)Mathematics, Vrije Universiteit Amsterdam, Amsterdam, Netherlands*

Background: A growing number of individuals with Autism Spectrum Disorders (ASD) is enrolling in higher education (Zeedyk et al., 2016). Despite this, studies on the transition of individuals with ASD from secondary school to higher education are limited. A systematic review of the literature (Gelbar et al., 2014) found only 20 articles, mostly case studies or self-reported experiences of in total no more than 69 college students diagnosed with ASD. Empirical research on college students with ASD is needed to complement existing qualitative insights and support policy making.

Objectives: The first objective of this study is to advance empirical research on college students with ASD. The second objective is to improve our understanding of the transition of students with ASD to higher education, comparing it to the transition of students with other conditions and students without known conditions.

Methods: Using an administrative data set with enrollments in bachelor programs of a major university in Europe from 2010 to 2016 consisting of 99 students formally diagnosed with ASD, 2,312 students with other conditions such as ADD/ADHD and dyslexia (OC), and 26,218 regular students (RS). The data set contains features on demographics, ethnicity, secondary education and examination grades, family background and support, orientation and planning, application, enrollment, matching, participation in an introduction program, language proficiency, disabilities and comorbidity.

Results: Preliminary analyses show differences between students with ASD and their peers. Most students with ASD were male (ASD: 71.7%; OC: 41.6%; RS: 45.4%). On average, students with ASD were older (ASD median = 20; OC median = 19; RS median = 19) and more often had non-standard pre-education degrees (ASD 9.09%; OC 2.77%; RS 2.44%). Students with ASD with a high school degree had similar examination grades compared to regular students, and better examination grades compared to students with other conditions. No differences were found in the way students with ASD orientated themselves. They had higher scores on help awareness and lower scores on self-reported extra-curricular activities and work compared to students with other conditions and regular students. Ethnicity of students with ASD was similarly distributed compared to regular students. On language proficiency, they scored better than students with other conditions and regular students, especially with regard to vocabulary. Comorbidity in students with ASD was more common than in students with other disabilities; most common combinations were dyslexia and ADD/ADHD.

Conclusions: The current findings are promising with regard to our empirical understanding of the characteristics and transition of college students with ASD. It appears that students with ASD need more time to reach higher education. On the other hand, students with ASD who do have a high school or comparable degree, show more similarity with regular students and have a better starting point compared to students with other conditions. Combined, these insights might indicate the importance of early diagnosis of ASD for transition to higher education.

This study was funded by the Vrije Universiteit Amsterdam. Conflict of interest: None.

54 **126.054** Transitioning to Adulthood: Tracking Adult Outcomes in a 25-Year Longitudinal Study

L. A. Pepa[1], *A. Megale*[1], *G. Gunin*[2], *M. Heyman*[1] *and C. Lord*[3], *(1)Weill Cornell Medicine, White Plains, NY, (2)Psychiatry, Weill Cornell Medical College, White Plains, NY, (3)University of California Los Angeles, Los Angeles, CA*

Background: Over the past 20 years, our knowledge about autism spectrum disorder (ASD) has made considerable advances. However, as the population of individuals with ASD continues to grow and change, there is still very little known about adult outcomes. Data from published studies suggest that adults with ASD are at significant risk of poor global outcomes, reporting low rates of independent living (Gotham et al., 2014), decreased post-secondary education (Farley et al., 2009), underemployment (Howlin et al., 2013), minimal reciprocal social contact (Orsmond et al., 2004), and high rates of comorbidity (Buck et al., 2014). While studies of adults are growing in number, many are limited by the longevity of data collection and the generalizability of the population sampled. Study populations are largely comprised of adults who actively engage with ASD clinics, and likely reflect those of the highest need. Studies of adults in the broader community may shed new light on a more diverse range of outcomes.

Objectives: This study aims to describe adult outcomes in a sample of individuals with ASD across 1) demographic areas and daily activities, 2) social participation and relationships, 3) comorbidity and behavior problems, and 4) general health outcomes.

Methods: Participants were young adults who have been seen as part of an ongoing 25-year long longitudinal outcome study. Participants were first referred to the study at age two following concern about possible ASD, and have been followed in the community over their lifetime. The current analyses include 141 young adults (66% of the original sample) who have contributed data through mail-based questionnaires and/or in-person visits after the age of 18. Data was gathered through a battery of diagnostic and clinical measures, interviews, and questionnaires. Of the 141 young adults in this sample, 84% (n=119) have received a lifetime diagnosis of ASD, and 16% (n=22) are considered to be non-spectrum (NS). In the ASD sample, 50% have a Verbal IQ of 70 or greater (68% in the NS group).

Results: The ASD sample falls within the reported limits of other studies in the area of daily activities. 63% of individuals live at home with their parents and only 18% received post-secondary degrees. 39% of the ASD sample was reported to be unemployed, compared to only 14% of the NS sample. However, looking at general health outcomes and psychiatric comorbidity, the current sample was more minimally impacted than other adult samples. 21 out of 74 (28%) individuals with ASD seen at age 25 endorsed a psychiatric comorbidity; rates that are much lower than other reports, though significantly higher than the general population mean for adults (17.9%; SAMHSA, 2015). Very few needed emergent psychiatric care (4%) or hospitalizations (1%), and the mean number of psychiatric medications taken is only 1.7 per individual. Results of social functioning will also be reported and discussed.

Conclusions: Preliminary findings suggest that adult ASD populations seen in the community are impaired with regard to daily activities, though may be less impacted by psychiatric comorbidity and general health problems than clinically-active samples.

55 **126.055** Using Machine Learning to Identify Patterns of Lifetime Health Problems in Decedents with Autism Spectrum Disorder

L. Bishop-Fitzpatrick[1]*, A. Movaghar*[2]*, J. S. Greenberg*[3]*, D. Page*[2]*, L. E. Smith DaWalt*[3]*, M. H. Brilliant*[4] *and M. Mailick*[3]*, (1)University of Wisconsin - Madison, Madison, WI, (2)University of Wisconsin-Madison, Madison, WI, (3)University of Wisconsin-Madison Waisman Center, Madison, WI, (4)Marshfield Clinic Research Institute, Marshfield, WI*

Background: As a large wave of individuals with autism spectrum disorder (ASD) diagnosed in the 1990s enters adulthood and middle age, knowledge about the patterning of lifetime health problems will become increasingly important for prevention efforts. However, although studies do suggest the presence of heightened morbidity and early mortality in ASD, we are aware of no studies conducted to date that have examined health problems throughout the life course of individuals with ASD using representative, population-level data.

Objectives: We sought to characterize lifetime health problems in a sample of decedents with ASD and matched controls.

Methods: We retrospectively analyzed diagnostic codes associated with de-identified electronic health records (EHRs) from the Marshfield Clinic, a multi-specialty group practice with more than 700 physicians providing integrated, comprehensive care to over one million people across more than 50 locations in northern, central, and western Wisconsin. Previous research has validated EHR data from the Marshfield Clinic and found that patients are representative of northern, central, and western Wisconsin. Notably, 97% of the population in this region receives the majority of their care at the Clinic.

Our analysis included 91 decedents with ASD who were matched based on their sex and birth year (within 5 years) to a sample of 6,186 decedent community controls (a 1:68 ratio). Mean age of death for decedents with ASD was 67.3 (range=60-89). We used a machine learning algorithm to classify participants into groups (ASD or control) based on their ICD-9 codes, V-codes, and E-codes using a 10-fold cross validation procedure. Information gain (IG) scores, which take into account information entropy for each class (ASD versus decedent community control) and feature (ICD-9 code, V-code, E-code), were used to measure the amount of information in each feature with respect to target class. Diagnoses related to developmental disabilities and mental health conditions (i.e., Chapter 5: Mental Disorders) were excluded from our algorithm to reduce overfitting.

Results: Diagnostic patterns distinguished decedents with ASD from matched decedent community controls with high sensitivity and specificity (AUC=0.88) and weighted average precision (98.2%) solely based on their ICD-9 codes, V-codes, and E-codes. Decedents with ASD had higher rates of epilepsy, choking, accidents, long-term medication use, cardiovascular screening, hypothyroidism, urinary tract dysfunction, motor abnormalities, skin conditions, respiratory problems, and digestive problems than decedent community controls. Decedents with ASD had lower rates of hypertension and cancer diagnosis and treatment than decedent community controls.

Conclusions: This study is the first study to characterize health problems in decedents with ASD, the majority of whom were older adults, and the first to use a machine learning algorithm to differentiate decedents with ASD from decedent community controls with a high level of sensitivity, specificity, and precision based on ICD-9 codes, V-codes, and E-codes identified in EHRs. This analysis found distinctive lifetime profiles of health problems among decedents with ASD compared to decedent community controls. While preliminary, these findings have the potential to inform best practices for prevention and monitoring of health problems in ASD across diverse healthcare settings if replicated in additional population-level datasets.

Poster Session
127 - Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
5:30 PM - 7:00 PM - Hall Grote Zaal

56 **127.056** Aberrant Cerebellar-Cerebro Functional Connectivity in Children and Adolescents with Autism Spectrum Disorder

R. Hanaie[1]*, I. Mohri*[2]*, K. Kagitani-Shimono*[1]*, M. Tachibana*[1] *and M. Taniike*[1]*, (1)United Graduate School of Child Development, Osaka University, Suita, Japan, (2)United Graduate School of Child Development, Osaka University, Osaka, Japan*

Background:

The cerebellum is one of the brain regions most consistently reported to have neuropathological findings in patients with autism spectrum disorder (ASD). Previous resting state functional connectivity (rsFC) studies in healthy adults have reported that the cerebellum forms widespread functional networks with the cerebral cortices and contributes to various cognitive functions (Buckner et al., 2011). However, studies on cerebellar-cerebro rsFCs in patients with ASD were very sparse.

Objectives:

Aim of this study was to investigate cerebellar-cerebro FC in children and adolescents with ASD using resting state functional magnetic resonance imaging (MRI) and to know whether its abnormalities are related to executive and socio-communicative deficits in children and adolescents with ASD.

Methods:

Echo planar imaging functional volume and T_1-weighted images of 16 subjects with ASD (all males; age: 11.1 ± 2.0 years) and 20 typically developing (TD) subjects (all males; age: 10.5 ± 2.5 years) were acquired on a 3 tesla MRI scanner. Furthermore, we added 130 male subjects extracted from the Autism Brain Imaging Data Exchange (ABIDE) II (ASD = 42, age: 10.7 ± 1.8 years; TD = 88, age: 10.3 ± 1.7 years). Final sample included 58 subjects with ASD (all males; mean age: 10.8 ± 1.9 years) and 108 TD subjects (all males; mean age: 10.3 ± 1.8 years). Seed-based rsFC analysis was performed using the CONN toolbox (http://www.nitrc.Org/projects/conn/). Cerebellar ROIs were created using the probabilistic MR Atlas of the human cerebellum (Diedrichsen, 2009). Group differences in FCs were examined using two sample *t*-tests, covarying for full-scale intelligence quotient (FSIQ) and mean frame wise displacement (FD) scores, and imaging sites. Correlation analyses were performed between FC values showing significant group differences and scores in the Social Responsiveness Scale (SRS), the Behavior Rating Inventory of Executive Function (BRIEF), and the Autism Diagnostic Observation Schedule (ADOS) in the ASD group.

Results:

The ASD group showed aberrant cerebellar-cerebro FCs relative to TD children. Findings of aberrant FCs with the cerebral regions converged mainly on the posterior lateral hemisphere and vermis of the cerebellum. The increased FCs between several posterior cerebellar subregions and left insula, left middle frontal gyrus, and right supramarginal gyrus were found. In addition, the decreased FCs between right dentate nucleus and several cerebral regions were found. In the ASD group, connectivity between right Crus II and left insula was negatively related to the Global Executive Composite (GEC) score in the BRIEF ($r = -0.408$, $p = 0.002$) and connectivity between vermis X and left angular gyrus was positively related to the total score in the ADOS-G ($r = 0.408$, $p = 0.034$) .

Conclusions:

Findings of aberrant FCs converged mainly on the posterior lateral hemisphere, the right dentate nucleus, and the posterior inferior vermis of the cerebellum. These results were consistent with those of previous studies reporting structural and neuropathological abnormalities in the cerebellum (D'Mello et al., 2015; Riva et al., 2013; Wegiel et al., 2014). Our findings may help to provide effective therapeutic interventions in children and adolescents with ASD.

57 **127.057** Adolescents with ASD Show Atypical Electrophysiological (EEG) Responses to a Novel Theory of Mind Reasoning Task: An ERP Study

E. J. Libsack[1], *C. M. Keifer*[1], *T. Clarkson*[2], *J. M. Mayor Torres*[1] *and M. D. Lerner*[3], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Temple University, Philadelphia, PA, (3)Psychology, Stony Brook University, Stony Brook, NY*

Background: Theory of Mind (ToM) reasoning involves making attributions about others' mental states and is critical for understanding and predicting others' behavior in social situations. Impairments in social communication, including deficits in ToM, are a core feature of autism spectrum disorders (ASD). Previous research using electroencephalography (EEG) has examined event-related potentials (ERPs) elicited during ToM reasoning tasks in TD youth (Liu, et al., 2004, 2009b; Meinhardt, et al. 2011; Sabbagh & Taylor, 2000), suggesting that correct ToM reasoning is associated with two distinct ERP components. The Late Positive Complex (LPC) is thought to index more automatic processing of conditional salience or expectancy, while the Late Slow Wave (LSW) is related to mental state attributions. However, prior research has not examined ERP correlates of ToM reasoning in adolescents with ASD, hindering understanding of the neurocognitive elements and time-course of ToM in ASD. Objectives: Investigate whether LPC and LSW ERP amplitudes differ in TD relative to ASD adolescents in a novel ToM task.

Methods: 33 Adolescent participants (22 male; M=13.0 years, SD=1.8) included 19 TD and 14 ASD with ADOS-2 confirmed diagnosis and IQ > 70. During EEG acquisition, participants viewed illustrated, narrated ToM vignettes and were asked to make mental state inferences about the characters' behavior (McKown et al., 2015). Individual response options were presented sequentially after the conclusion of the vignette, allowing target ERPs to be time-locked to the presentation of correct and incorrect response options. ERPs were measured at parietal electrode sites and extracted as mean area amplitudes within discrete post-stimulus time windows (LPC 300-600ms; LSW 600-1200ms). An independent groups t-test was used to assess group differences in behavioral response accuracy. LPC and LSW ERP data were analyzed in two separate 2 (ASD, TD) by 2 (correct, incorrect) repeated measures ANOVAs (RM-ANOVAs).

Results: The ASD group made significantly more errors than the TD group on the ToM task (t(39)=2.185, *p*=.035). RM-ANOVA revealed significant main effects at the LPC (F(1,31)=14.86, p=.009) and the LSW (F(1,31)=4.167), p=0.05), such that correct responses were larger than incorrect responses (Figure 1). Diagnosis x Response Accuracy interactions were marginally significant for the LPC (F(1,31)=3.71, p=.063) and significant for the LSW (F(1,31)=4.36, p=.045) (Figure 2). During both epochs, the TD group evinced a greater neural response to correct relative to incorrect responses compared to the ASD group.

Conclusions: Results indicate that youth with ASD demonstrate neural and behavioral deficits in complex ToM reasoning. Individuals with ASD demonstrated marginally attenuated differentiation between correct-vs-incorrect ToM vignettes at the LPC, and attenuated differentiation at the LSW. The LPC has been associated with more attentional aspects of ToM reasoning, whereas the LSW has been associated with more elaborative processing of mental states (Meinhardt et al. 2011. This could suggest that early differences in the LPC might be contributing to later observed differences in the LSW. To probe this effect, future studies should examine the relative contribution of individual ERP components to complex ToM in order to best pinpoint the processing stage at which ToM deficits first occur.

58 **127.058** Altered Plasticity of Prefrontal Cortex in Adult Autism Spectrum Disorder

M. Nakamura[1], *T. Itahashi*[1], *T. Izuno*[2], *J. Fujino*[1], *H. Ohta*[1], *R. Hashimoto*[3] *and N. Kato*[1], *(1)Medical Institute of Developmental Disabilities Research, Showa University, Tokyo, Japan, (2)Kanagawa Psychiatric Center, Yokohama, Japan, (3)Tokyo Metropolitan University, Tokyo, Japan*

Background: Altered metaplasticity is hypothesized in psychiatric disorders including neurodevelopmental disorders. However, stimulation-induced neuroplastic changes in human prefrontal cortex have not been sufficiently elucidated due to lack of reliable biomarkers like motor evoked potentials (MEP).
Objectives: The study was aimed to establish reliable biomarkers of TMS-evoked potentials (TEP), which could evaluate the neuroplasticity in the heteromodal association cortices.

Methods: Neurophysiological changes followed by rTMS over dorsolateral prefrontal cortex (DLPFC) were longitudinally investigated using resting-state EEG (64ch recording) and TEP. TEP measurements followed by intermittent theta burst stimulation (iTBS) or sham stimulation were applied to twenty adult patients with autism spectrum disorder (ASD) and 21 matched healthy adults of typical development (TD).

Results: TEP components (mainly N45) revealed that facilitatory iTBS could enhance prefrontal TEP amplitudes for around an hour in healthy volunteers as compared with sham condition (t=2.37, p=0.026), accompanied by tentative cognitive enhancement in working memory task. However, adult ASD patients did not show the enhancement of TEP components and also cognitive enhancement. In terms of responder rate, 67% of TD adults and 25% of ASD adults were electrophysiological responders, which showed N45 amplitude enhancement more than 2 SD range of N45 amplitude variation observed in the sham group.

Conclusions: The TEP component of N45 could be a candidate for biomarker for functional neuroplasticity induced by rTMS. The present result suggested that prefrontal cortex of adult ASD may not have enough capacity to induce the long-term potentiation (LTP)-like effects, possibly due to saturated synaptic strength.

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127.059 Altered Prefrontal Functional Connectivity and Anatomy in Mice Lacking Autism-Associated Gene Shank3

M. Pagani[1,2]*, A. Liska*[1,2]*, A. Galbusera*[1]*, M. Sabbioni*[3]*, M. L. Scattoni*[3] *and A. Gozzi*[1]*, (1)Istituto Italiano di Tecnologia, Functional Neuroimaging Lab, Centre for Neuroscience and Cognitive Systems, Rovereto, Italy, (2)University of Trento, CIMEC, Rovereto, Italy, (3)Istituto Superiore di Sanità, Neurotoxicology and Neuroendocrinology Section, Department of Cell Biology and Neurosciences, Rome, Italy*

Background: Mutations in postsynaptic scaffolding protein Shank3 have been strongly implicated in 22q13 deletion syndrome (Phelan–McDermid syndrome) as well as other non-syndromic forms of autism spectrum disorder (ASD). A number of recent reports have investigated basal ganglia function in mouse lines harboring Shank3 mutations, revealing specific striatal circuit impairments underlying self-injurious repetitive grooming exhibited by these mutants. However, Shank3 mutations in humans are often associated with intellectual disability and cognitive impairments, leading to the hypothesis that functional alterations in this gene can affect extra-striatal brain substrates, including higher order neocortical regions.
Objectives: Our work probes the hypothesis that Shank3 mutations impair function and anatomy of extra-striatal neocortical substrates, including higher-order cognitive substrates. To this aim, we used high resolution structural MRI and in vivo resting-state fMRI (rsfMRI) to map regional gray matter volume and brain-wide functional connectivity in male Shank3B$^{-/-}$ mutants.

Methods: Adult male Shank3B$^{-/-}$ (n=11) and control wild type littermates (n=10) were imaged at 7T under shallow halothane anesthesia (0.75%) using a single-shot EPI sequence as previously described (Liska et al., 2017, Cerebral Cortex). The protocol preserves large-scale functional connectivity in rodents (Gozzi & Schwarz, 2016, NeuroImage). We calculated global and local brain connectivity maps for all subjects and mapped voxelwise inter-group differences in both measures. We also employed post-mortem voxel based morphometry (VBM) and automated anatomical labeling on high resolution images obtained with a FLASH sequence with an isotropic voxel size of 70µm. The same brains underwent DTI imaging using 80 directions, a 120x120x240 voxel size, and b=3000, d=6 and D=13 ms as recently described (Liska et al., 2017, Cerebral Cortex).

Results: Whole-brain rsfMRI connectivity mapping revealed large foci of reduced global and local connectivity in prefrontal and anterior cingulate hub regions of the mouse brain (A-B). This effect was associated with diminished long-range connectivity in midline integrative areas of the mouse default mode network (C), as well as impaired striato-cortical coupling (D). A correlation between impaired ultrasound vocalization and decreased prefrontal connectivity was also observed. No overt genotype-dependent alterations in white macrostructure or fiber-organization were observed, as documented by DTI-based mapping and tractographic analyses (G). In keeping with the observed functional alterations, prefrontal and parietal regions exhibiting impaired connectivity also showed prominent reductions in gray matter volume (E-F), suggesting of a hypotrophic maturation of these areas. Cortical regions of Shank3$^{-/-}$ mutants also exhibited idiosyncratic variability in homotopic connectivity.

Conclusions: We show that Shank3B deletion leads to cortical volumetric loss and reduced local and long-range functional connectivity within prefrontal and posterior connectivity hub region, an effect that is associated with social communication deficits. These findings suggest a pivotal role for Shank3B in the establishment of functional and neuroanatomical coupling between integrative higher order neocortical areas, and suggest that mutations in this gene may predispose to autism via a selective trophic and functional downregulation of prefrontal circuits.

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127.060 Anxiety in Adolescents with ASD Modulates Neural Responses during Simulated Social Interactive Paradigm.

M. L. McNair*, A. Naples, K. A. McNaughton, T. C. Day, T. Winkelman, M. J. Rolison, K. S. Ellison, E. Jarzabek, B. Lewis, J. Wolf and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Anxiety affects 40-50% of individuals with autism spectrum disorder (ASD) and potentiates the social difficulties experienced by these individuals. Prior work demonstrates atypical brain activity and patterns of attention to social stimuli in both individuals with ASD and anxiety. However, most research has relied on passive observation of static and dynamic stimuli, and there is little research investigating the relationship of anxiety and brain response in interactive contexts.
Objectives: We developed a novel interactive paradigm in which on-screen faces responded to participants' looking patterns to assess: (1) brain and gaze response to faces that respond in a reciprocal manner between individuals with ASD and typically developing (TD) controls and (2) the moderating effect of anxiety on brain activity and looking patterns. We hypothesized that anxious symptomology would differentially impact the expression of temporally early social brain function in the context of social vulnerabilities in ASD.

Methods: EEG and eye-tracking were collected from adolescents with ASD (n=45, age=14.68 years, IQ=110.44) and age/IQ matched TD controls (n=43, age=13.68 years, IQ=109.52). Following an arrow cue, participants would look to the eyes or mouth of an on-screen face, which responded by opening its eyes or mouth. In this way, faces would display reciprocal (eye-to-eye; mouth-to-mouth) and nonreciprocal (eye-to-mouth; mouth-to-eye) facial movement. We examined temporally early brain responses at face sensitive ERP components, the P100 and N170, and measured their relationships to social and anxious symptomatology using parent-report on the Child Behavior Checklist (CBCL).

Results: Participants with ASD exhibited significantly greater parent-reported anxiety, as determined by the CBCL's Anxiety Problems (*F*(1,58)=12.063, *p*=0.001), Social Problems (*F*(1,58)=25.678, *p*<0.000), and Anxious Depressed T-Scores (*F*(1,58)=9.954, *p*=0.003). A significant main effect of condition (eye-to-eye/mouth-to-mouth) for N170 peak amplitude (*F*(1, 86)=48.512, *p*<0.000) demonstrated that reciprocal eye-contact elicited the largest effect on N170 response across groups. Individuals with ASD, compared to TD controls, exhibited greater N170 amplitudes to reciprocal eye-contact in the right hemisphere (*F*(1, 86)=10.783, *p*<0.001) and this effect correlated with increased anxiety, such that greater levels of anxiety correlated with greater neural response to eye-contact (Anxiety Problems (r(28)=-0.369, *p*=0.053), Social Problems (r(28)=-0.346, *p*=0.072), and Anxious Depressed (r(28)=-0.482, *p*=0.009)). Furthermore, a diagnosis by condition interaction at the P100 amplitude revealed that, across both hemispheres, individuals with ASD exhibited greater P100s to mouth movements while controls exhibited greater P100s to reciprocal eye-contact (*F*(1, 86)=4.074, *p*=0.047), suggesting that participants with ASD exhibit atypical patterns of preparatory vigilance during reciprocal social interactions. Eye-tracking data analysis is ongoing.

Conclusions: Our findings show that anxiety modulates neural responses to social interaction simulations in participants with ASD and that these individuals exhibit both hypersensitivity to reciprocal eye-contact and atypical patterns of vigilance when viewing faces. Given the prevalence of anxiety in ASD and the differential neural responses to social interactions observed in these individuals, anxiety could serve not only as a treatment target for alleviating ASD symptomatology but also as a specific subtype of ASD. The particular neural responses seen in our participants with ASD may also act as a potential biomarker for ASD and anxiety.

61 **127.061** Atypical Brain Connectivity during a Theory-of-Mind Task in Adults with and without Autism Spectrum Disorder

V. Yuk[1,2]*, E. Anagnostou*[3] *and M. J. Taylor*[1,2]*, (1)The Hospital for Sick Children, Toronto, ON, Canada, (2)University of Toronto, Toronto, ON, Canada, (3)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: Individuals with autism spectrum disorder (ASD) exhibit atypical functional brain connectivity across a variety of tasks, generally showing a pattern of long-range underconnectivity and short-range hyperconnectivity in task-relevant networks. For instance, studies find reduced connectivity between the nodes of the theory-of-mind (ToM) network, which mainly consists of the medial prefrontal cortex, temporoparietal junction, posterior superior temporal sulcus, and precuneus, and this decreased connectivity is thought to contribute to the social cognitive deficits that characterize ASD. However, the specific differences in the temporal-spatial dynamics of this ToM network have yet to be determined, and analyzing how brain connectivity differs across time and frequency bands may demonstrate that these differences are more nuanced than previously found.

Objectives: To utilize the excellent temporal and spatial resolution of magnetoencephalography (MEG) to examine timing and frequency differences in brain connectivity between adults with and without ASD during a ToM task.

Methods: We studied 35 control adults (23 M, 12 F; mean age = 26.4±4.9 years) and 43 adults with ASD (30 M, 13 F; mean age = 26.7±5.5). Participants performed a false-belief task, based on the classic Sally-Anne task, to assess ToM, while in the MEG scanner. The task required participants to infer whether a character had a true or false belief about an object's location. Time series of activity during this task at various brain areas were reconstructed from the MEG data using a vector beamformer. Connectivity between sources was estimated using the weighted phase lag index (wPLI) metric, which was then averaged within several canonical frequency bands (theta, alpha, beta, and low and high gamma) and within a series of 100-ms time windows from 100-600 ms following stimulus onset. Brain connectivity in the false vs. true belief trials were compared. Significant results are reported at a FWE-corrected p<0.05.

Results: Whole-brain network analyses revealed a mixed pattern of under- and overconnectivity in adults with ASD during our ToM task. Between 100-200 ms, adults with ASD showed decreased right temporoparietal junction and ventromedial prefrontal cortex connectivity, and decreased anterior and posterior cingula connectivity in the theta frequency band, as well as increased precuneus and ventromedial prefrontal cortex connectivity, and increased left inferior frontal gyrus and dorsomedial prefrontal cortex connectivity in the beta frequency band. Between 300-400 ms, the ASD group also showed reduced left superior parietal lobule and ventromedial prefrontal cortex connectivity in the low gamma frequency band.

Conclusions: Our results indicate that adults with ASD show distinct patterns of brain connectivity compared to controls across a number of frequency bands, between areas within and outside the ToM network. The most prominent effects seen in the ASD group were the reduced connections in the theta frequency band, which is known to reflect long-range connectivity during cognitive processing. Additional analyses will correlate these connectivity findings with behavioural performance on tasks involving understanding the emotions and intentions of others.

62 **127.062** Atypical Brain Connectivity in Children with Autism Spectrum Disorder during a Music Familiarity Task (POND Network)

C. P. De Barros Freitas[1,2]*, L. Ristic*[1]*, S. Fragiadakis*[3]*, S. Chow*[1]*, S. M. Wong*[4]*, A. Iaboni*[3]*, B. Dunkley*[5]*, M. J. Taylor*[6]*, J. P. Lerch*[7] *and E. Anagnostou*[3]*, (1)Bloorview Research Institute, Toronto, ON, Canada, (2)Institute of Medical Science, University of Toronto, Toronto, ON, Canada, (3)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Division of Neurosurgery, Hospital for Sick Children, Toronto, ON, Canada, (5)Diagnostic Imaging, Hospital for Sickkids, Toronto, ON, Canada, (6)The Hospital for Sick Children, Toronto, ON, Canada, (7)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada*

Background: Emerging evidence suggests autism is a disorder of brain connectivity and atypical reward processing has been proposed as an explanation for social deficits in ASD. Music is a valuable tool to study human cognition, emotion and reward networks and it is also an auditory stimulus that interests and motivates children with ASD.

Objectives: To examine neural synchrony in the reward networks associated with familiarity and liking of music listening in children with ASD.

Methods: 23 children with autism (ASD) and 23 typically developing children (TDC) children, between 7 to 14 years old, matched on age and sex were recruited. Magnetoencephalography (MEG) was used to measure brain activation and neural synchrony, while listening to different types of music (familiar liked, familiar disliked, unfamiliar liked and unfamiliar disliked). These music selections were chosen by the children and then modified (and matched with unfamiliar songs of the same genre, tempo, mode and dissonance) for presentation in the MEG.

Preliminary Results: 23 ASD (mean age 10.09 ± 1.41) and 23 TDC (mean age 10.26 ± 1.85) of IQ>70 have been recruited. Whole brain connectivity revealed significant group differences in the theta band (4-8 Hz) frequency while listening to different types of music (familiar liked, familiar disliked, unfamiliar liked and unfamiliar disliked). ASD group engaged different networks, showing over-connectivity in frontal areas and under-connectivity in posterior areas including the occipital and parietal lobes. MEG analyses of the reward networks are currently underway, using reward network seeds (such as the nucleus accumbens).

Conclusions: These findings reinforce functional disconnection in brain networks mediating music listening in children with ASD. The outcome of this research will enhance our understanding of the neurobiology of music listening and reward processing in ASD population so that meaningful translation can occur into innovative music therapy interventions.

63 **127.063** Atypicality of the N170 Event-Related Potential in Autism Spectrum Disorder: A Meta-Analysis

***E. Kang**[1], C. M. Keifer[1], E. J. Levy[2], J. Foss-Feig[3], J. McPartland[4] and M. D. Lerner[5], (1)Stony Brook University, Stony Brook, NY, (2)Duke University, Durham, NC, (3)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Psychology, Stony Brook University, Stony Brook, NY*

Background: Autism spectrum disorder (ASD) is associated with impaired processing of social information, such as faces (Lozier et al., 2014; McPartland et al., 2004). However, the neurocognitive processes that underlie social deficits in ASD are poorly understood. The N170 event-related potential (ERP) indexes early face processing in humans by electroencephalogram (EEG; Bentin et al., 1996) and has been used to index face processing impairments in psychiatric disorders (Feuerrigel et al., 2015; McCleery et al., 2015). Although the N170 is considered among the most promising biomarkers of ASD (Jeste & Nelson, 2009; McPartland et al., 2016), published literature on the N170 is not consistent, and studies often suffer from small sample sizes. No quantitative review to date has integrated the literature to assess whether N170 response to faces in individuals with ASD differs from that of typically-developing (TD) individuals.

Objectives: This meta-analysis examined the corpus of literature investigating differences in N170 response to faces in individuals with and without ASD. In addition, to examine the specificity of differential N170 response to face stimuli in particular, this study also meta-analyzed differences in a) N170 response to non-face stimuli and b) P1 response to faces in the same sample of studies.

Methods: Web of Science, PubMed, and PsycINFO databases and citation lists from past systematic reviews on the topic were searched. Data from 23 studies (N_{ASD}=374, N_{TD}=359; Table 1) were reviewed and double-coded by two independent raters (ICC>0.90). Meta-analysis was used to examine the effect size (Hedges' *g*) of the difference in N170 and P1 latency and amplitude among individuals with and without ASD, averaged across all relevant facial (e.g., different emotions) and non-facial (e.g., objects, houses) stimuli for each study. Analyses were also conducted examining potential moderators (mean age and IQ of participants, sex distribution of participants, use of gold-standard ASD diagnostic measures, and ASD symptom severity) and publication bias.

Results: On average, N170 latencies to faces were delayed in individuals with ASD relative to TD participants (g=0.36, 95% CI [0.06, 0.67], p=0.02; Figure 1A), but amplitudes did not differ between ASD and TD groups overall (g=-0.03, 95% CI [-0.33, 0.26], p=0.82; Figure 1B). Moderator analyses revealed that N170 amplitudes were smaller in magnitude in the ASD relative to TD participants in adult samples (Q[1]=10.87, p=0.001) and in those with higher cognitive ability (b=0.08, p=0.006). No evidence of publication bias was found. N170 latency and amplitude to non-faces and P1 latency and amplitude to faces in the ASD group were not statistically different when compared to TD controls (all *p*s>0.12).

Conclusions: Atypicality of N170 response to faces, particularly increased latency, appears to be a robust biomarker of social-communicative dysfunction in ASD. This marker may relate to differential developmental experiences and use of compensatory cognitive mechanisms. Future research should further examine phenotypic differences contributing to N170 heterogeneity in ASD, as well as its malleability in response to treatment.

64 **127.064** Brain Activity Underlying the Recognition of Vocal Affect Bursts in Autism Spectrum Disorder

***V. Yap**[1,2], A. Connelly[3], I. E. Scheffer[3,4,5,6] and S. J. Wilson[1,2], (1)Melbourne School of Psychological Sciences, The University of Melbourne, Melbourne, VIC, Australia, (2)Florey Institute of Neuroscience and Mental Health, Melbourne, VIC, Australia, (3)Florey Institute of Neuroscience and Mental Health, Melbourne, Australia, (4)Department of Medicine, The University of Melbourne, Melbourne, Australia, (5)Department of Paediatrics, Austin Health, Melbourne, Australia, (6)Department of Neurology, Royal Children's Hospital, Melbourne, Australia*

Background: Functional MRI research has shown that individuals with Autism Spectrum Disorder (ASD) demonstrate atypical neural responses while processing emotional prosody in speech. Specifically, enhanced activation in brain regions for attention and executive function has been reported in ASD, suggesting a greater reliance on cognitive resources to process emotional cues in the voice. Previous studies have not utilised nonlinguistic emotional stimuli or vocal affect bursts (e.g., laughter, screams), although these expressions represent purer markers of affective states that do not contain the linguistic and semantic components of prosodic speech. Further, most studies have employed implicit tasks and ratings of emotional intensity or valence to elicit brain activation, instead of using tasks that explicitly assess the identification of emotions in vocal stimuli.

Objectives: We aimed to examine brain activity associated with the recognition of vocal affect bursts in ASD using a forced-choice discrimination task.

Methods: We assessed 16 participants with high-functioning Autism and 16 healthy controls (12 males per group) matched on age (M_{ASD} =23.00, $M_{Controls}$=23.19) and Full-Scale IQ (M_{ASD}=112.56, $M_{Controls}$=116.88). The in-scanner paradigm included blocks of tasks assessing emotion recognition (experimental condition) and gender recognition (baseline condition). On the emotion task, participants listened to vocal affect bursts representing the six basic emotions and identified the correct emotion from two options. On the gender task, participants listened to neutral voices and identified whether the speaker was male or female. We specified an "emotion > gender" contrast to isolate activity related to the cognitive and affective processes that underlie vocal emotion recognition.

Results: Analysis of in-scanner task performance revealed no significant difference in emotion recognition accuracy between both groups, suggesting that the ASD group reliably performed the task. Despite this, whole-brain, fixed effects analyses revealed that the ASD group demonstrated significantly higher activation across several brain regions at a cluster-corrected threshold. These included regions sensitive to emotional voices, such as the left inferior frontal gyrus and superior temporal sulcus, which belong to the mirror neuron system (MNS). The ASD group also showed more activation in structures for autobiographical memory retrieval (e.g., bilateral hippocampus, precuneus, posterior cingulate cortex) and visual processing (e.g., bilateral occipital gyri, fusiform gyri). Other regions of enhanced activation included the bilateral angular gyri and cerebellum. No region with significantly lower activation was found in the ASD group.

Conclusions: Compared to healthy controls, participants with ASD required greater activation across multiple brain regions to successfully perform the emotion task. Our findings suggest that the ASD group used additional cognitive effort to identify vocal affect bursts. It is possible that the ASD group relied more on compensatory strategies to perform the task, including cross-modal processing (e.g., mental imagery) and self-referential processing (e.g., autobiographical memory retrieval). Greater activation in the inferior frontal gyrus and superior temporal sulcus also indicates atypical MNS response to the recognition of vocal affect bursts in ASD. Our findings are consistent with fMRI research on emotional prosody perception in ASD, suggesting that enhanced brain activation to emotional voices is robust across different vocal stimuli and task demands.

65 **127.065** Brain Correlates of Automatic Detection of Emotional Prosody in Children and Adults with Autism Spectrum Disorders

M. Gomot[1], *J. Charpentier*[1], *J. Malvy*[2], *F. Bonnet-Brilhault*[3], *E. Houy-Durand*[1] *and M. Latinus*[4], *(1)UMR930 Inserm, Université François-Rabelais de Tours, Tours, France, (2)CHRU Tours, Tours, France, (3)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (4)UMR INSERM U930, Tours, France*

Background: Although intolerance of change is a main feature of Autistic Spectrum Disorder (ASD), the brain processes underlying this aspect of the disorder remain poorly understood. This oversensitivity to changes may lead to an inability to adapt to new sensory inputs, and especially to the ever changing social environment. In this respect the processes involved in pre-attentional detection of changes in stimulus features have been investigated in ASD using the mismatch negativity (MMN), an event-related potential that reflects error detection caused by a deviation from a learned regularity. Although ASD is also characterized by an inability to detect and adapt to changes in emotional states, only few MMN studies in this population have investigated automatic deviancy detection in an emotional context. These studies used different deviant emotions that where always compared to neutral standards, and showed that emotional MMN was smaller or less lateralized in ASD than in controls.

Objectives: In order to determine if particularities observed in emotional prosody processing are related to emotion processing or to change detection abnormalities, the present study addresses direct comparison of automatic change detection of neutral and emotional deviants with strictly controlled acoustic parameters, in children and adults with ASD.

Methods: Thirty-two adults (16 typical; 16 ASD) and thirty 7-12 years old children (15 typical; 15 ASD) were presented with two voice deviants, neutral (p=.085) and angry (p=.085) (prosodic variation of the vowel 'aaa') embedded in a repetitive sequence of neutral stimuli. Brain electrical activity was recorded using a 64-channels Biosemi EEG system, while participants were watching a silent movie. MMN was measured for each condition as the subtraction of the stimuli presented in an equiprobable sequence from the same deviant stimuli in the oddball sequence.

Results: Comparisons of age groups during typical development indicate a late maturation of the brain processes associated with emotional prosody discrimination. Findings in both children and adults with ASD revealed an overall impairment of change detection with an earlier MMN and a larger P3a compared to controls. In children with ASD, the amplitude of the responses to voice stimuli from the equiprobable sequence was smaller than in controls for both the neutral and the emotional prosody, as where the responses to deviancy, and with no modulation of change detection by emotion. In adults with ASD responses to voice stimuli were found normal regardless prosody. Though the discrimination between different vocal emotions seems efficient, the MMN to neutral and emotional deviancy presented atypical brain distributions.

Conclusions: The detection of prosody deviancy was found altered in children with ASD, together with atypical responses to voice, and this regardless of expression. In adults despite a normalization in voice processing, the detection of vocal deviancy remains affected. Altogether these findings suggest that voice and prosody processing can improve with age in ASD, but that the lack of expertise in vocal encoding during childhood would lead to a long lasting difficulty in the online processing of emotional changes, which potentially plays a crucial role in social interaction deficits.

66 **127.066** Brain-to-Brain Synchrony during Social Cooperation in Autism – a NIRS-Based Hyperscanning Study

J. A. Kruppa[1,2], *V. Reindl*[2,3], *J. Prinz*[2], *E. Oberwelland Weiss*[1,2], *C. Gerloff*[4], *W. Scharke*[2], *K. Konrad*[1,2,3], *B. Herpertz-Dahlmann*[2] *and M. Schulte-Ruther*[1,3], *(1)Cognitive Neuroscience, Institute of Neuroscience and Medicine (INM-3), Research Center Jülich, Jülich, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, University Hospital RWTH Aachen, Aachen, Germany, (3)JARA Brain, University RWTH Aachen & Research Center Jülich, Aachen, Germany, (4)Advanced Analytics, School of Business and Economics, RWTH Aachen University, Aachen, Germany*

Background: In healthy adults, synchronization of brain activation has repeatedly been demonstrated during joint social tasks, and may play an important role for successful dyadic social interaction. Pioneering studies have demonstrated diminished brain-to-brain synchrony in adults with autism spectrum disorder (ASD) during such tasks, e.g. during performance of a real-time joint-attention task. To date, no study has investigated brain-to-brain synchrony in children with ASD during social interaction. Importantly, the familiarity of the interaction partner (i.e. a familiar person or a stranger) may modulate synchronization of brain activation.

Objectives: We investigated brain-to-brain synchrony in children and adolescents with and without ASD during a social cooperation game that the participants played with either a parent or an adult stranger as their interaction partner.

Methods: Using functional Near-Infrared Spectroscopy (fNIRS) hyperscanning, we assessed brain-to-brain synchrony during performance of a cooperative and a competitive computer game in 43 typically developing (TD) children, 15 children with ASD (8-18 years, all males) while playing with one of their parents, mostly mothers. In addition, adult strangers performed the identical game with each participating child. Participants were instructed to either respond jointly (as simultaneously as possible) via button press in response to a target (cooperation task), or to respond faster than the other player (competition task). Within each dyad, wavelet coherence was calculated for corresponding channels as a measure of brain-to-brain synchrony.

Results: On the behavioral level, preliminary results showed that the dyad's cooperative performance was neither influenced by the interaction partner (parent or stranger) nor by the group (TD or ASD group). However, during competition, the child won more often against the parent than against the stranger, and children with ASD won more often against parent/stranger than TD children. On the neural level, preliminary results revealed a significant interaction of partner and group for coherence in channels 2 and 4, which correspond to Brodmann areas 8 and 9. Breaking down the two-way interaction, results revealed that coherence in the ASD group was significantly smaller when playing with the parent compared to an adult stranger. No significant effect of partner was observed in the TD group.

Conclusions: Data collection in the ASD sample is ongoing. Preliminary results suggest differential coherence in ASD with respect to the familiarity of the interaction partner. In a larger sample it remains to be seen, whether fNIRS hyperscanning represents a valuable tool for investigating brain synchrony during social tasks as a proxy for typical and atypical social interaction. To this end, we will also analyze the relation of brain-to-brain synchrony with symptom severity measures and treatment related changes.

67 **127.067** Broadly Reduced Intrinsic Functional Connectivity in Girls Compared to Boys with Autism Spectrum Disorders

L. Olson[1,2]*, A. C. Linke*[2]*, L. E. Mash*[1,3]*, M. A. Reiter*[1,3]*, R. A. Mueller*[1,2] *and I. Fishman*[1,2]*, (1)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA, (2)Brain Development Imaging Laboratories, San Diego State University, San Diego, CA, (3)Brain Development Imaging Laboratories, Department of Psychology, San Diego State University, San Diego, CA*

Background: The high male:female prevalence ratio of autism spectrum disorders (ASDs) has been recognized dating back to Leo Kanner's initial description in 1943 (Kanner, 1943). The majority of research studies in autism reflect this strong male bias. Although a growing body of research suggests that ASDs may affect females differently than males (Werling & Geschwind, 2013), little is known about possible female variants. Further research with adequate samples is necessary to inform our understanding of gender-related neurobiological differences in ASDs. Knowledge of gender-specific differences in ASDs promises to inform novel, targeted therapeutic interventions (Constantino, 2017).

Objectives: Investigate gender-based differences in iFC, and within- versus between-domain connectivity, in children and adolescents with and without ASDs.

Methods:

Resting-state functional MRI data for 142 children and adolescents (ages 7-18 years) were selected from the Autism Brain Imaging Database Exchange (ABIDE I and II; n = 111; DiMartino et al., 2014 & 2017) and an in-house sample (n = 31), with 70 datasets from children with ASDs (36 females) and 72 datasets from typically developing (TD) children (36 females). Within each diagnostic group, boys and girls were matched on age, handedness, cognitive functioning, head motion, and study site. Group independent component analysis (ICA) and dual-regression were used to generate intrinsic functional networks for each subject. The spatial maps were thresholded at 90th percentile to extract separate functional clusters (ROIs). Functional connectivity (FC) was estimated by generating intra-individual ROI-ROI correlation matrices, with mean connectivity matrices averaged across participants. ROIs were categorized into three domains: sensorimotor, default mode, and executive. Chi-square tests of independence were used to test for differences in the proportion of significant within- and between-domain ROI-ROI correlations ($rs > |0.4|$).

Results: Within the TD group, boys (TD-B) showed significantly more positive correlations within the sensorimotor domain than girls (TD-G) ($X^2 = 14.7$, $p < 0.001$). TD-B and TD-G did not differ in their within- or between-domain connectivity for any other domains. In contrast, girls with ASDs (ASD-G) showed broad underconnectivity compared to boys with ASDs (ASD-B). Specifically, ASD-G showed fewer positive correlations between the sensory networks and executive and default mode networks ($X^2 = 5.11$, $p = 0.02$); fewer positive correlations within the DMN ($X^2 = 5.00$, $p = 0.03$); fewer positive correlations between the DMN and other domains ($X^2 = 15.78$, $p = < 0.0001$); fewer positive correlations within the executive domain ($X^2 = 6.12$, $p = 0.01$); and fewer positive correlations between executive and other domains ($X^2 = 10.85$, $p < 0.0001$).

Conclusions: We found a pattern of pervasive underconnectivity in girls compared to boys with ASDs, whereas in the TD group, gender differences in connectivity were seen only within the sensorimotor domain. Our study includes a substantially larger sample than previous reports. Use of ABIDE data, however, precluded inclusion of puberty status and hormonal changes, which are likely to affect brain organization.

68 **127.068** Cerebellar Topography in Autism and Rescue of Autism-Related Behaviors in Autism Mouse Models

ABSTRACT WITHDRAWN

Background:

Autism Spectrum Disorders (ASDs) are prevalent neurodevelopmental disorders marked by social impairments, repetitive behaviors, and cognitive inflexibility. Despite a prevalence exceeding 1%, underlyingmechanisms are poorly understood while targeted therapies and their guiding parameters are needed. Recent evidence has implicated the cerebellum in ASD pathogenesis, and we have recently demonstrated that cerebellar dysfunction is sufficient to generate autism-relevant behaviors in mice. However, the cerebellar topography regulating autism-related behaviors and the neural circuits regulating those behaviors remain poorly understood.

Objectives: to identify cerebellar topography and cerebellar-regulated circuits underlying autism-related behaviors

Methods: To achieve these objectives, we have combined genetic mouse models, MR imaging, and targeted, *in vivo* chemogenetic- mediated neuromodulation paired with *in vivo* electrophysiology and detailed behavioral analyses.

Results: Using these methods, we have identified the clinically implicated cerebellar sub-region, Right Crus I, as a critical region in the regulation of autism-related behaviors. We determine that inhibition of this domain is sufficient to generate social, repetitive, and inflexible behaviors in mice. Moreover, we demonstrate that stimulation of this sub-region is sufficient to rescue social deficits in an ASD mouse model even during adulthood. We then identified functional connectivity between right Crus I and cortical association areas, connectivity that is disrupted in this ASD mouse model and in children with ASD. Modulation of these cortical areas in turn mediates cerebellar-regulated ASD behaviors.

Conclusions: These findings, thus, not only further our mechanistic understanding of the cerebellar contribution to ASD but also offer novel therapeutic targets and strategies for the treatment of autism-related behaviors.

69 **127.069** Differences in Resting State EEG Spectral Power in Infants at Elevated Risk for ASD

M. J. Rolison[1]*, A. Naples*[1]*, T. McAllister*[1]*, T. Kim*[1]*, H. Reuman*[1]*, R. Tillman*[2]*, C. E. Mukerji*[3]*, K. K. Powell*[1]*, S. Macari*[1]*, K. Chawarska*[1] *and J. McPartland*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)University of Maryland, College Park, MD, (3)Harvard University, Cambridge, MA*

Background: Clinical diagnosis of autism spectrum disorder (ASD) can be made by two years of age, but experimental evidence suggests earlier emergence of differences in attention and brain activity in infants that later develop ASD. Prior work using resting state EEG has found attenuated spectral power in infants at elevated risk for developing ASD (HR-ASD) compared to normal risk (NR) infants (Tierney, 2012). Additionally, HR-ASD infants demonstrate different developmental trajectories compared to NR infants as indexed by spectral power. Resting state EEG offers an inexpensive, non-invasive measure of cortical activity, with potential to serve as a practicable biomarker of atypical development.
Objectives: Examine differences in resting EEG spectral power between HR-ASD and NR infants throughout the first two years of life.

Methods: EEG data was recorded from 41 HR-ASD and 42 NR infants at 3, 6, 9, 12, 18, and 24 months of age. At each time point, 2 minutes of EEG was recorded in a dimly lit room using a 128-channel HydroCel Geodesic Sensor Net. Infants sat on their parent's lap while a research assistant blew bubbles to keep them still. EEG data were filtered from 0.1-100 Hz, segmented into 1 second epochs, and baseline corrected. Bad channels were interpolated and epochs containing artifact were removed. EEG recordings that did not have a minimum length of 20s were omitted from further analysis. Spectral power was extracted from frontal regions of the scalp. Delta (2-4 Hz), theta (4-6 Hz), low alpha (6-9 Hz), high alpha (9-13 Hz), beta (13-30 Hz), and gamma (30-50 Hz) frequency bands were defined based on prior research examining EEG power in HR-ASD infants (Tierney, 2012). Both absolute and relative power were compared between groups at each time point.

Results: Preliminary analyses of relative power revealed lower high alpha power in HR-ASD infants at 9 and 18 months of age ($p=0.02$ and $p=0.01$, respectively). At 24 months of age, HR-ASD infants demonstrated lower levels of relative delta power ($p=0.04$) and greater relative theta power ($p=0.03$) than NR infants. Analyses of absolute power revealed greater low alpha power ($p=0.01$) and greater theta power ($p<0.01$) in HR-ASD infants at 24 months.

Conclusions: Preliminary results indicate both absolute and relative differences in spectral power bands between HR-ASD and NR infants. These findings expand upon prior work that has identified differences in delta, theta, and alpha power across development in infants at elevated risk for ASD. These results provide additional insight into typical and atypical neural development in the first two years of life. Ongoing analyses are examining spectral power differences among these developmental trajectories through the incorporation of phenotypic outcome data collected at 36 months of age.

70 **127.070** Diminished Neural Resources Allocation to Time Processing in Autism Spectrum Disorders

A. Lambrechts[1], *C. M. Falter-Wagner*[2,3] *and V. van Wassenhove*[4], *(1)City, University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)LMU Munich, Munich, Germany, (3)Institute of Medical Psychology, Faculty of Medicine, LMU Munich, Munich, Germany, (4)Cognitive Neuroimaging Unit, CEA DRF/Joliot/NeuroSpin, INSERM, Université Paris-Sud, Université Paris-Saclay, Gif/Yvette, France*

Background: Interval timing, the ability to judge the duration of short events, has been shown to be compromised in Autism Spectrum Disorders (ASD). Timing abilities are ubiquitous and underlie behaviours as varied as sensory integration, motor coordination or communication. It has been suggested that atypical temporal processing in ASD could contribute to some of the disorder's symptoms, in particular motor clumsiness and difficulties in social interaction and communication. Recent behavioural investigations have suggested that interval timing in ASD was characterised by intact sensitivity but reduced precision in duration judgements.
Objectives: In this study we investigated the processing of duration as compared to pitch in a group of high-functioning individuals with ASD using magnetoencephalography (MEG).

Methods: 18 adolescents and adults with ASD and 18 age- and IQ-matched typically-developing control (TDC) individuals compared two consecutive tones according to their duration or pitch in separate experimental blocks. MEG activity was recorded throughout the task. The analysis was carried out exclusively on physically identical stimuli (500 Hz tones lasting 600 ms), which served, according to instruction, as standard or probe in a Duration or Pitch task respectively.

Results: Our results indicate that compared to TDC individuals, individuals with ASD are less able to predict the duration of the standard tone accurately, affecting the sensitivity of the comparison process. In addition, contrary to TDC individuals who allocate resources at different times depending on the nature of the task (pitch or duration discrimination), our data suggest that individuals with ASD engage less resources for the Duration task than for the Pitch task regardless of the context.

Conclusions: Although individuals with ASD showed top-down adaptation to the context of the task, this neuronal strategy reflects a bias in the readiness to perform different types of tasks, and in particular a diminished allocation of resources to duration processing which could have cascading effect on learning and development of other cognitive functions such as turn-taking and motor coordination.

71 **127.071** Dynamic fcMRI Reveals Transient Atypical Connectivity Patterns in Adolescents with Autism Spectrum Disorders

L. E. Mash[1,2], *A. C. Linke*[3], *C. H. Fong*[3], *M. Falahpour*[4], *T. T. Liu*[4] *and R. A. Mueller*[3], *(1)Brain Development Imaging Laboratories, Department of Psychology, San Diego State University, San Diego, CA, (2)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA, (3)Brain Development Imaging Laboratories, San Diego State University, San Diego, CA, (4)Center for Functional MRI, Department of Radiology, UC San Diego, San Diego, CA*

Background: There is ample evidence of atypical static functional connectivity (FC) in autism spectrum disorders (ASDs). However, transient relationships between neural networks are not easily captured by conventional functional connectivity magnetic resonance imaging (fcMRI) methods. Dynamic FC approaches have been used to identify repeated, transient connectivity patterns ("brain states"), revealing spatiotemporal network properties that are not observable in static FC. Several recent studies using this method have found atypical dynamic FC in ASDs (Chen et al., 2017; de Lacy et al., 2017). However, the exact relationship between static and dynamic FC in ASDs remains unclear, as does the characterization of state-specific group differences.
Objectives: We aimed to (i) establish the relationship between static and dynamic FC in typical development (TD) and ASDs; (ii) describe group differences in transient states and compare these to static FC patterns; and (iii) examine temporal stability and flexibility between identified states.

Methods: Resting-state functional MRI data from 62 ASD and 57 TD participants were included, group-matched for motion, age, sex, handedness, and nonverbal cognitive ability. High-order group independent component analysis and dual-regression were used to generate maximally independent, functionally cohesive network regions of interest (ROIs) at the individual level. Static FC was calculated using entire time series.

Dynamic FC between ROI pairs was examined using tapered sliding windows, generating a temporally contiguous series of connectivity matrices. For each subject and ROI pairing, the standard deviation of FC (sd-FC) was calculated across all time windows. Windows underwent k-means clustering, generating four analogous brain states in each group.

Results: A one-sample t-test determined that across all ROI pairings, group differences in static FC primarily reflected hyperconnectivity in ASD (t(1080) = 12.06, p <.001); additionally, increased sd-FC in the ASD group predominated (t(1080) = 9.72, p < .001). There was a significant negative relationship between static FC and sd-FC in both the ASD (r = -.34, p <.001) and TD groups (r = -.29, p < .001). However, the strength of this association at the individual level was predicted by diagnosis in a general linear model, being weaker in individuals with ASD (β = .09, p =.04). While static FC group differences did not survive FDR correction, two dynamic states showed widespread significant group differences. In one of these states, relative within-network hypoconnectivity and between-network hyperconnectivity were observed for both default-mode and sensorimotor ROIs. This state was more likely to occur in participants with ASD (χ^2= 11.99, p < .001). No significant group differences were observed for time spent per state, mean dwell time, or state-switching frequency.

Conclusions: Higher static FC was associated with reduced variability over time, but this relationship was weaker in ASD participants. Group connectivity differences emerged in dynamic FC states that were not observed in the static FC analysis. Furthermore, findings in one state, which occurred more frequently in ASD participants, were consistent with previous evidence of reduced network integration and differentiation in ASDs. These results highlight the importance of dynamic approaches, and may explain discrepant findings in the static FC literature.

72 **127.072** Dysregulated Local Oscillatory Connectivity of the Visual System in Autism Spectrum Disorder

R. A. Seymour[1,2]*, G. Rippon*[2] *and K. Kessler*[2]*, (1)Department of Cognitive Science, Macquarie University, Sydney, Australia, (2)Aston Brain Centre, Aston University, Birmingham, United Kingdom*

Background:

Individuals diagnosed with Autism Spectrum Disorder (ASD) frequently report sensory overload (both hypo- and hyper-sensitivities), and display a distinct sensory processing style. However, the neurophysiological principles underlying this remain largely unknown. Recent non-invasive magnetoencephalography (MEG) autism research suggests one candidate mechanism may be disorganised local oscillations (neuronal rhythms) produced in response to sensory stimuli, combined with reduced top-down modulation.

Objectives:

We set out to investigate the oscillation-based connectivity within the visual system of ASD participants and matched controls. Specifically, we quantified local dysregulation through low-frequency alpha (7-13Hz) to high-frequency gamma (40-100Hz) phase-amplitude coupling (PAC); and feedforward versus feedback connectivity, using non-parametric granger causality.

Methods:

Whilst undergoing MEG, 17 participants (mean age = 16.63) diagnosed with ASD and 17 matched controls (mean age = 17.43, 15 analysed at present) performed an interactive visual paradigm, with embedded visual grating, designed to elicit non phase-locked high-frequency (40-70Hz) gamma oscillations. Both groups had movement less than 5mm and similar numbers of trials (mean ASD = 62.46, mean control = 62.33). All participants completed the Autism Quotient and Glasgow Sensory questionnaires, to asses the severity of ASD sensory symptoms.

Results:

As expected, presentation of the visual grating was accompanied by increases in gamma-band (40-70Hz) power and decreases in alpha-band (8-13Hz) power within the ventral occipital cortex. There were no statistical differences in power between groups at either frequency. However, there were differences between groups in the coupling (PAC) between the amplitude of gamma-band oscillations and the phase of alpha-band oscillations extracted from virtual electrode time courses in primary visual cortex (V1). The ASD group showed PAC between higher alpha (12-13Hz) and gamma frequencies (60-80Hz) than the control group (9-10Hz and 50-70Hz, respectively). We argue that this could be indicative of dysregulated oscillatory activity and an excitation-inhibition imbalance in autism. Next, virtual electrode time-courses were extracted from areas V1 and V4 to quantify directed functional connectivity from V1 to V4 (feedforward) and V4 to V1 (feedback), using Granger causality. Whilst feedforward connectivity was equivalent in both groups and elevated at gamma frequency (40-80Hz) in particular, V4 to V1 feedback connectivity was significantly reduced in the ASD group, especially at alpha frequency (~10Hz).

Interestingly, the strength of alpha-gamma PAC (9-10Hz; 50-70Hz) was correlated with the ratio between feedforward and feedback connectivity, for the control but not ASD group. Neurophysiologically, this suggests that processing within the visual system is locally segregated in autism, resulting in a stronger dissociation between peak gamma frequencies for PAC (~75Hz), power (~55Hz) and forward connectivity (~45Hz).

Finally, these MEG data will be regressed against self-report questionnaire data, to determine whether local connectivity is related to ASD sensory symptoms.

Conclusions:

Overall, our work suggests that the complex interplay of stimulus-related alpha and gamma oscillations within the human visual system could be dysregulated in autism. The ASD group showed typical patterns of oscillatory power and feedforward connectivity, but dysregulated oscillatory coupling between frequency bands (PAC) and reduced feedback alpha-band connectivity. These findings have implications for emerging neurocognitive theories of sensory processing in autism.

73 **127.073** Early Sensory Prediction Errors Are Less Modulated By Global Context in Autism Spectrum Disorder

J. Goris[1]*, S. Braem*[2]*, A. D. Nijhof*[3]*, D. Rigoni*[4]*, E. Deschrijver*[4]*, S. Van de Cruys*[5]*, J. R. Wiersema*[6] *and M. Brass*[1]*, (1)Department of Experimental Psychology, Ghent University, Ghent, Belgium, (2)Department of Psychology, Vrije Universiteit Brussel, Brussels, Belgium, (3)Institute of Psychiatry, King's College London, London, United Kingdom, (4)Ghent University, Ghent, Belgium, (5)Laboratory of Experimental Psychology, Brain & Cognition, KU Leuven, Leuven, Belgium, (6)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background: Recent theories of autism spectrum disorder (ASD) attempt to explain both social and sensory symptoms of ASD by using the predictive coding framework. Central to these domain general accounts is the hypothesis that individuals with ASD are less flexible in modulating local prediction errors as a function of global top-down expectations. Though some studies already provided preliminary support for these recent

theories, this main hypothesis remains to be tested.
Objectives: As a direct test of this central hypothesis, we used electroencephalography (EEG) to investigate whether local prediction error processing was less modulated by global context in ASD.

Methods: A group of 24 adults diagnosed with ASD was compared to a gender-, age- and IQ-matched group of 24 neurotypical adults on a well-validated hierarchical predictive coding paradigm. In this auditory oddball task, participants listened to short sequences of either five identical sounds or four identical sounds and a fifth deviant sound. The latter condition is known to generate the mismatch negativity (MMN) component, believed to reflect early sensory prediction error processing. Crucially, we manipulated the relative frequency of deviant sound sequences across blocks, as previous studies have shown that in blocks with frequent deviant sound sequences, top-down expectations seem to attenuate the MMN. We predicted that this modulation by global context would be less pronounced in the ASD group.

Results: Both groups showed a MMN that was modulated by global context. However, this effect was significantly smaller in the ASD group as compared to the neurotypical group. In contrast, the P3b, as an electroencephalographic marker of conscious expectation processes, did not differ across groups.

Conclusions: Our results demonstrate that the MMN was less modulated by global context in the ASD compared to the neurotypical group. These findings confirm the central hypothesis of contemporary predictive coding accounts of ASD, indicating that individuals with ASD are less flexible in modulating their low-level prediction errors according to more global contexts. Therefore, this study provides an important piece of evidence for these domain general theories of ASD.

74 **127.074** EEG DATA Processed By Advanced Machine Learning Systems ALLOW an Accurate Differential Diagnosis between ASD Children and Children with Other Neuro-Psychiatric Disorders.

E. Grossi[1], *M. Buscema*[2] *and R. J. Swatzyna*[3], *(1)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (2)Semeion Research Centre, Roma, Italy, (3)Tarnow Center for Self-Management, Huston, TX*

Background: In a previous study the authors have shown the ability of a novel kind of Machine Learning System(MLS) named MS-ROM/I-FAST developed by The Semeion Research Institute in Rome to extract interesting features in computerized EEG that allow an almost perfectly distinction of ASD children from typically developing ones. The proof of concept study, published in 2017 in Computer Method and Programs in Biomedicine showed accuracy values near to 100% using training-testing protocol and to 84% - 92.8% using Leave One Out protocol. The similarities among the MLS weight matrixes measured with apposite algorithms were not affected by the age of the subjects suggesting that the MLS do not read age-related EEG patterns, but rather invariant features related to the brain's underlying abnormalities.
Objectives: The aim of the study is to assess how effectively this methodology distinguishes ADS subjects from children affected with other neuro-psychiatric disorders .

Methods: Twenty definite ASD subjects and twenty subjects with neuropsychiatric disorders matched for age and gender distribution observed at Tarnow Center for Self-Management, Huston (US) were included in the study. The two groups had the same age range (4-14 yrs) and male/female ratio (14/6). ASD patients received independent Autism diagnoses according to DSM-V criteria, subsequently confirmed by a qualified psychiatrist using the ADOS scale. No autistic child was affected by genetic conditions and/or cerebral malformations documented by neuroimaging and epilepsy. In the comparison group the range of primary diagnoses was the following: Attention-Deficit Disorder (N= 13), Disorder of social functioning(N=3), Anxiety disorders(N= 2), Major depressive disorder(N= 1), Specific developmental disorders of scholastic skills(N=1). A continuous segment of artefact-free EEG data lasting 10 minutes in ASCCI format was used to compute multi-scale entropy values and for subsequent analyses. A Multi-scale ranked organizing map (MS-ROM), based on the self-organizing map (SOM) neural network, coupled with the TWIST system (an evolutionary system able to select predictive features) created an invariant features vector input of EEG on which supervised machine learning systems acted as blind classifiers.

Results: After MS-ROM/I-FAST preprocessing, twelve features were extracted representing the EEG signature. Acting on these features the overall predictive capability of different machine learning systems in deciphering autistic cases from other NP disorders ranged between 93% and 97.5% (Table 1). These results were obtained at different times in separate experiments performed on the same training and testing subsets. The similarities among the ANN weight matrixes measured with apposite algorithms were not affected by the age of the subjects.

Conclusions: This study demonstrates the value of EEG processing with advanced MLS in the differential diagnosis between ASD and other NP disorders confirming therefore the existence of a specific EEG signature in ASD.

75 **127.075** EEG Resting State Architecture Is Atypical in Children with ASD and Sleep Disturbances

T. Winkelman[1], *S. Hasselmo*[1], *K. A. McNaughton*[1], *T. C. Day*[1], *M. J. Rolison*[1], *K. S. Ellison*[1], *E. Jarzabek*[1], *B. Lewis*[1], *J. Wolf*[1], *S. Baddam*[2], *C. Canapari*[3], *T. McAllister*[1], *A. Naples*[1] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Yale University, New Haven, CT, (3)333 Cedar St PO Box 208064, Yale University, New Haven, CT*

Background: Sleep disturbance is common in Autism Spectrum Disorder (ASD), with between 40 and 80% of children with ASD reporting sleep difficulties, as compared to just 9 to 50% of typically developing (TD) children (Robinson-Shelton, 2016). Sleep disturbances and consequent sleep deprivation are reflected in increased absolute theta (4-8 Hz) power during resting state brain activity in both children and adults (Cajochen, 1995). While the resting EEG profile associated with sleep deprivation is established in the literature, relationships among resting state EEG profiles and sleep disturbances in children with ASD are poorly understood.
Objectives: To investigate relationships among sleep disturbances and resting state EEG power in children with ASD and TD. Study of sleep disturbances in the ASD population may provide important information about underlying neuropathology and potential subgroups of ASD.

Methods: Participants were children with ASD (n=31) and TD controls (n=16), aged 6-18. Parents and children completed measures of social functioning, anxiety, and problem behaviors. Parents additionally completed the Children's Sleep Habits Questionnaire (CSHQ), a validated 33-item measure of sleep problems; impaired sleep is defined as a CSHQ score ≥ 41. A resting EEG was collected from all participants. Participants sat for 60 seconds with their eyes open, followed by 60 seconds with their eyes closed. EEG data was filtered, segmented into 2-s epochs, and hand-edited for movement artifacts. Participants with less than 30 seconds of artifact-free data were excluded, resulting in a final sample of 13 children with ASD and 11 TD children.

Results: Consistent with the literature, 52% of children with ASD met CSHQ criteria for sleep impairment, as compared to 25% of children with TD, approaching a statistically significant difference in this small sample (p=0.08). CSHQ score did not correlate with measures of behavioral dysregulation from the Child Behavior Checklist. All children demonstrated global reduction of absolute theta power with increasing age (frontal: p=0.003, central: p=0.01, posterior: p=0.009; temporal p=0.01), consistent with the expected developmental trajectory. Children with TD showed a positive correlation between CSHQ score and theta power along the midline (r=0.9, p<0.001), frontal (r=0.87, p=0.001), and central (r=0.65, p<0.001) regions of the scalp, whereas children with ASD showed no correlation between theta power and CSHQ score.

Conclusions: Findings demonstrate that children with ASD had higher rates of sleep disturbances, however do not exhibit the expected relationship between sleep problems and EEG spectral power that was seen in TD children. This atypical presentation of sleep problems suggests a potentially distinct neural mechanism of sleep disturbance in ASD. An EEG correlate of the disruption of the sleep/wake cycle in children with ASD provides an important area for future study.

76 **127.076** EEG-IP: An International Infant EEG Data Integration Platform for the Study of Risk and Resilience in Autism and Related Conditions

J. Desjardins[1], *L. A-Abbas*[2], *M. Cichonski*[3], *S. Huberty*[4], *S. J. Segalowitz*[5], *M. H. Johnson*[6], *T. Gliga*[7], *S. J. Webb*[8], *C. A. Nelson*[9], *H. Tager-Flusberg*[10], *S. Jeste*[11], *A. C. Evans*[12] *and M. Elsabbagh*[13], *(1)SHARCNET, St Catharines, ON, Canada, (2)Research Institute - McGill University Health Centre, Montreal, QC, Canada, (3)Brock University, St Catharines, ON, Canada, (4)Mcgill University, Montreal, QC, Canada, (5)Psychology, Brock University, St Catharines, ON, Canada, (6)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (7)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (8)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (9)Boston Children's Hospital, Boston, MA, (10)Psychological and Brain Sciences, Boston University, Boston, MA, (11)University of California, Los Angeles, Los Angeles, CA, (12)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (13)McGill University, Montreal, PQ, Canada*

Background: EEG is a widely available, non-intrusive and powerful method for capturing aspects of brain behaviour. There has been an increased interest in using EEG to identify neurological markers of ASD that precede the onset of behavioral symptoms. However, EEG lacks standards in acquisition and processing, and is prone to noise contamination (Movement, EMG, EOG, ECG), particularly when working with populations with neurodevelopmental disorders and infants. Additionally, while infant samples are important in studying early risk markers of autism, most studies remain limited by small sample size.

Objectives: We established a new International infant EEG data-integration platform for the study of risk and resilience in autism (EEG-IP). The platform includes three components: (1) A data repository of >4,000 recordings on approximately 700 infants at risk and controls collected across four laboratories; (2) A generalizable and highly optimized signal extraction pipeline that maximizes the isolation of signal and noise in large-scale EEG data recordings; (3) A signal processing toolbox that optimizes the execution of analytic techniques for infant data.

Methods: Data integration of EEG recording is currently underway. In parallel, we validated the new analytic pipeline by exploring whether or not it can isolate the cortical signal to identify clearly event-related potentials (ERPs) and a reliable ICA decomposition at the individual infant level. 75 EEG recordings of 7-month old infants were drawn from EEG-IP. The visual stimulus procedure included a stimulus stream of human faces and non-face stimuli (phase scrambled version of the face stimuli). The recordings were preprocessed using the new Lossless pipeline that uses a sequence of robust measures to isolate spatially non-stationary channels and periods of time in the recording. This pipeline also performs the Adaptive Mixture Independent Component Analysis (AMICA) to isolate noise factors from cortical signal, as well as isolate the activation of specific cortical generators.

Results: Many of the procedures employed by the Lossless pipeline are computationally intensive and typical EEG pre-processing for ICA requires substantial manual interaction with the data. By optimizing this procedure for High Performance Computing (HPC) resources, and streamlining manual interaction to single annotation procedure, a sample of this size can be processed in days rather than weeks or months. From the output state of the processing pipeline we were able to extract pronounced ERPs emanating from various occipital regions of the cortex. Unlike more typical preprocessing pipelines, the output file contains all of the original data (nothing is removed that cannot be reinserted) so this signal isolation process does not restrict post-processing options.

Conclusions: Infants at risk for ASD are a traditionally difficult population to recruit, and the EEG-IP provides a sufficiently powered sample size for hypothesis testing at an unprecedented scale. However, this rests on our ability to extract valid individual-level data. The Lossless pipeline produces a state of EEG data with annotations regarding several fine-grained measures of signal quality and ICA decompositions, allowing researchers to perform complex analyses on the data, with the goal of identifying neurological differences between infants that do and don’t develop ASD.

77 **127.077** Effect of Cooperative and Non-Cooperative Social Interactions on Personal Space Regulation in Adults with Autism Spectrum Disorders: An fMRI Study

G. Silani[1], *C. Massaccesi*[1], *A. Grössing*[1], *M. Hubinger*[1], *L. Rosenberger*[1], *M. Candini*[2], *G. di Pellegrino*[2] *and F. Frassinetti*[2], *(1)University of Vienna, Vienna, Austria, (2)University of Bologna, Bologna, Italy*

Background: Personal Space (PS) is the space immediately surrounding an individual and it can be regulated during social interactions. Intrusion into this space by others can generate feelings of discomfort. Developmental and psychiatric disorders influence the regulation of PS. Importantly, in the case of autism spectrum disorder (ASD), characterized by deficits in interpersonal interaction, the regulation of PS is often altered compared to typically developing (TD) children [1] and/or not modulated by changes in the quality of experienced social interactions [2].

Objectives: This study aimed at extending the previous findings to the ASD adult population and to investigate the behavioral and neurophysiological underpinning of PS and its modulation by different types of social interactions.

Methods: Fifteen ASD and fifteen TD matched participants underwent fMRI investigation while performing a modified version of the stop-distance paradigm for measuring PS preferences. In particular, participants were presented with several prerecorded videos from a first person perspective: an actor moving a predetermined number of steps towards them. They were asked to specify how comfortable they felt in regard to the observed distance. In order to see the effect of social interaction on PS perception, participants and confederates played a repeated trust game session, in which cooperative and non-cooperative interactions were experimentally manipulated. After the game, participants were confronted a second time with the distance task, in order to measure PS preference variation due to the type of social interaction (cooperative or not) previously experienced.

Results: We observed a significant modulation of the trust game on the PS, as TD participants showed increased comfort toward the cooperative player and increased discomfort towards the non-cooperative one (Fig.1), associated with modulation of emotional brain areas (bilateral insula). Notably, we observed the same effect in the ASD population on the behavioral level, but reduced insular activity on the neural level, suggesting that the perception of a cooperative (or not) interaction is processed differently in the ASD population (Fig.2A,B). Moreover, ASD participants showed a general reduction of activity in the intraparietal sulcus, a region involved during the observation of approaching stimuli (Fig. 2C). Notably, a stronger approaching-bias observed in this region has been recently associated to higher sociability in healthy participants [3].

Conclusions: The findings suggest differences between ASD and TD individuals in processing the emotional saliency of an approaching person, as result of the type of social interaction previously experienced. A better understanding of the behavioral and the neuronal mechanisms behind PS perception and its modulation will improve our knowledge of the social deficits observed in ASD.

[1] Gessaroli et al., PLoS One (2013).

[2] Candini et al., Autism Res. (2017).

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78 **127.078** Effect of Eye Contact and Anxiety Symptoms on ERPs in Autism Spectrum Disorder and Schizophrenia

D. Stahl[1], *A. Naples*[1], *J. Wolf*[1], *K. A. McNaughton*[1], *T. C. Day*[1], *B. Lewis*[1], *E. Jarzabek*[1], *K. S. Ellison*[1], *M. R. Altschuler*[1], *S. Hasselmo*[1], *T. Halligan*[1], *T. Winkelman*[1], *E. Hamo*[1], *J. Foss-Feig*[2], *V. Srihari*[3], *A. Anticevic*[3] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: Individuals with Autism Spectrum Disorder (ASD) exhibit high levels of comorbid anxiety that can impede treatment, but the neural basis of this anxiety is under-characterized. Previous work studying early time course brain activity in anxiety and ASD has identified that the P100 and N170 ERP components are atypical in response to social stimuli. However, few have examined this brain activity transdiagnostically in interactive social contexts that better capture the reciprocal nature of social interactions.

Objectives: We examined brain responses to faces across diagnostic categories with vulnerabilities in social and anxious symptomologies. We assessed the relationship of categorical and continuous clinical characterization on brain activity.

Methods: 22 individuals with ASD, 23 with Schizophrenia (SCZ), and 31 TD adults (aged 18-48) participated. Eye tracking and EEG were used to measure brain response to reciprocal gaze. Participants looked at the mouth or eyes of a face; the mouth ("Mouth") or eyes ("Eye Contact") then opened. EEG data was recorded using an EGI 128 channel net at 500Hz. P100 and N170 components were recorded from temporal-parietal electrodes. Anxiety symptoms were measured using the State-Trait Anxiety Inventory (STAI) and Beck Anxiety Inventory (BAI). ASD symptoms were measured with the Autism Quotient (AQ), ADOS, and Social Communication Questionnaire (SCQ).

Results: ANOVAs were run with ERP component as dependent, and diagnosis, hemisphere, and condition as independent, variables. Main effects of condition for N170 amplitude, latency, and P100 amplitude were significant ($p<0.01$): Eye Contact increased N170 amplitude and decreased P100 amplitude and latency relative to the Mouth condition. There were no main effects of diagnosis. Across groups, increased STAI [$r(40)=-0.38$, $p<0.05$] and BAI total scores [$r(42)=-0.43$, $p<0.01$] correlated with faster P100 in the right hemisphere (RH) during Eye Contact. Greater anxiety correlated with smaller differences in P100 amplitude between Eye Contact and Mouth Movement [STAI $r(40)=-0.33$, $p<0.05$; BAI $r(42)=-0.32$, $p<0.05$]. Increased ASD traits on the AQ correlated with decreased P100 to Eye Contact [$r(71)=-0.32$, $p<0.01$]. Among individuals who did not show eye contact on the ADOS, BAI score was associated with decreased P100 latency [$r(5)=-0.93$, $p<0.05$]. On the SCQ, participants that looked at faces had slower N170s with increased STAI score [$r(10)=0.68$, $p=0.01$]. Those that did not had a marginally significant correlation between faster N170s and increased STAI score [$r(9)=-0.58$, $p=0.056$]. These correlations differed from each other ($p<0.01$).

Conclusions: Symptoms of ASD and anxiety modulate the P100 and N170. Consistent with previous research, greater anxiety related to faster P100 in the RH. Greater anxiety was also associated with smaller differences between P100 amplitudes in the Eye Contact and Mouth conditions. Previous research has found eye contact evokes stronger N170 responses than no eye contact. This indicates that individuals with greater anxiety ascribe similar amounts of attention to both Eye Contact and Mouth conditions. Increased symptoms of ASD correlated with slower P100 during Eye Contact. Lack of eye contact, an important social symptom in ASD, and anxiety significantly altered latency of both N170 and P100, suggesting that anxiety symptoms alter early processing of social information in this group.

79 **127.079** Effects of Autism on Emotional Sharing and Learning in the Anterior Cingulate

J. H. G. Williams[1], *L. Braadbaart*[2] *and G. Waiter*[2], *(1)Psychiatry, University of Aberdeen, Aberdeen, United Kingdom of Great Britain and Northern Ireland, (2)University of Aberdeen, Aberdeen, United Kingdom of Great Britain and Northern Ireland*

Background:

Impaired imitation in autism is well recognised but the developmental relationship between imitation and aspects of autism psychopathology, such as impaired empathy and shared emotion, is poorly understood. This is possibly because research has focussed on either manual imitation or emotional mimicry. We have created a task that blends facial stimuli expressing basic emotions, in which we systematically vary the relative quantity of each emotion being expressed. The task measures an individual's ability to evidence accurate discrimination between emotionally expressive stimuli of varying similarity by expression through imitation. Task performance shows good correlations with empathic traits.

Objectives:

To determine the neural correlates of facial imitation ability and to determine whether these are disrupted in autism.

Methods:

27 participants with autism (aged 9-20 yrs, 2 females, IQ 93-133; diagnosis confirmed using ADI-R; current severity assessed with Social Responsiveness Scale [SRS]), matched on age, sex and IQ to 25 control participants undertook the facial imitation task. Of the participants who

took part in the behavioural tasks, 17 participants with autism and 19 controls were able to complete the task during functional neuroimaging, in which they also completed a control task, viewing the same stimuli but instead enacting a previously learnt facial action in response to an instruction. In addition we utilised data from a previous study in which 20 adults undertook the same tasks during fMRI.

Results:

The ASD group should much lower levels of imitation accuracy on the behavioural task (ASD mean facial error=41.82, SD=5.97; control group error=36.07, SD=3.38; df=50; t=4.229; p< .001). Imitation accuracy across the whole group correlated with self-reported and parent-reported empathy quotient, as well as SRS score. In the fMRI study, using the whole group and conservative statistical thresholds (p<0.05 FWE corrected for cluster), facial imitation ability only correlated with activity in the genu of the anterior cingulate (ACCg) where activity was greater in the control task compared to imitation. Using this cluster as a region of interest we found significantly decreased activity in this area among the group with autism

Conclusions:

The ACCg serves to represent the value of actions to others and also signals differences between predicted and experienced action outcomes. We found that higher activity in this region when perception-action differences were greater predicted imitation accuracy and empathic traits. Low activity was associated with autism. We suggest that the ACCg plays a key role in the intentional control and learning of appropriate emotional responses to others' emotionally communicative actions. This is required for development of empathy, shared emotion and the cultural transmission of behaviour according to its emotional value. A number of studies have shown abnormal anatomy and neurochemistry in this region, suggesting that the reduced prediction error signal in ACCg (and easily measured facial imitation ability) may provide a practical target for therapeutic intervention.

80 **127.080** Effects of Oxytocin on Social Perception in Youth with ASD: A MEG Study

A. Korisky[1], *A. Goldstein*[2] *and I. Gordon*[3], *(1)Department of psychology, Bar-Ilan University, Ramat Gan, Israel, (2)Department of Psychology, Bar Ilan University, Ramat Gan, Israel, (3)Department of Psychology, Bar-Ilan University, Ramat-Gan, Israel*

Background: Autism spectrum disorders (ASD) are neurodevelopmental conditions characterized partly by core social dysfunction, impaired social motivation and interaction. Recent discoveries draw attention to the impact that intranasal administration of the neuropeptide Oxytocin (OT) may have on social behavior and perception in ASD. Several brain imaging studies in individuals with ASD highlighted OT's capacity to modulate "the social brain", however, there is a gap in the literature regarding the influences of OT on neural temporal dynamics. Thus, a comprehensive understanding of OT's influences on the brain in ASD requires the use of methods with superior temporal resolution, especially in children.

Objectives: This study aims to explore the impact of OT on temporal dynamics in ASD using magnetoencephalography (MEG) during a well-validated social perception paradigm. Extending on previous findings which pointed to OT modulation of ERP components in typically developed (TD) adults during a similar task, we focused on the P100, N170 and P250 components, which also tend to show atypical patterns in ASD. We hypothesize that OT will modulate the amplitude and latency of these components to resemble those of an age-matched TD group.

Methods: As a part of an ongoing study, we present initial data from seven youth with ASD (aged 12-18), who received a single dose of intranasal OT (24IUs) in a double-blind placebo-controlled study. Forty five minutes following administration, participants were scanned in the MEG. During each scan participants were presented with pictures of emotional eyes or vehicles and asked to identify the picture theme. An aged-matched TD group served as a baseline for comparison. For ethical reasons, TD participants did not receive OT/placebo.

Results: Preliminary results indicate that in our components of interest, OT indeed normalized brain activity in ASD to be more similar to that of the TD group (enhancing P100 and P250 amplitudes while reducing N170 amplitude). This effect was visible only for the amplitude but not for the latencies of the components. Interestingly, while this effect was present in all three components in the emotional identification condition, in the vehicles recognition condition, OT influenced only the P100 component.

Conclusions: These initial results provide the basis for essential understanding of the influences of OT on ASD neural activation from a new perspective. Being the first exploration of the impact of OT on the brain in youth with ASD using MEG, this study indicates that OT can modulate early stages of visual perception, especially during social stimuli. Our study addresses core issues regarding OT's impact on the social brain and social behavior in ASD and thus, in the future, may promote the development of more effective treatments for social deficits.

81 **127.081** Elevated Cortical Reactivity to Auditory Repetition Is Present at 8 but Not 14 Months in Infants with Later ASD

A. Kolesnik[1], *E. J. Jones*[2], *J. Begum Ali*[2], *T. Gliga*[3], *J. Guiraud*[4], *T. Charman*[5] *and M. H. Johnson*[6], *(1)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (4)Brookside Family Consultation Clinic, Cambridge, United Kingdom, (5)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Autism Spectrum Disorders (ASDs) are characterised by difficulties in social communication, restricted interests and repetitive behaviours, as well as sensory perturbations (APA, 2013). Previous work from animal models and the mature adult brain suggests that abnormal cortical excitability could underlie ASD aetiology (Rubenstein & Merzenich, 2003; Lee et al., 2017). Potential atypicalities in regulation of excitation/inhibition balance in early development could alter homeostatic interplay between perceptual mechanisms and result in ASD-phenotype. This would feed into novel treatment approaches to be administered prior to symptom onset and within a stage of augmented plasticity. Recent studies have suggested gamma-band activity may be a candidate neural marker of e/i balance regulation (Rojas, 2008,2014).

Objectives: In this longitudinal study, we examine whether infant siblings with later ASD show a distinct pattern of oscillatory activity and phase-locking responses to auditory repetition relative to those with typical development. We aim to expand on previous reports of atypical gamma-band activity in individuals with ASD and their first-degree relatives.

Methods: Infants with and without family history of ASD were tested in an auditory oddball paradigm at 8 and 14 months. Wavelet analyses were used to examine change in evoked gamma amplitude and low-frequency phase-locking in response to repeated standard tones. Analysis was constrained to location and frequency band where low-risk controls showed habituation effect to repetition, and then the model was applied to high-risk siblings. Infants were followed up at 36 months with standardised assessments of current ASD symptoms.

Results: Relative to high-risk infants with typical development, those with later ASD showed reduced habituation of evoked gamma at 8 months (40-60Hz, 30-150ms; [p=.012, h^2=.105]) and greater phase-locking (10-20Hz, 100-180ms; [p = .036, h^2= .06]) to repeated tones. A combined index of cortical hyper-reactivity was dimensionally associated with levels of parent-rated social impairment (SRS™) at 3 years as well as with reduced growth in Receptive Language skills between 8 months and 3 years across the whole sample [p = .032]. However, preliminary analysis suggested that reduced habituation did not appear to be present in the ASD group at 14 months (within the same time and frequency bands, all p values are above .05).

Conclusions: We present the first evidence for cortical hyper-reactivity to be present in infants with later ASD, before the onset of behavioural symptoms. The data is consistent with the literature on E/I balance as a potential mechanism underlying neurodevelopmental disorders, further suggesting that an imbalance can be detected during early stages of brain development. This effect did not appear to be present during the 14-month-visit. This could be due to the differences in the nature of the E/I balance itself and possible compensation strategies used by the auditory cortex in response to repetition (Mottron et al., 2006).

82 **127.082** Frontal Interhemispheric Coherence of the Electroencephalogram after Dolphin-Assisted Therapy in Children with Autism Spectrum Disorder

***F. Mulas**[1], P. Ortiz[1], P. ROCA[2], R. Gandia[1] and L. Abad[3], (1)Child Neurology, INVANEP-Instituto Valenciano de Neurología Pediátrica, VALENCIA, Spain, (2)INVANEP- Instituto Valenciano de Neurologia Pediatrica, VALENCIA, Spain, (3)Centros de Desarrollo Cognitivo RED CENIT, VALENCIA, Spain*

Background: Interhemispheric coherence of the electroencephalogram (IHC) show differences between Autism Spectrum Disorder (ASD) and typical development children (TD). This fact is congruent with connectivity disorder models in ASD.
Objectives: The aim of this study was to explore the frontal IHC in children with diagnosis of ASD before and after an intervention with dolphin-assisted therapy.

Methods: Frontal IHC was determined in 42 subjects with ASD (4-6 years old) before randomly assigning them to two therapeutic groups, one with dolphins (DAT) and one without dolphins (TIWD). Furthermore, a TD group (20 children) was added to compare the differences with ASD children.

Results: Frontal IHC was significantly lower in TD than ASD children (p<0.001). Alpha frequency in frontal IHC showed a significant reduction in both ASD groups compared to basal measurement (p<0.05), whereas this reduction was higher in DAT group (without reaching statistical significance).

Conclusions: Frontal IHC was higher in ASD than in TD children. The dolphin-assisted intervention did not show significant differences between the treated groups.

83 **127.083** Functional Integration of the Neural Theory-of-Mind Network and Its Relations to Children's Social Communication and Functioning

***C. E. Mukerji**[1,2], S. H. Lincoln[3], C. I. Hooker[4] and C. A. Nelson[2], (1)Harvard University, Cambridge, MA, (2)Boston Children's Hospital, Boston, MA, (3)McLean Hospital/Harvard Medical School, Belmont, MA, (4)Psychiatry Department, Rush University Medical Center, Chicago, IL*

Background: Theory of Mind (ToM) impairments may contribute to social communication and interaction deficits in autism spectrum disorder (ASD). Individuals with ASD show atypical neural activity and connectivity in the ToM network. Despite its relevance to understanding functional integration, few studies have evaluated effective connectivity of ToM circuitry, i.e., how different neural regions interact to support ToM reasoning versus other inferential processes, during childhood. Moreover, associations between effective connectivity and variation in social communication and interaction across typical (TD) and atypical child development remain unclear.
Objectives: This study aimed to (a) evaluate effective connectivity between key nodes of the ToM network, i.e., the precuneus and bilateral temporoparietal junction (rTPJ and lTPJ), and other brain regions during ToM versus non-ToM reasoning and (b) explore relations between these neural measures of functional integration and children’s social communication skills and everyday social functioning. We predicted that (a) TD children would demonstrate greater connectivity between ToM regions and other neural circuitry implicated in social cognition during ToM reasoning and (b) the strength of this functional coupling would be associated with individual variation in children’s social communication and functioning.

Methods: Participants were 32 TD children, ages 9-13. In the MRI scanner, participants completed a false belief task. In the experimental (ToM) condition, children listened to vignettes describing social scenarios and evaluated characters’ beliefs. In the control condition, they listened to non-social scenarios and made inferences about physical causality. Children also completed the Social Language Development Test, and parents completed the Social Skills Improvement System questionnaire.

Results: Generalized psychophysiological interaction (gPPI) analyses seeded in the precuneus, lTPJ, and rTPJ revealed distinct patterns of effective connectivity during ToM versus control conditions. Results were significant at a peak threshold of p<.001 with a cluster-wise false discovery rate correction (p<.05). The precuneus demonstrated greater connectivity with the left middle temporal gyrus (MTG), while the lTPJ showed enhanced connectivity with the bilateral superior temporal sulcus (STS). The rTPJ showed increased connectivity with several brain regions associated with social cognition, including the left dorsomedial prefrontal cortex (DMPC), pSTS/MTG, pre-supplementary motor area, and right cerebellum. Brain-behavior analyses revealed that greater coupling between the rTPJ and DMPFC showed a trend-level association with better social functioning (r_s=0.33, p=.078); diminished coupling between the precuneus and MTG was associated with better social communication, specifically using mental state inferences to explain others’ behavior (r_s=-0.41, p=.027).

Conclusions: Children demonstrated greater coupling of the rTPJ, lTPJ, and precuneus with a distributed set of neural regions implicated in social cognition during ToM relative to control conditions. Findings elucidate how key nodes of the ToM network interact with other regions to support mental state reasoning. Results also suggest that measures of effective connectivity during ToM index individual variation in children’s social communication and functioning. This work has important translational implications for studying social deficits in children with ASD. Exploring effective connectivity in atypical neurodevelopment could yield insight into disruptions in functional integration of the social brain. Moreover, effective connectivity measures may serve as potential metrics of heterogeneity in social development.

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127.084 Global and Local Scale Gamma-Band Activity within a Perceptual Organization Task in Individuals with and without Autism Spectrum Disorder

S. Naumann[1]*, U. Senftleben*[2] *and S. J. Webb*[3]*, (1)Humboldt-Universitaet zu Berlin, Berlin, Germany, (2)Technische Universitaet Dresden, Dresden, Germany, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA*

Background: In autism spectrum disorders (ASD), a bias to process local rather than global facial information (e.g., relations between face parts) has been proposed to be an underlying cause of impaired face processing. The temporal synchronization within and between cortical micro circuits, as measured by oscillatory gamma-band activity (GBA; > 25 Hz), offers an opportunity to examine how the brain integrates visual information into a coherent whole ("binding problem"). GBA findings are heterogeneous in ASD when compared to controls. Novel analytic approaches suggest coherence measures such as the inter-trial variability within subjects (inter-trial phase coherence; ITPC) and phase synchrony between electrodes (phase-locking value; PLV) to study processing efficiencies.

Objectives: We examined GBA amplitude, ITPC and PLVs in ASD individuals (n=20) and age- and IQ-matched neurotypical controls (N=25) during a perceptual organization task to investigate the hypothesis of an imbalance of local and global processing of faces.

Methods: Participants saw upright and inverted Mooney stimuli, which are degraded, two-tone pictures of human faces, and indicated face perception behaviorally (Face or No-Face). EEG was time-locked to the presentation of the stimuli.

Results: The pattern for Face and No-Face responses indicated significantly larger GBA for controls compared to individuals with ASD. ITPC analyses did not reveal any Group differences. Compared to ASD individuals, controls displayed larger phase synchrony for Face responses at posterior sites. For No-Face responses, synchrony pairs at frontal sites showed larger synchrony in controls compared to ASD individuals.

Conclusions: We detected lower levels of GBA for Face and No-Face responses in individuals with ASD, potentially indicative of a less effective activation of cortical micro circuits or impaired binding processes. Since ITPC did not differ between groups, ASD individuals do not seem to be inefficient in their local response to visual stimuli. Larger PLVs for controls (higher phase synchrony between electrodes) may suggest more elaborated communication on the global scale. In line with the framework provided by Kessler et al. (2016), our results suggest that local neural activity is similar in both ASD and neurotypical controls, but that the global, neural communication is less effective in ASD.

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127.085 Infants at High Risk for ASD Show Altered Functional Connectivity in Auditory Networks at 9 Months of Age

J. Liu[1]*, T. Tsang*[1]*, L. P. Jackson*[2]*, C. Ponting*[1]*, S. Jeste*[1]*, S. Y. Bookheimer*[3] *and M. Dapretto*[3]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)UCLA, Los Angeles, CA, (3)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: Altered functional connectivity is characteristic of developmental disorders involving language impairments such as autism spectrum disorder (ASD). Children with ASD show altered connectivity in several resting state networks compared to neurotypical controls (Uddin et al., 2013, Hernandez et al., 2014), suggesting that functional connectivity may provide a reliable biomarker of the disorder. In particular, connectivity with the right anterior insula, the hub of the salience network, is altered in ASD. In addition to its role in modulating attention to salient elements of one's environment, the insula has also been shown to be specialized for sensory and auditory-related functions as an integration hub for auditory stimuli (Bamiou et al., 2003; Oh et al., 2014). As such, altered functional connectivity between auditory regions and the insula early in life may predict future language outcome and ASD diagnosis.

Objectives: Here we use resting-state fMRI (rsfMRI) to characterize the developing auditory network and its connectivity with the right anterior insula in 9-month-old infants at high (HR) and low risk (LR) for ASD. Early differences in functional connectivity may predict altered developmental trajectories prior to overt language delays and the onset of ASD symptomatology.

Methods: During natural sleep, 8-minute rsfMRI scans were collected in 9-month-old infants. Preprocessing was performed using FSL. To correct for effects of head motion, an advanced ICA-based strategy for automatic removal of motion artifacts (ICA-AROMA; Pruim et al., 2015) was used. Auditory network connectivity was examined using left and right hemisphere Heschl's gyrus (HG) and superior temporal gyrus (STG) seeds from an infant brain template (Shi et al., 2011). Time-series extracted from processed residuals in standard space were correlated with every other voxel to generate functional connectivity maps. We examined group differences for functional networks associated with each seed separately. Next, we investigated connectivity between primary auditory cortex (left and right HG) and right anterior insula, the hub of the salience network. Lastly, differences in auditory network connectivity were related to behavioral indices of language development and ASD symptom severity collected at 12 and 18 months of age.

Results: Whole-brain correlation maps generated from left and right HG and STG seeds demonstrated that the auditory network was detectable in all infants. Between-group comparisons yielded significant differences in functional connectivity with HR infants showing hyperconnectivity between left HG and supplementary motor area. By contrast, LR infants showed stronger intrahemispheric connectivity between right STG and right temporo-parietal areas when compared to the HR group. Furthermore, HR infants showed hyperconnectivity between both left and right HG with right anterior insula. Auditory network connectivity and auditory-insular hyperconnectivity were positively associated with better language outcome at both 12 and 18 months, and less severe ASD symptomatology at 18 months.

Conclusions: At 9 months of age, the auditory network is hyperconnected with various cortical and subcortical regions in infants at risk for developing ASD. Early evidence of increased connectivity between these regions may reflect a compensatory mechanism in ASD risk.

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127.086 Interhemispheric Alpha-Band Hypoconnectivity in Children with Autism Spectrum Disorder (ASD)

A. H. Dickinson[1]*, C. DiStefano*[2]*, E. Lin*[3]*, A. W. Scheffler*[3]*, D. Senturk*[3] *and S. Jeste*[1]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)University of California Los Angeles, Los Angeles, CA, (3)UCLA, Los Angeles, CA*

Background: Autism Spectrum Disorder (ASD) has been associated with, and likely results from, aberrant neural connectivity, with patterns of decreased short range and increased long range connectivity generally described (Wass, 2011). The dynamics of neural oscillations in the alpha range (6-12 Hz) are exquisitely sensitive to healthy development of (Varokin, 2012), and disruptions to (Hinkley, 2011), functional and structural connectivity. Here we used electroencephalography (EEG) to quantify alpha-band functional connectivity in children with ASD across a range of cognitive abilities. Employing a data driven approach to analyze all possible short and long range connections allowed for an unbiased examination of all possible atypical connectivity patterns.

Objectives: We asked: (1) whether alpha band coherence in both long and short-range networks distinguishes children with ASD from typically developing (TD) children, and (2) whether alpha band coherence relates to developmental level and cognitive function within the autism spectrum.

Methods: We studied 59 children with ASD (mean age 69 months; range: 25-126) with nonverbal IQ ranging from 10-145 (mean NVIQ: 75) and 39 age matched TD children (mean age: 72 months; range: 29-146; mean NVIQ: 113). Spontaneous EEG was recorded using a high density 128 channel hydrocel geodesic sensor net (EGI inc.), and extensively cleaned through both manual inspection, and independent component analysis (ICA). To mitigate the effects of volume conduction, EEG data were transformed into current source density (CSD) using a spherical spline Laplacian transform. CSD estimates were then decomposed into the time-frequency domain using fast Fourier transform. Phase coherence within the alpha range was calculated between every possible electrode pair. A permutation test with a false discovery rate (FDR) adjustment for multiple testing was used to identify electrode pairs which demonstrated significantly different phase coherence between ASD and TD participants.

Results: Using a conservative FDR correction of 0.05, one electrode pair between left and right temporal regions showed significantly decreased phase coherence in ASD compared to TD children ($t(96)=4.20$, $P=.000$). Alpha phase coherence for this electrode pair was not associated with either age or IQ in the ASD group (age: $P=.193$; non-verbal IQ: $P=.267$, verbal IQ: $P=.215$).

Conclusions: Long range alpha band coherence between left and right temporal regions distinguished TD children from a heterogeneous group of ASD children. No association was found between long range connectivity and cognitive ability. Our results are consistent with previous research, suggesting that interhemispheric temporal hypoconnectivity represents a fundamental brain difference in children with ASD across a wide cognitive range. The findings presented here may reflect structural factors causing decreased neural communication (such as white mater disturbances), or increased signal variability at one (or both) temporal sites in ASD (neural noise). Future research will address the earliest developmental origins of aberrant spontaneous functional connectivity in infants at risk for ASD and will examine the specific behavioral consequences of these connectivity patterns.

87 **127.087** Investigating Social Reward Circuitry during Real-Time Peer Interaction in ASD

L. A. Kirby[1], *E. Sadikova*[2], *K. R. Warnell*[3], *M. G. Pecukonis*[4], *D. Moraczewski*[5] *and E. Redcay*[5], *(1)Yale Child Study Center, New Haven, CT, (2)Children's National Health System, Washington, DC, (3)Department of Psychology, Texas State University, San Marcos, TX, (4)Psychological and Brain Sciences, Boston University, Boston, MA, (5)Department of Psychology, University of Maryland, College Park, MD*

Background: Difficulties with social communication and social interaction, including reduced interest in both approaching and sharing information with peers, are core features of autism spectrum disorder (ASD). Some hypothesize that reduced social motivation in ASD is one cause of these social communication deficits. However, functional magnetic resonance imaging (fMRI) studies investigating the neural correlates of social motivation in ASD reveal inconsistent findings. Critically, these past paradigms do not involve social *interactions*, which is a core area of dysfunction in ASD. Rather, participants are asked to passively and independently view images (e.g., static photos of smiling faces), which may not approximate real-world social communicative contexts. This lack of reciprocal social interaction and real-world applicability is troubling since individuals with ASD perform within normal limits on non-interactive laboratory tasks related to social cognition, but may have the most difficulty in interactive social communicative contexts (Schilbach et al., 2013; Senju et al., 2009).

Objectives: The purpose of this study was to utilize a real-world interactive fMRI paradigm to investigate neural circuitry supporting social reward during reciprocal social interaction in ASD and neurotypical (NT) children.

Methods: 21 children with ASD (ages 7-14, three females) and 19 NT children (ages 8-14, three females) were informed they would be chatting online with a peer and a computer. The chat was simulated, but all children believed that the peer was real. Participants shared information about themselves with the peer and the computer, then during the “Reply” period, received either engaged (Peer: “Me too!”, Computer: “Matched!”) or non-engaged (Peer: “Away”, Computer: “Disconnected”) responses. For the current analyses, we focused on differences in neural activation between ASD and NT to the peer versus the computer during this “Reply” period.

Results: There were no differences between ASD and NT in a whole brain analysis when participants believed they were chatting with a peer versus a computer (“Me too!” vs. “Matched!”; $p<0.005$, k=20). Consistent with whole brain analyses, ROI analyses within classic reward regions (amygdala, ventral striatum, and ventral medial prefrontal cortex) revealed no group by condition interactions. However, posthoc analyses showed greater activation during the peer response in these reward regions in NT ($ps<0.05$), but not ASD participants. Whole brain and ROI analyses revealed no differences between ASD and NT when they believed they were chatting with a peer versus when they believed the peer was busy (“Me too!” vs. “Away”*;* $p<0.005$, k=20).

Conclusions: In summary, preliminary results suggest no differences between ASD and NT in classic reward brain regions when receiving a response from a peer. These findings suggest that the neural circuitry supporting social reward may be intact in ASD, and that perhaps other brain regions underlie the difficulties with social communication and social interaction that define the disorder. The investigation of neural and behavioral correlates of social reward within real-time social interactive contexts will help us better understand the core social deficits in ASD as well as typically developing children’s drive to orient to and interact with the social world.

88 **127.088** Language Associated Neural Responses of Infants at High Risk for ASD and Nonsyndromic Craniosynostosis

R. Wu[1,2], ***T. Halligan***[3], *A. H. Sun*[4], *M. J. Rolison*[3], *R. Cabrejo*[2], *C. Chuang*[2], *J. Yang*[2], *A. Wilson*[2], *N. Landi*[5], *L. Mayes*[2], *J. Persing*[2] *and J. McPartland*[3], *(1)Yale School of Medicine, New Haven, CT, (2)Yale University School of Medicine, New Haven, CT, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (5)University of Connecticut, New Haven, CT*

Background: Literature suggests that infants at high risk for autism spectrum disorder (HR-ASD) and nonsyndromic craniosynostosis (NSC), early cranial suture fusion, have similar language acquisition profiles. Essential in language remediation for these cohorts is early detection and prevention. Auditory event-related potentials (ERPs) measure passive neurological responses to speech sounds, suggesting a promising avenue for studying infant speech development. In particular, the mismatch negativity (MMN) quantifies perceptual narrowing and can predict future language development. The MMN component has demonstrated attenuated responses in HR-ASD infants compared to typically-developing (TD) controls. Previous work has established differences between the auditory ERPs of HR-ASD and those of metopic synostosis (MSO) and sagittal synostosis (SSO) infants. However, comparisons have not been made with coronal synostosis (CSO) or across groups of NSC.

Objectives: To characterize specificity of language acquisition in HR-ASD by comparing MMN responses to speech sounds between HR-ASD, CSO, MSO, SSO, and TD controls.

Methods: HR-ASD, NSC, and TD infants were recruited from the Yale Autism Program and Yale Craniofacial Clinic. Participants were presented with a non-native phoneme discrimination paradigm involving the Hindi retroflex phoneme /da/ and the dental phoneme /da/ in random order. Auditory stimuli were set at 80 dB, and EEG was recorded at 250 Hz with a 128-channel HydroCel Geodesic Sensor Net. Analysis focused on four electrode clusters: left and right frontal, and left and right central electrodes. The MMN component was calculated as the largest negative amplitude in the difference wave between 80-300ms after stimulus presentation. Statistical comparisons were performed with ANOVA and studentized T-tests.

Results: 12 HR-ASD, 5 CSO, 14 SSO, 14 MSO, and 34 age-matched TD infants were included in analyses. The MMN amplitudes measured in left frontal clusters were statistically different between cohorts (*p=0.043*). HR-ASD, SSO, and MSO infants produced attenuated left frontal responses compared to TDs (*p*=0.025, *p*=0.001, *p*=0.003). Between NSC cohorts, SSO and MSO infants had attenuated MMN responses in the left frontal clusters compared to CSO (*p*=0.022, *p*=0.04). MMN amplitudes in the left central clusters were also significantly different between cohorts (*p*=0.006). SSO and MSO infants demonstrated attenuation in the left central clusters compared to TDs (*p*=0.015). In comparison to HR-ASD, SSO produced attenuated right frontal and central clusters (*p*=0.031, *p*=0.008), while MSO demonstrated attenuated right central clusters (*p*=0.005). There were not differences between CSO infants and TD or HR-ASD infants.

Conclusions: This represents the largest ERP comparison of ASD with different subtypes of NSC. Results replicate earlier findings that HR-ASD infants respond with lower MMN amplitudes than TD infants. In comparison with SSO and MSO infants, our findings suggest that HR-ASD infants may manifest cerebral attenuation focal to the left frontal brain, the hemisphere responsible for language production. Importantly, CSO infants may represent an intermediary phenotype between TD and HR-ASD infants. This study begins to develop the early language profile of HR-ASD infants within the clinical context of different suture fusion synostosis. Results warrant future studies comparing language acquisition in HR-ASD and NSC.

89 **127.089** Role of Anxiety in the Neural Response to Faces in Children with ASD: Results from the ABC-CT Feasibility Study

T. Halligan[1], *A. Naples*[1], *B. Lewis*[1], *K. Chawarska*[1], *R. Bernier*[2], *S. Jeste*[3], *C. A. Nelson*[4], *G. Dawson*[5], *S. J. Webb*[2], *M. Murias*[6], *F. Shic*[7], *C. Sugar*[3] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)University of California, Los Angeles, Los Angeles, CA, (4)Boston Children's Hospital, Boston, MA, (5)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (7)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Background: Biomarkers of social-communication in autism spectrum disorder (ASD) are needed to obtain objective measures of social functioning. Furthermore, examining relationships among potential biomarkers and other measures of functioning within and across diagnostic groups is vital. There is high comorbidity of anxiety disorders in ASD; specifically, 40-84% of individuals with ASD have at least one co-morbid anxiety disorder. Exploring the role of anxiety on neural response to social stimuli measured with event related potentials (ERP) may provide insight into the complex relationship between anxiety and ASD and provide pertinent information regarding potential ERP biomarkers.
Objectives: Examine relationships between anxiety and neural response to faces in children with and without ASD.

Methods: Across five sites, ERPs were collected from 20 children with ASD [16 males; *M*=7.99±2.26 years] and 26 typically developing (TD) children [17 males; *M*=6.59±1.98 years] using a 128 electrode Geodesic Net. Children were presented with standardized photographs in two experiments: 1) 50 neutral and 50 fearful faces; 2) 72 upright faces, inverted faces, and upright houses. P100 and N170 ERP latencies were extracted from selected electrodes over the occipitotemporal cortex. Anxiety was measured with the *Childhood and Adolescent Symptom Inventory*, and analyses included *T*-scores from the General and Social Anxiety subscales. Group differences were examined using t-tests, and relationships between anxiety and neural responses were examined with correlational analyses.

Results: Participants were matched on sex, [$X^2(1,46)=1.19$, *p*=.34], but not IQ [*t*(44)=-4.59, *p*<.01], or age [*t*(44)=2.24, *p*=.03]. ASD children had higher symptoms of general anxiety [*M*=66.62±13.67] than TD children [*M*=42.95±3.95], [*t*(31)=7.34, *p*<.01] and higher symptoms of social anxiety [*M*=57.92±13.43] compared to TD children [*M*=45.05±4.40], [*t*(31)=3.40, *p*<.01]. Significant negative relationships were found between general anxiety and P100 and N170 latency to stimuli across hemispheres and conditions in Experiment 1 [all *r*'s(20)≥-.59, *p*'s<.01] and Experiment 2 [all *r*'s(20)≥-.47, *p*'s<.04] in TD children only. There were no significant relationships between general anxiety and neural response in ASD children in either experiment. For ASD children, social anxiety was negatively correlated with N170 latency to fearful faces in the right hemisphere [*r*(13)=-.59, *p*=.03], and upright faces in the left hemisphere [*r*(17)=-.50, *p*=.04]. There were no significant relationships between social anxiety and neural responses in TD children in either experiment.

Conclusions: Results indicate that general anxiety, but not social anxiety, affect TD neural response to stimuli regardless of content or emotional valence. Faster activation in individuals with heightened anxiety symptomology may reflect a neural index of hypervigilance. A different pattern was observed for ASD children; only social anxiety impacted neural response to condition-specific stimuli. These findings suggest that increased anxiety specific to core deficits in ASD (i.e. processing social information) relates to faster neural processing when presented with 1) fearful compared to neutral faces and 2) upright faces compared to inverted faces and upright houses. Results indicate that potential ERP biomarkers were sensitive to the effect of anxiety on neural processing, and specific in distinguishing differences between diagnostic groups.

90 **127.090** Language Perception in Infants at Risk for ASD：a Functional Near Infrared Spectroscopy Study

***F. Zhang**, P. Warreyn and H. Roeyers, Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background:
Researchers have gained interest in the early development of behaviour and brain functions in Autism Spectrum Disorder (ASD) over the past decade. In order to investigate such an early developmental issue, they started to study infants who have older sibling with ASD (HR) and thus have a high risk to develop ASD. The majority of individuals with ASD have difficulties in language processing, especially when they have to extract implicit social cues. There is increasing consensus that language impairments in ASD are linked to disturbances of brain functions. However, such

functional alterations related with language dysfunction in infants at risk of ASD have not yet been fully characterized.

Objectives:

In this study, we aimed to explore whether the brain response in HR infants differs from low risk (LR) controls by using functional near infrared spectroscopy (fNIRS). The developmental trajectory of brain functions related to language processing in HR infants was also observed through the comparison of different age groups.

Methods:

We recruited 5- and 10- month-old infants to participate in this language study. Infants were coming from two different groups including the HR group and LR group with no family history with ASD. All subjects underwent a 16-minute experiment with three sessions of fNIRS measurements. The first session was 5-min resting state, and the latter two sessions were 5.5-minutes speech tasks using forward and backward Dutch sentences respectively. Infants were held in the parent's arms or sat on the lap of the parent in a silent room with dim lighting. A NIRScout (NIRX, Germany/USA) device was used to measure the hemodynamic changes in bilateral neural activity of the brain. The probe holders were placed over the bilateral frontal, temporal and inferior parietal areas. To investigate possible patterns of brain response in HR infants in the process of language perception, changes in the hemodynamic response were recorded and compared between HR and LR infants in the language-related regions.

Results:

Our preliminary results suggested that 5-month-old infants with HR show less neural responses to speech stimuli in the left temporal areas than the LR group. During the non-speech task, there were no significant differences in the left temporal areas between these two groups. For 10-month-old infants, the changes in the oxygenated hemoglobin (Hb) showed a different pattern between speech and non-speech tasks in LR group but not in HR infants.

Conclusions:

Our initial results show a different neural response in the language brain regions in infants at high risk for ASD at 5 and 10 months. This suggests that language development may already be impaired in the first year of life in (some of the) infants in the HR group. A complete analysis on 40 participants in each group will be presented at the conference.

91 **127.091** Magnetoencephalographic (MEG) Gamma Oscillations and Sensory Sensitivity in People with and without Autism Spectrum Disorders (ASD)

E. V. Orekhova[1], *J. F. Schneiderman*[2,3], *S. Lundström*[4], *B. Riaz*[5], *N. Hadjikhani*[4,6], *O. V. Sysoeva*[1], *T. A. Stroganova*[1] *and C. Gillberg*[4], *(1)MEG-Center, Moscow University of Psychology and Education, Moscow, Russian Federation, (2)Department of Clinical Neurophysiology, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden, (3)MedTech West, Gothenburg, Sweden, (4)Gillberg Neuropsychiatry Centre, Department of Psychiatry and Neurochemistry, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden, (5)Department of Clinical Neuroscience, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden, (6)MGH/ Martinos Center for Biomedical Imaging/ Harvard Medical School, Charlestown, MA*

Background: People with ASD often demonstrate hypo- and hypersensitivity to sensory stimuli of different modalities. Altered balance between neural excitation (E) and inhibition (I) has been suggested as one of the mechanisms underlying ASD and is likely to contribute to the sensory sensitivity problems through affecting gain control properties of the neurons in sensory cortex (Isaacson and Scanziani, Neuron, 2011, 72:231-43). Neural oscillations in high-frequency (30-100 Hz, i.e. 'gamma') range are generated by local E-I circuits and are highly sensitive to changes in the E/I balance. Therefore, variations in gain control properties of the cortical circuitry may be reflected in intensity-related changes of gamma oscillations.

Objectives: In this study we sought to find E/I–related neurophysiological underpinning of abnormal sensory sensitivity in people with ASD by investigating properties of magnetoencephalographic (MEG) gamma oscillations and their modulation by intensity of visual stimulation (excitatory drive).

Methods: MEG was recorded in 20+20 high-functioning adults with and without ASD. Subjects watched high-contrast concentric gratings moving at 1.2, 3.6 or 6.0 deg/sec that effectively induced visual gamma oscillations in our previous study in children. We also recorded pupillary constriction as an indirect measure of excitatory drive. Sensory sensitivity was assessed in all participants using the Adolescent/Adult Sensory Profile questionnaire.

Results: Participants with ASD had higher sensory sensitivity ($p<0.05$). Increasing stimulus velocity led to stronger pupillary constriction - reflecting an increase in excitatory drive to the cortex **–** both in individuals with ASD and those without. The increase in excitatory drive was accompanied by highly significant acceleration of gamma oscillations and suppression of gamma response magnitude. The ASD group demonstrated weaker intensity-related suppression of gamma response, while no significant group differences in either amplitude or frequency of gamma response were found. In both groups the weaker suppression of gamma response correlated with higher sensory sensitivity.

Conclusions: The intensity-related changes in MEG gamma oscillations may be useful for characterization of E/I balance in the visual cortex and may provide biomarkers for clinical trial studies targeting E/I balance in ASD.

92 **127.092** Modulation of Emotional Face Processing By Visual Attentional Flexibility and Attention Deficit Hyperactivity Disorder (ADHD) Symptoms in ASD: Results from the ABC-CT Feasibility Study

M. R. Altschuler[1], *A. Naples*[1], *B. Lewis*[1], *G. Dawson*[2], *R. Bernier*[3], *S. Jeste*[4], *C. A. Nelson*[5], *K. Chawarska*[1], *S. J. Webb*[3], *F. Shic*[6], *Q. Wang*[1], *M. Murias*[7], *C. Sugar*[4] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)University of California, Los Angeles, Los Angeles, CA, (5)Boston Children's Hospital, Boston, MA, (6)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC*

Background: Face processing difficulties are common in ASD. In addition to social deficits, children with ASD often show impaired executive function(EF). Atypical face processing and impaired EF are also evident in ADHD, which often co-occurs in ASD. It is not known whether ADHD and visual attentional flexibility(VAF)—a type of EF that involves shifting, engaging, and disengaging visual-spatial attention—modulate ERPs to emotional faces in ASD.

Objectives: To examine whether ADHD and VAF modulate ERPs to emotional faces in ASD versus TD.

Methods: EEG and eye-tracking(ET) data were collected from children (4-11 years-old and *DAS-2* IQ ≥ 50) with ASD (n=25) and TD (n=26). For EEG, participants viewed neutral and fearful faces, while EEG was recorded with a 128-channel Hydrocel Geodesic net at 1000Hz. ERPs (P100, N170) were extracted over left(LH) and right(RH) hemispheres. For ET, participants completed a gap-overlap task, while fixations were recorded via a SR Eyelink 1000+ binocular eye-tracker at 500Hz. A central stimulus(CS) was displayed, followed by a peripheral stimulus(PS). PS was displayed while CS was on screen (overlap), immediately after CS disappeared (baseline), or 200 ms after CS disappeared (gap). VAF effects were calculated from reaction time(RT) to PS: disengagement (overlap-baseline), facilitation (baseline-gap), and gap (overlap-gap). *Childhood and Adolescent Symptom Inventory-5* measured ADHD inattention and hyperactivity/impulsivity symptoms. To examine effects of group and condition, ANOVAs were used for ERPs, and trial-level linear mixed effects modeling(LMM) was used for gap-overlap, controlling for IQ.

Results: In ASD, greater inattention related to slower P100 to fearful faces (LH; r=.69, p=.01), and greater hyperactivity/impulsivity related to slower N170 to fearful (LH; r=.59, p=.04) and neutral (RH; r=.56, p=.049) faces. In TD, greater inattention related to faster N170 to fearful faces (LH; r=-.46, p=.04). In ASD, greater inattention related to slower P100 to fearful versus neutral faces (LH; r=-.56, p=.048), and greater hyperactivity/impulsivity related to slower N170 to fearful versus neutral faces (LH; r=-.64, p=.02). Greater facilitation effect related to slower N170 to fearful versus neutral faces (RH; r=-.60, p=.04) in ASD, whereas greater gap effect related to faster N170 to fearful versus neutral faces (RH; r=.47, p=.02) in TD. Main effects of group were identified for gap-overlap RTs (p=.048), but not ERPs (p>.05). RTs were faster in ASD. Main effects of condition were identified for N170 and P100 amplitudes (p<.03) and gap-overlap RTs (p<.001). P300 will be extracted for future analyses.

Conclusions: Variability in EF-related ADHD symptoms and VAF modulate neural response to faces differently in ASD versus TD. Children with ASD with more ADHD symptoms showed slower neural responses to faces, whereas TD children showed the opposite. When comparing emotional faces, children with ASD with more ADHD symptoms showed slower neural responses to fearful versus neutral faces. Greater facilitation predicted slower neural response to fearful versus neutral faces in ASD, while greater gap effect in TD predicted the reverse. Therefore, brain response to faces may be modulated by orienting efficiency in ASD but by processing efficiency in TD, suggesting distinct relationships among EF and social perception in ASD versus TD.

93 **127.093** Mu Suppression during Action Execution and Observation in Low-Functioning, Young Children with Autism Spectrum Disorder

A. Kylliainen[1]*, P. Warreyn*[2]*, M. Miettinen*[3]*, T. M. Helminen*[1]*, K. Eriksson*[4] *and J. M. Leppanen*[1]*, (1)Tampere University, Tampere, Finland, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (3)University of Tampere, Tampere, Finland, (4)Tampere University and Tampere University Hospital, Tampere, Finland*

Background: There has been a discrepancy in literature whether the dysfunctional mirror neuron system (MNS) underlies the imitation difficulties in autism spectrum disorder (ASD). The attenuation of the EEG mu rhythm is considered to reflect the activation of the MNS. The suppression of the mu rhythm occurs not only when individuals execute actions but also when they observe actions. It has been suggested that differences in age, developmental level and symptom severity of a sample with ASD might explain why some studies have found a lack of suppression during the action observation in individuals with ASD whereas other studies have not.

Objectives: The aim of the study was to investigate mu suppression during the execution and observation of hand actions in low-functioning, young children with severe ASD. In order to study the effects of developmental level, we also had an IQ-matched comparison group of children with intellectual disability who did not show marked autistic behaviour. In addition there was a normative comparison group of age-matched typically developing children.

Methods: The original sample consisted of 58 children aged 2.5-6.5 years. The final sample included 12 children with ASD, 11 children with intellectual disability (ID) and 14 typically developing children (TD) who had a sufficient number of artefact-free trials. The EEG mu rhythm (7-11Hz) was measured using The EGI Geodesic 128-channel dense-array system whilst the children were shown 6-second video clips of object-directed hand actions (e.g., pressing a button), meaningless, non-object-directed hand actions (e.g., tapping a table with fingers), a non-biological movement (a slightly bouncing ball), or a white screen. In the action execution conditions, the children imitated the preceding object-directed action. The suppression was calculated as a ratio of mu band power between three action conditions (execute, observation of object-directed and non-object-directed actions) and the baseline conditions (non-biological movement and white screen).

Results: The repeated-measures ANOVA showed a significant main effect of condition (F (2, 34) = 25.644, p < .001), reflecting greater mu suppression over central region in the action execution condition as compared to other conditions. There was no main effects of hemisphere, group or any interaction effects involving these factors on mu suppression. Separate analyses of condition effects within groups revealed, however, that mu suppression was significantly different from baseline in the observation condition of object-directed action in the TD group only. The execution condition differed significantly from baseline in all groups. None of the groups showed significant suppression in non-object-directed condition (Figure 1).

Conclusions: The findings of the study provided no evidence for an ASD-specific deficit in MNS function, as assessed by group by condition interaction effect on mu suppression. Separate within-group comparisons were consistent with prior results showing significant mu suppression during observation in typically developing children but not in young, low-functioning children with ASD. This result was not, however, specific to children with ASD as a similar pattern was also found in children with intellectual disability, raising the possibility that the lack of mu suppression during action observation could relate to more general developmental difficulties.

94 **127.094** Neonatal Electrophysiological Biomarkers for Neurodevelopmental Disorder Risk

L. C. Shuffrey[1]*, P. E. Springer*[2]*, M. Potter*[3]*, H. J. Odendaal*[4]*, J. D. Nugent*[1]*, N. H. Brito*[5] *and W. P. Fifer*[1]*, (1)Division of Developmental Neuroscience, Columbia University Medical Center, New York, NY, (2)Paediatrics & Child Health, Stellenbosch University, Cape Town, South Africa, (3)Obstetrics and Gynaecology, Stellenbosch University, Bellville, South Africa, (4)Obstetrics and Gynaecology, Stellenbosch University, Cape Town, South Africa,* *(5)Department of Applied Psychology, New York University, New York, NY*

Background: Presently, the factors leading to ASD are unknown, with no specific biological, genetic, or environmental marker. But, there is abundant evidence of structural, functional, and morphological brain abnormalities in individuals with ASD. Although ASD can be reliably diagnosed as early as 2, the median age of diagnosis is approximately 4 years of age. Prior research has demonstrated that early intervention services from birth to 36 months of age can drastically improve neurodevelopmental outcome. Therefore, the identification of an objective neonatal marker of ASD has the potential to aid in detecting at-risk children who may benefit from early intervention services.

Objectives: Prior research has demonstrated that neonatal electroencephalography (EEG) during sleep is predictive of neurodevelopmental outcome in clinical and neurotypical populations. Although abnormal EEG power and coherence has been demonstrated concurrently in both children and adults with ASD, to our knowledge this is the first study to examine EEG power in neonates and subsequent autism risk.

Methods: Neonatal EEG was collected from healthy term newborns enrolled in the Prenatal Alcohol and SIDS and Stillbirth Network in the Western Cape province of South Africa. Average power for 10 frequency bands were computed for multiple 30-second epochs for a 10-minute period prior to a physiological challenge. We examined neonatal EEG power in active sleep in the low-frequency theta (2-9Hz), mid-frequency Alpha (10-12Hz), and higher-frequencies Beta (13-21Hz) and Low Gamma (22-36Hz). Neurocognitive outcome and autism risk were assessed between 30 and 38 months of age by The Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F) (n=198), the Brief Infant-Toddler Social and Emotional Assessment (BITSEA) (n=253), and the Bayley Scales of Infant Development III Screener (Bayley)(n=117).

Results: When controlling for gestational age at birth, sex, chronological age in months at the time of assessment, and multiple comparisons (Benjamini & Hochberg 5% False Discovery Rate), significant associations were found between neonatal EEG power during active sleep, autism risk, and expressive language ability. BITSEA ASD Risk scores were correlated with EEG power in the Theta frequency in the right temporal region (r(86)=.279, p<.005) where lower EEG power was indicative of higher autism risk. Although there were no significant correlations between the receptive language, gross motor, fine motor, or the overall cognitive scores, there were moderate correlations between the Bayley expressive language subdomain and EEG power in the Alpha, Beta, and Low Gamma frequencies in the left central, occipital, and frontal polar regions (Alpha left-central: (r(86)=-.453, p<.001); Alpha left-occipital (r(86) = -.450, p<.001); Beta left-central: (r(43)=-.434, p< .001); Low gamma left-central (r(43)=-.483, p<.001); Low gamma left-frontalpolar (r(44)=-.457, p< .001)). Specifically, higher EEG power in these frequency bands was indicative of superior expressive language ability.

Conclusions: Our preliminary results demonstrate robust associations for expressive language ability and modest associations between early neural biomarkers for autism risk. Further research to examine neonatal neural oscillations and subsequent developmental trajectories may contribute to our comprehension of atypical neurodevelopment. Data collection is ongoing.

95 **127.095** Neural Response to Emotional Faces and Anxiety in Children with Autism Spectrum Disorder

***K. S. Ellison**, J. Wolf, A. Naples, K. A. McNaughton, T. C. Day, T. Winkelman, M. J. Rolison, E. Jarzabek, B. Lewis and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Anxiety is highly prevalent in children with Autism Spectrum Disorder (ASD; White et al., 2009). While it is well established that children with ASD have an atypical brain response to emotional faces (Dawson et al., 2004), there is less research examining anxiety dimensionally and how this comorbidity may affect a child's neural response to social stimuli. This study investigated electrophysiological (EEG) brain response during a gaze-contingent paradigm that simulated face-to-face interactions.

Objectives: To examine the relationship between anxiety symptoms and face-processing event related brain potential (ERP) components in children with ASD with varying levels of anxiety.

Methods: ERPs were recorded from 24 youth with ASD (18 males, 6 females) and 22 typically developing (TD) controls (13 males, 9 females) using a 128 channel Geodesic Sensor Net). The sample was matched on age (ASD; *M:* 14.38, *SD:* 2.36, TD; *M:* 12.93, *SD:* 3.00) and IQ (ASD; *M:* 109.10, *SD*: 20.35, TD; *M:* 109.01, *SD*: 11.55). Participants were presented with 80 distinct photorealistic, animated faces matched for low-level visual features. Utilizing gaze-contingent eye tracking technology, stimuli responded to a participant's direct fixation to the face by exhibiting happy or fearful emotions. P100 and N170 amplitudes and latencies were extracted from selected electrodes over the occipitotemporal scalp. Difference scores were calculated as Fear minus Happy condition. Anxious symptomology was measured using the following standardized child self-report measures: The Multidimensional Anxiety Scale for Children (MASC-C) and Social Anxiety Scale for Adolescence/Children (SAS-A/SASC-R). Correlations were conducted between the ERP difference scores and standard scores on the anxiety measures. Eye-tracking analyses (data collected using an EyeLink-1000 remote camera system) are ongoing.

Results: In children with ASD, greater left N170 Amplitude to Fear vs. Happy was associated social anxiety (SAS-A/SASC-R Fear of Negative Evaluation [*r*(24)=.428, *p*=.04], and MASC-C Humiliation/Rejection [*r*(23)=.380, *p*=.07]). Additionally, children with ASD had a shorter P100 Latency to Fear vs. Happy associated with physical symptoms of anxiety (MASC-C Tense/Restlessness [*r*(23)=-.616, *p* <.001], MASC-C Somatic/Automatic [*r*(23)=-.393, *p*=.06], MASC-C Physical Symptoms Total [*r*(23)=-.597, *p* <.001]), as well as overall anxiety (MASC-C Total [*r*(23)=-.406, *p*=.06]). Children in the TD group had a smaller right N170 Amplitude to Fear vs. Happy associated with social anxiety (MASC-C Humiliation/Rejection [*r*(22)=-.469, *p*=.03], MASC-C Performance Fears [*r*(22)=-.423, *p*=.05], MASC-C Social Anxiety Total [*r*(22)=-.479, *p*=.03]). Furthermore, the TD group had a smaller right P100 Amplitude to Fear vs. Happy associated with social anxiety (MASC-C Performance Fears [*r*(22)=-.427, *p*=.05], MASC-C Social Anxiety Total [*r*(22)=-.426, *p*=.05]). No other significant associations were found between the N170 or the P100 Amplitude or latencies and the other subscales of the SAS-A/SASC-R

Conclusions: Results demonstrate that anxiety influences brain response to emotional faces in ASD, providing information potentially useful for stratification in a heterogeneous population. Understanding the role of anxiety in relation to social-communicative biomarkers may lead to targeted, biologically informed treatments.

96 **127.096** Transdiagnostic Relationships Among Social Communication and Neural Response to Dynamic Social Stimuli

*K. Shulman[1], **K. S. Ellison**[1], J. Wolf[1], K. A. McNaughton[1], T. C. Day[1], T. Winkelman[1], M. J. Rolison[1], B. Lewis[1], E. Jarzabek[1], J. Foss-Feig[2], A. Naples[1], A. Anticevic[3], V. Srihari[3] and J. McPartland[1], (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: Individuals with Autism Spectrum Disorder (ASD) and individuals with Schizophrenia (SCZ) both experience deficits in social communication (Abdi & Sharma, 2004). Previous studies have found atypical brain response to faces in ASD at a facially sensitive event-related potential (ERP), the N170 (Bentin et al., 1996; McPartland et al., 2004). This study aimed to use an interactive social EEG paradigm to explore the relationships between social communication and brain response across diagnostic groups
Objectives: To explore the relationship between the N170 response to dynamic social stimuli and degree of social impairment across adults with diagnoses of ASD, SCZ and typically developing (TD) controls.

Methods: ERPs were recorded from 43 adults (16 with a diagnosis of ASD, 16 with a diagnosis of SCZ, and 11 TD controls) using a 128-electrode Geodesic Sensor Net. Utilizing gaze-contingent eye tracking technology, on-screen dynamic face stimuli responded to the participant's gaze by either directing or averting gaze. N170 amplitudes and latencies for both conditions were extracted from select electrodes. Social communication functioning was measured using standardized measures, the Autism Diagnostic Observation Schedule (ADOS-2) Module 4 (clinician-rated) and the Social Responsiveness Scale (SRS-2; self-report). Relationships were examined between ERP components and the ADOS-2 Module 4 total score and SRS-2 standard scores. Data collection is ongoing.

Results: A smaller N170 amplitude to averted gaze was associated with social communication impairment (SRS-2 Total T-score [$r(43)=-.310$, $p=.04$], SRS-2 Social Motivation T-score [$r(43)=-.319$, $p=.04$], SRS-2 Cognition T-score [$r(43)=-.287$, $p=.06$], SRS-2 Communication T-score [$r(43)=-.294$, $p=.06$], SRS-2 Awareness [$r(43)=-.146$, $p=.35$]). No significant associations were found between N170 amplitude to direct gaze and the SRS-2. Additionally, participants had a smaller N170 amplitude to direct gaze associated with the ADOS-2 Algorithm Total Score [$r(43)=-.291$, $p=.06$]. No significant associations were found between the N170 amplitude to averted gaze and the ADOS-2. Additionally, no significant associations were found between N170 latency and the SRS-2 or ADOS-2.

Conclusions: Results suggest that the ADOS-2 and SRS-2 measure distinct aspects of social communication associated with differential patterns of brain response to gaze-related stimuli, with the former being associated with direct gaze and the latter being associated with averted gaze. Response to averted gaze may reflect interpretation of the stimulus (e.g. as a sign of rejection or disinterest) and is thus more influenced by factors captured by the SRS-2, such as social motivation and cognition. In contrast, neural response to direct gaze may be more associated with observable gaze-related behaviors as measured by the ADOS-2. This suggests the importance of measuring social communication in a comprehensive fashion, utilizing multi-informant ratings across multiple measures.

97 **127.097** Neural Response to Eye Gaze Differentiates ASD Diagnostic Status Among Adults Meeting ADOS-2 Criteria

K. A. McNaughton[1], *A. Naples*[1], *T. C. Day*[1], *T. Winkelman*[1], *M. J. Rolison*[1], *T. McAllister*[1], *D. Stahl*[1], *S. Hasselmo*[1], *T. Halligan*[1], *B. Lewis*[1], *K. S. Ellison*[1], *E. Jarzabek*[1], *J. Wolf*[1], *J. Foss-Feig*[2], *A. Anticevic*[3], *V. Srihari*[3] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: Individuals with autism spectrum disorders (ASD) process social information differently than individuals with typical development (TD), as indicated by a slower latency of face-specific processing components (McPartland et al., 2004). However, there has been little investigation of the relationship between neural processing of social stimuli in individuals who have social communication challenges but do not receive an ASD diagnosis from a clinician compared to individuals who receive an ASD diagnosis.
Objectives: To examine the relationship between EEG response to faces, social communication symptoms, and autism diagnosis in a clinically heterogeneous population.

Methods: The study included (a) adults who met criteria for autism or autism spectrum on the ADOS-2 Module 4 and received an ASD diagnosis (n=20; male=15); (b) adults who met criteria on the ADOS-2 but did not receive an ASD diagnosis (n=10; male=8; DX: n=9 schizophrenia spectrum, n=1 generalized anxiety disorder); and (c) adults who did not meet criteria on the ADOS-2 and did not receive an ASD diagnosis (n=40; male=26). Groups did not differ on age or IQ, and the two groups that met criteria on the ADOS did not differ in their communication and social interaction totals (ps>0.05). Each EEG trial began with a crosshair in the upper, middle, or lower portion of the screen directing gaze to specific regions of a subsequently appearing stimulus (eye/nose/mouth region of a face or upper/middle/lower region of a house). The N170 event-related potential, a component reflecting early face processing, was segmented to the appearance of the face or house.

Results: There was a significant main effect of diagnostic group on N170 latency ($F(2, 67)=8.16$, $p<0.01$). Adults who met criteria on the ADOS and received an ASD diagnosis had significantly longer N170 latencies to all stimuli than adults who met criteria but did not receive a diagnosis ($p<0.01$) and adults who did not meet criteria ($p<0.01$). Adults who met criteria but did not receive an ASD diagnosis did not have significantly different N170 latencies from adults who did not meet criteria on the ADOS ($p=0.72$). There was a significant main effect of condition on N170 latency ($F(3, 201)=5.30$, $p<0.01$) and amplitude ($F(3, 201)=54.18$, $p<0.01$), with faster N170 components to eyes than mouths, noses, or houses, and more negative N170 components to facial features than houses. Among adults who met criteria on the ADOS, those who did and did not receive an ASD diagnosis differed significantly in their N170 latency to eyes ($p=0.01$), noses ($p=0.03$), and houses ($p=0.03$), but not mouths ($p=0.11$), with only the latency difference to eyes remaining significant after post-hoc correction.

Conclusions: The presence of differences in N170 latency between groups that scored similarly on the ADOS but had different diagnostic outcomes underscores the utility of N170 latency as a biomarker to differentiate individuals with ASD from individuals without an ASD diagnosis. This finding further highlights the importance of considering brain-based measures of social functioning, as they provide practicable and complementary information to commonly used clinical instruments such as the ADOS.

98 **127.098** Ouch and Yucks: Anxiety, Alexithymia and Empathetic Reactions in Autism

A. Lassalle[1,2], *N. R. Zurcher*[2], *C. A. Porro*[3], *F. Benuzzi*[3], *L. Hippolyte*[4], *E. Lemonnier*[5], *J. Åsberg Johnels*[6] *and N. Hadjikhani*[2,7], *(1)Psychology (Brain & Cognition), University of Amsterdam, Amsterdam, Netherlands, (2)MGH/ Martinos Center for Biomedical Imaging/ Harvard Medical School, Charlestown, MA, (3)Biomedical, Metabolic and Neural Sciences, Università di Modena e Reggio Emilia, Modena, Italy, (4)Service de Genetique Medicale, University of Lausanne, Lausanne, Switzerland, (5)centre expert autisme du limousin, CHU de limoges, Limoges, France, (6)Gillberg Neuropsychiatry Center, University of Gothenburg, Göteborg, Sweden, (7)Gillberg Neuropsychiatry Center, Gothenburg University, Gothenburg, Sweden*

Background: The circumstances under which empathy is altered in Autism Spectrum Disorder (ASD) remain unclear, as previous studies did not systematically find differences in brain activation between people with and without ASD in empathy-eliciting paradigms. In addition, these studies did not always monitor whether the differences between ASD and controls were primarily due to ASD "per se", or to conditions overlapping with ASD, such as alexithymia and anxiety.
Objectives: The present study aimed at (1) clarifying the difference of activations in the empathy network between people with and without ASD viewing a particular kind of empathy eliciting stimulus, and (2) investigating the influence of alexithymia and anxiety on those activation differences.

Methods: Functional Magnetic Resonance Imaging (fMRI) data were collected from 47 participants (22 with ASD) viewing pictures depicting the hands and feet of unknown others in painful, disgusting, or neutral situations. We focused our analysis on two contrasts: painful vs. neutral and disgusting vs. neutral. For those contrasts, we extracted whole brain (WB) activity and activity in Regions Of Interests (ROIs) of the empathy network (frontal pole, supplementary motor area, thalamus, anterior cingulate cortex, posterior cingulate cortex, anterior insula, post central gyrus, and parietal operculum). We also explored the influence of alexithymia and anxiety on WB and ROI activity for those two contrasts, using regression and correlation analyses.

Results: We found that participants with ASD had decreased activation for both contrasts compared with control participants. However, these differences disappeared when either alexithymia or anxiety (both more elevated in the ASD group than in the control group) were controlled for. For ROIs, alexithymia (but not anxiety or autistic traits) was correlated with activation in the frontal pole for painful stimuli (after correction for multiple comparison).

Conclusions: Our results suggest that empathy is affected in ASD but that this association is complex and not necessarily attributable to ASD "per se".

99 **127.099** Reduced Neural Activity of Social and Motor Networks in Children and Adolescents with Autism Spectrum Disorder and Developmental Coordination Disorder during Observation and Imitation of Social and Motor Actions

E. Kilroy[1], *C. Butera*[1], *L. A. Harrison*[2], *L. Aziz-Zadeh*[3] *and S. A. Cermak*[1], *(1)USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)California Institute of Technology, Pasadena, CA, (3)Occupational Science and Occupational Therapy; Psychology, University of Southern California, Los Angeles, CA*

Background: A growing body of literature suggests that children with ASD often have motor deficits and that these deficits may be related to social skills in ASD (Dziuk, 2007). Previous imaging work has shown that motor system networks (e.g., Action Observation Network [AON]) play a role in supporting intention understanding as well as imitation (Iacoboni, 2005). It is thus possible that mechanisms underlying motor impairments contribute to social deficits in ASD. To our knowledge, no study to date has investigated social and motor neural processing in ASD across a spectrum of social-motor stimuli nor has anyone compared such stimuli to clinical populations with motor impairments.
Objectives: (1) To assess how children and adolescents with ASD differ in social neural networks when observing and imitating social and motor stimuli compared to typically developing (TD) participants and individuals with developmental coordination disorder (DCD). (2) To assess how these differences may be related to group differences in social and motor skills assessed with the Social Responsiveness Scale (SRS; Constantino, 2003) and Movement Assessment Battery for Children (MABC-2; Henderson, 2007).

Methods: Data from thirteen high-functioning children and adolescents with ASD (mean age [years] 11.26±1.09), seven children and adolescents with DCD (mean age [years] 11.97±2.09), and sixteen TD participants (mean age [years] 11.25±1.41) were analyzed. Imaging data was collected on a 3-T Siemens MAGNETOM Prisma scanner. In the scanner, participants observed and imitated separately to three video stimuli conditions: 1) emotional expressions (i.e., Happy), 2) Non-Emotional expressions (i.e., wiggle nose) and 3) hand actions (i.e., cutting paper). Using a block design, each condition was randomly presented for 15-seconds followed by 15-seconds of rest. Standard preprocessing and motion scrubbing were performed. Direct whole brain comparisons between groups were made. The degree of social and motor skills were also analyzed to determine group differences in ability.

Results: During the observation task, the ASD group elicited less activation in social and motor regions (angular gyrus, amygdala) when observing emotional faces and increased activity when observing hand actions compared to TD participants. During the imitation task, TD participants showed increase activation in the left IFG when imitating emotional faces compared to the ASD group (p=.021), and when imitating hand condition compared to DCD (p=.022). Movement scores were significantly related to activity in motor regions (IFG) during the imitation task across groups (R=.405, p=.019). For children with ASD, activity in motor regions (inferior frontal gyrus) was also correlated with social ability (p<.05).

Conclusions: Our results indicate that motor regions are less active in ASD during observation and imitation. During imitation, activity in motor regions (inferior frontal gyrys) correlates with motor ability (MABC2 scores) across groups, and for social ability in the ASD group. These results may have implications for understanding heterogeneity within ASD along the axis of motor impairment, and in the long run, lead to individualized forms of treatment.

100 **127.100** Relating Measures of Sleep from Polysomnography Exams and Parent Questionnaires in Children with Autism

A. Arazi[1,2], *A. Tarasiuk*[3,4], *G. Meiri*[5] *and I. Dinstein*[6,7,8], *(1)Department of Cognitive and Brain Sciences, Ben Gurion University, Beer Sheba, Israel, (2)Zlotowski Center for Neuroscience, Ben Gurion University of the Negev, Beer Sheba, Israel, (3)Sleep-Wake Disorders Unit, Soroka University Medical Center, Beer Sheba, Israel, (4)Department of Physiology, Ben Gurion University of the Negev, Beer Sheba, Israel, (5)Soroka Medical Center, Beer Sheba, Israel, (6)Negev Autism Center, Ben Gurion University of the Negev, Beer Sheba, Israel, (7)Department of Psychology, Ben Gurion University of the Negev, Beer Sheba, Israel, (8)Department of Cognitive and Brain Sciences, Ben Gurion University of the Negev, Beer Sheba, Israel*

Background:
Numerous studies using parental questionnaires, such as the Children’s Sleep Habits Questionnaire (CSHQ), reported that sleep problems are highly prevalent in children with autism. In parallel, several polysomnography studies have reported that the proportion of rapid eye movement (REM) sleep is decreased and that low-frequency EEG power (Delta band: 0.5-4 Hz) is weaker in toddlers with autism. Are such polysomnography measures related to parental reports of sleep disturbances or to measures of autism severity (ADOS)? To examine these relationships, we performed prospective polysomnography recordings in children with autism and asked their parents to fill out the CSHQ. All participating children

were part of the regional autism database initiative at the Negev Autism Center in Israel (www.negevautism.org), which continues to grow at a rate of ~20 new children per month.

Objectives:

To explore the association between objective sleep measures by polysomnography recordings and subjective parental report measures from the CSHQ questionnaire.

Methods:

Twenty-two children with autism (mean age: 55±4 months) were prospectively recruited to the study. All children underwent overnight polysomnography recording at Soroka University Medical Center and completed the Autism Diagnostic Observation Schedule (ADOS) assessment. Parents of all children completed the CSHQ questionnaire. Sleep/wake activity was scored according to accepted guidelines and EEG power in the Delta (1-4Hz), Theta (4-8Hz), Alpha (8-13Hz) and Beta (13-20Hz) frequency bands were calculated for each sleep stage (I, II, III, and REM).

Results:

Parental report with the CSHQ revealed that 86% of participating children had a total sleep disturbance score of over 41 (mean score: 53±2.5), which is often used as a cutoff score for identifying sleep problems. No significant correlations were found between the total sleep disturbance score and EEG power in any of the examined bands, nor with the proportion of REM sleep/duration, or with ADOS scores. However, ADOS scores were positively correlated with Delta power ($r>0.51$, $p<0.05$) and negatively correlated with Alpha ($r<-0.41$, $p<0.05$) and Beta ($r<-0.49$, $p<0.05$) power.

Conclusions:

These results suggest that parental reports of sleep quality using the CSHQ were not associated with Polysomnography measures of sleep. Interestingly, children with more severe autism symptoms exhibited deeper sleep (i.e., larger Delta power during all sleep stages). We continue to expand the sample to determine the validity of these preliminary findings.

101 **127.101** Sex-Dependent Cerebellar Connectivity in Autism Spectrum Disorders

R. E. Smith[1,2]*, S. J. Gotts*[1]*, J. A. Avery*[1]*, G. L. Wallace*[3]*, L. Kenworthy*[4] *and A. Martin*[5]*, (1)Laboratory of Brain and Cognition, NIH/NIMH, Bethesda, MD, (2)Institute of Cognitive Neuroscience, University College London, London, United Kingdom, (3)The George Washington University, Washington, DC, (4)Children's National Health System, Washington, DC, (5)NIMH, Bethesda, MD*

Background: Human neuroimaging studies have documented sex-specific differences in the development, structure, and function of the cerebellum (Nguon et al., 2005). This part of the brain, in conjunction with the cortex, is involved in both sensorimotor and socio-affective processes. These two domains of function are both impaired in autism spectrum disorders (ASD), and not surprisingly, the cerebellum has been highlighted in neuroimaging studies of males with ASD. Behavioral studies have also found sex differences in ASD prevalence and phenotype.

Objectives: Given what we know about the relationship between ASD and the cerebellum, and the sex differences associated with each, we were interested in whether there may be sex-dependent changes in the cerebellum's functional architecture in ASD. The aim of the current study was to explore this using resting-state functional magnetic resonance imaging (fMRI).

Methods: We collected resting-state fMRI scans from 47 women (23 ASD, and 24 controls) and 120 men (56 ASD, and 64 controls), matched on age, head motion and IQ. Using a measure of global functional connectivity, we ran a linear mixed effects analysis across both groups to determine whether there was a sex-by-diagnosis interaction associated with resting state functional connectivity.

Results: Two clusters in the left and right cerebellum exhibited a diagnosis-by-sex interaction in global connectivity ($p< 0.005$ with small volume correction in the cerebellum). Compared to controls, females with ASD showed *hyper*connectivity between those cerebellar clusters and the cortex, whereas males with ASD showed the opposite pattern (*hypoco*nnectivity with the rest of the brain). Follow-up analyses of seed-based connectivity effects underlying these global connectivity differences (using a 6mm spherical region of interest centered on the peak voxel in each cerebellar cluster) revealed significant diagnosis-by-sex interactions between the cerebellum and several cortical regions including the right fusiform, right inferior frontal gyrus, right precentral gyrus, mid-cingulate, precuneus, middle temporal gyrus, and thalamus.

Conclusions: These results shed light on the sex-specific pathophysiology of ASD. This pattern of sex-dependent, aberrant cerebellar connectivity in ASD might explain some of the abnormalities in motor and socio-affective abilities seen in this population.

102 **127.102** Shared and Distinct Features of Dynamic Emotional Face Processing in Autism Spectrum Disorder and Schizophrenia As Measured By Neural and Behavioral Responses

T. C. Day[1]*, A. Naples*[1]*, B. Lewis*[1]*, K. A. McNaughton*[1]*, T. Halligan*[1]*, T. Winkelman*[1]*, M. J. Rolison*[1]*, T. McAllister*[1]*, S. A. A. Chang*[1]*, K. S. Ellison*[1]*, E. Jarzabek*[1]*, J. Wolf*[1]*, J. Foss-Feig*[2]*, V. Srihari*[3]*, A. Anticevic*[3] *and J. McPartland*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Division of Neurocognition, Neurocomputation, and Neurogenetics (N3), Yale University School of Medicine, New Haven, CT*

Background: Social impairment is a shared feature of autism spectrum disorder (ASD) and schizophrenia (SCZ). Nonverbal communication, including emotional facial expression, is a central component in understanding the social world. Examinations of electroencephalography (EEG) and eye-tracking (ET) have revealed similar brain and behavior atypicalities in individuals with ASD and SCZ in response to emotional faces. Collecting EEG and ET simultaneously during changes in emotional expressions allows for the examination of brain-behavior relationships in more ecologically valid contexts.

Objectives: To contrast event-related potentials (ERPs) to dynamic emotional faces in adults with typical development (TD), ASD, and SCZ and examine their relation to behavior, eye-tracking, and affective expression.

Methods: The TD (n=21), ASD (n=18), and SCZ (n=15) groups were matched on age (range: 18-33 years). EEG was collected using a 128-channel Geodesic Sensor Net. Concurrently, ET was collected with an EyeLink-1000 remote camera system. Participants underwent an interactive paradigm during ET-EEG collection in which they viewed a neutral face, and, contingent upon participant gaze to the eyes, the expression changed to happy or fearful. The N170 ERP component was extracted at emotional expression onset. Behavior, time looking at facial features, and a measure of affective blunting, the Unchanging Facial Expression item from the Scale for the Assessment of Negative Symptoms, were collected.

Results: The TD, ASD, and SCZ groups did not differ on N170 amplitude or latency response to dynamic emotional faces. The ASD and SCZ groups were combined into a clinical group in which an interaction effect between N170 amplitude and group approached significance [*F*(1, 53)=3.66, *p*=.06]. A significant difference in time spent looking at the left eye emerged across the TD, ASD, and SCZ groups [*F*(1, 51)=3.80, *p*=.03]. The ASD group looked to the left eye significantly less than the SCZ group (*p*=.01) which survived Bonferroni correction. Time spent looking at eyes in the fearful condition was related to faster right N170 latency in the ASD group (r_s=-.52, *p*=.03), and a trend was present in the SCZ group (r_s=-.45, *p*=.09), but not the TD group (r_s=.21, *p*=.36). This relationship in the happy condition approached significance in the ASD group (r_s=-.45, *p*=.06) only. A marginally significant relationship between faster right N170 latency in the fear condition and affective expression, as measured by the Unchanging Facial Expression item, emerged in the ASD group (r_s=.557 *p*=.06) only.

Conclusions: Examination of individual diagnostic groups and a single clinical group compared to normative social function revealed both common and distinct elements of brain-behavior responses to emotional faces between clinical groups. Together, individuals with clinical levels of social dysfunction exhibited distinct neural response from TD individuals suggesting atypical emotional face processing may not be unique to ASD. Yet individuals with ASD and SCZ had distinct viewing patterns of emotional faces and showed distinct brain-behavior relationships from one another and the TD group. Furthermore, the association between observed affect and emotional face processing may serve as a bridge between clinical phenotype and underlying biological response, specifically, in ASD.

103 **127.103** Socio-Dramatic Affective-Relational Intervention (SDARI) Changes the N100 ERP to Prosodic Voices

C. M. Keifer[1]*, E. J. Libsack*[1] *and M. D. Lerner*[2]*, (1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: Several group social skills interventions have been developed to target social communication skills, a core deficit in autism spectrum disorder (ASD; McMahon et al., 2013). One such intervention, Socio-Dramatic Affective-Relational Intervention (SDARI), uses naturalistic performance-based techniques to develop social skills (Lerner et al., 2011). While participation in SDARI is related to social gains on subjective measures and behavioral (including vocal) emotion identification tasks, it is difficult to objectively quantify social communication improvements. Event-related potentials (ERPs) recorded via electroencephalogram (EEG) can be used to index the neural correlates of social processing and thus may be a useful tool for quantifying social improvement. The N100 and N300 are two ERP components related to processing vocal prosody that are aberrant in amplitude in individuals with social deficits (Pinheiro et al., 2011). While the N100 reflects early perceptual coding of auditory stimuli and is modulated by attention, the N300 is related to cognitive evaluation of emotion (Paulmann et al., 2008). Auditory ERPs to emotional prosody may be a useful objective technique for quantifying treatment outcomes in ASD.

Objectives: Examine whether participation in SDARI versus an active control is related to changes in N100 and N300 ERPs.

Methods: Thirty-three children (25 male; M_{age}=12.77, SD_{age}=3.01) with ADOS-2 confirmed ASD diagnosis and IQ ≥ 70 (M_{IQ}=107.94, SD_{IQ}=15.20) were randomly assigned to participate in 10 weeks of SDARI or a recreational games control group. Pre- and post-intervention, participants completed a measure of vocal emotion recognition (DANVA-2; Nowicki, 2004) while EEG was recorded. N100 and N300 to auditory stimuli of neutral sentences with emotional prosody were extracted from EEG data. We used Generalized Estimating Equations (GEE) to examine change in ERP amplitude and intensity as a function of group membership. We modeled the ERP (N100 or N300) at post-test as the dependent variable, group membership (SDARI vs. CONTROL) as the nested between-subjects variable, and ERP at pre-test as a covariate.

Results: Participation in SDARI resulted in significantly larger (more negative) N100 amplitude at post test (*Wald's c2*=4.43, *B*=2.78, *p*<.05). To probe this effect we ran two additional GEE models examining N100 amplitude to low and high intensity emotional voices. No significant effects were found for low intensity voices but participation in SDARI was associated with increases in N100 amplitude to high intensity emotional prosody (*Wald's c2*=6.75, *B*=2.25, *p*<.01). GEE models of change in N100 latency, N300 amplitude, and N300 latency were non-significant (all *p*>.05).

Conclusions: Results indicate that participation in SDARI, a naturalistic social skills intervention, is associated with increased magnitude of N100 response to highly salient prosodic language in youth with ASD. This suggests that engagement in this performance-based intervention leads to greater attention to and engagement in perceptual coding of emotional voices in comparison to an attention-control intervention. Thus, performance-based interventions such as SDARI may improve sensitivity to salient social cues like prosody. Not only is the N100 malleable in response to intervention, but future intervention studies might consider implementing the N100 as an objective index of social gains resultant from participation in intervention tasks.

104 **127.104** Sustained Neural Processing of Personally Relevant Negative Emotional Stimuli in Youth with ASD: A Possible Mechanistic Explanation for Poor Emotion Regulation

J. Golt[1]*, G. J. Siegle*[2] *and C. A. Mazefsky*[2]*, (1)University of Pittsburgh Medical Center, Pittsburgh, PA, (2)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: There is increasing evidence that individuals with autism spectrum disorder (ASD) have poor emotion regulation, but the underlying neural processes are not well understood. In depressed samples, functional neuroimaging has revealed sustained neural processing of emotional stimuli (Erk et al., 2010). This may also occur in ASD given observations that emotional reactions are often characterized by a perseverative quality and prolonged negative affect (Mazefsky, Pelphrey, & Dahl, 2012).

Objectives: This study investigated differences in blood oxygen level dependent (BOLD) signal activation in youth with ASD during an event-related task that alternated between emotional processing and non-emotional processing conditions. Using a priori criteria, the objective was to identify brain regions with sustained activity following the presentation of personally-relevant negatively valenced stimuli.

Methods: Youth (12-17 years old) with ADOS- and ADI-confirmed ASD without intellectual disability (n= 25) and an IQ-, age-, and gender-matched control sample (n= 23) completed a task in a Siemens Verio 3T Magnetic Resonance Imaging (MRI) Scanner with a 32-channel head coil. The participants, together with their parents, created a list of 12 words that had a negative connotation to them prior to the participant being scanned. Each of the imaging trials alternated between an emotional processing condition, which consisted either of the personally-relevant negative words or normed neutral words, and a non-emotional simple memory task. Analyses were conducted using the Analysis of Functional NeuroImages (AFNI). A feature conjunction analysis was conducted to identify regions that satisfied the following a priori criteria in support of the hypothesis: 1) ASD group had greater activity than controls during the emotional portion of the task; 2) ASD group had greater activity during the entire trial (into the memory task), following the presentation of negative words: 3) ASD group was more reactive to negative versus neutral words; 4) changes in activity represented an increase from baseline. All regions included were greater than 30 voxels and had an effect size that was medium or greater (d > .5) and *p* <.05.

Results: Regions satisfying all a priori criteria were the left insula (89 vox), right pulvinar (67 vox), left dorsolateral prefrontal cortex (62 vox), and right insula (45 vox) (Figure 1). Time course plots of activity in these brain regions provided further support for increased and sustained processing across the trial after the personally relevant negative words in the ASD group (Figure 2). In the ASD group, correlations between heightened and sustained activity in the identified regions and poorer cognitive control and greater irritability were moderate and approaching significance.

Conclusions: fMRI findings indicate a heightened and sustained response to negative stimuli in youth with ASD in brain regions related to salience evaluations and cognitive control. This may provide a potential neural mechanism to explain poor emotion regulation in ASD. Prolonged processing

105 **127.105** Whole Brain Patterns of Cross-Frequency Coupling in ASD

***J. I. Berman**, S. Liu, J. C. Edgar, L. Blaskey and T. P. Roberts, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Phase amplitude coupling (PAC) has emerged as a fundamental resting-state mechanism by which low-frequency (4-12Hz) cortical oscillations modulate or gate higher frequency oscillations such as gamma-band activity (30-80Hz). PAC is thought to facilitate the input of long-range networks to local connections and subsequent processing. Abnormally high midline parietal-occipital resting-state alpha-gamma PAC has been previously observed in children with autism spectrum disorder (ASD). This study introduces a novel whole-brain mapping of PAC in order to elucidate the spatial pattern of resting-state cortical dysfunction in ASD.

Objectives: This study hypothesized that the PAC abnormalities in ASD are network-wide and pervasive.

Methods: Participants included 26 children with ASD (mean age = 9.5, SD = 2.2) and 22 typically developing (TD) children (mean age = 10.5, SD = 2.4). Five minutes of eyes-closed resting-state data were obtained using a 275-channel MEG system (VSM MedTech). Using BESA, a 15 regional source model assessed cortical activity across the entire brain at an approximately lobar level. At each cortical source, PAC was computed for each frequency pairing allowing whole-brain mapping of PAC (PAC-map) as a function of both space and frequency pairing. For this study, PAC between alpha (9 to 11 Hz) and gamma (30 to 40Hz) was examined.

Results: Across both ASD and controls, PAC decreased with age in midline frontal, left parietal and right parietal regions (p<0.05, each). In the ASD group, PAC was lower in midline frontal, left parietal, and right parietal regions (p<0.05 each) and elevated in the occipital-parietal midline region (p<0.05) compared to controls. In the midline frontal region, PAC decreased with age at a slower rate in ASD than controls (p<0.01).

Conclusions: PAC was visualized throughout the cerebral cortex to enable characterization of the development and heterogeneity of this vital neural network process. A primary finding was that PAC decreased in frontal and parietal regions as a function of age, with a slower frontal PAC decrease in ASD than controls. Whole brain PAC-map may form the foundation of future studies examining spatial patterns of cortical dysfunction in ASD.

Poster Session
128 - Diagnostic, Behavioral & Intellectual Assessment

5:30 PM - 7:00 PM - Hall Grote Zaal

106 **128.106** ASD Diagnosis within the Medical Home: Feasibility, Sustainability, and Satisfaction

***J. F. Hine**[1], A. Pasternak[2] and Z. Warren[1], (1)Vanderbilt University Medical Center, Nashville, TN, (2)Vanderbilt Kennedy Center/TRIAD, Nashville, TN*

Background:
Early accurate diagnosis of Autism Spectrum Disorder (ASD) currently represents a challenging public health and clinical practice issue. Despite the wide-scale availability of effective screening tools for young children, waits for diagnostic assessment are still often quite lengthy and impede access of appropriate early intervention services. Embedded processes for effective triage and diagnosis of children at-risk for ASD within the medical home may be a viable mechanism for reducing age of detection and initiation of services.

Objectives:
We examined (1) the feasibility and value of incorporating ASD-specific assessment and targeted treatment services in primary care settings, (2) analysis of sustainability and financial viability of services, and (3) physician satisfaction with services. We hypothesized that embedding a psychologist with specific skills and training related to ASD diagnostic consultation could help accurately and rapidly identify many cases of ASD and potentially represent a more realistic model for advancing ASD identification.

Methods:
We developed explicit ASD diagnostic consultation and support clinics embedded across two medical center affiliated pediatric primary care programs. A psychologist was physically embedded in the clinic one day per week and available solely for providing follow-up for ASD-related concerns (e.g., failed screenings, diagnostic referrals, behavioral consultation). Data about referral types, show rates, and latency to consultation and diagnosis were used to assess feasibility and impact. Specific data regarding time, cost, and resources associated with implementation were collected via electronic medical records. We also surveyed medical providers regarding the benefits and challenges of the embedded service. They were asked their level of agreement with statements about whether integration of behavioral-health services improves the quality/continuity of healthcare, reduces added healthcare costs, increases show rates, and increases their own ability to identify/manage behavioral health concerns.

Results:
The embedded psychologist saw over 400 children and adolescents over 24 months, 60% of the patients were referred due to concerns for ASD. Of those patients, 42% received formal diagnoses of ASD. It was possible to make a diagnosis within the initial consult session for 60% of the children; further testing was required for the remaining children. The latency to evaluation and diagnosis for referred children was less than two months, compared with a minimum of 7-8 months for other specialty clinic assessments. Similarly, the median age at diagnosis (32 months) was considerably lower than the national average of approximately 50 months. Provider feedback indicated significant improvements related to quality and continuity of care and decreased waits for service. Updated clinical data and data regarding financial viability of the program over

time will be provided in detail.

Conclusions:

This study extends support for the value of embedding behavioral health services for children with ASD within pediatric primary care settings. Such models of care may reduce waits, age of diagnosis, and reduce other service barriers encountered by individuals with ASD and their families seeking services through referrals to traditional tertiary care facilities.

107 **128.107** Assessment and Diagnostic Practices for School-Aged Children with Autism Spectrum Disorders: A Survey of Canadian Clinicians

A. M. Yaholkoski[1], *J. M. Montgomery*[2] *and B. M. Stoesz*[1], *(1)Psychology, University of Manitoba, Winnipeg, MB, Canada, (2)Psychology, University of Manitoba, Winnipeg, MB, CANADA*

Background: Timely assessment for Autism Spectrum Disorder (ASD) is essential to provide a comprehensive understanding of child functioning, advise diagnosis, and inform individualized treatment. Although early diagnosis is ideal, many children with ASD are not identified until school age. Information to guide early diagnostic practice is widely available; however, information specific to diagnosing ASD in school-aged populations is limited. Some evidence-based practice guidelines for school-aged ASD diagnosis have been developed, however, results from studies conducted outside of Canada suggest that disparities between these practice guidelines and clinical procedures exist. Various challenges to using these guidelines have also been identified. To date, no research has been conducted to examine school-aged ASD diagnostic practices in Canada.

Objectives: The primary objectives of this study were to: (a) understand clinicians' knowledge, practices, and challenges encountered in screening, assessment, and diagnosis of ASD in Canadian school-aged children (i.e., ages 4-21 years); (b) compare Canadian clinicians' reports of procedures and assessment tools used to existing practice guidelines; (c) identify training and professional development needs; and (d) determine whether policy changes may be required to alleviate challenges in the diagnostic process.

Methods: Clinicians (i.e., school and clinical psychologists, psychiatrists, and physicians) involved in diagnostic assessment of school-aged children suspected of having ASD were recruited via Canadian professional organizations to participate. A web-based survey (using Qualtrics Survey Software) was used to gather information about knowledge, practices, and challenges for screening, assessment, and diagnosis of ASD. The survey consisted of four sections to gather information about: (1) referral, screening, and assessment processes; (2) tools used for screening, assessing, and diagnosing ASD; (3) broad assessment approaches for ASD diagnosis; (4) and participant demographics.

Results: Findings suggest both similarities and differences in perceived knowledge and expertise for ASD diagnosis, processes implemented, inter-professional consultation practices, and frequencies in using specific tools across professional groups and across Canada. Clinicians indicated that assessing comorbidities, difficulties organizing assessment teams, identifying ASD in higher functioning individuals, and lack of training/knowledge specific to ASD assessment are significant challenges. Although clinicians' responses indicated that they are generally aware of and follow evidence-based practice guidelines, in some cases, procedures differed from specific practice guidelines. This may reflect context specific constraints (e.g., access to specific tools and/or other professionals for consultation) rather than an awareness or unwillingness to follow recommended practice.

Conclusions: This study provides a picture of the current Canadian context for school-aged ASD assessment and diagnosis. Specifically, the findings contribute to an understanding of the extent to which Canadian clinicians conduct assessments in accordance with evidence-based practice guidelines for ASD diagnosis, and highlights reasons why they may be unable to adhere to some recommendations. This information may be used to inform the development of additional training opportunities, and highlight where funding and policy changes are required to alleviate challenges in the diagnostic process to increase access to timely, accurate identification.

108 **128.108** Assessment of Patterns of Play in Children with and without ASD and Their Relations with Maternal Behavior in Collaborative Play Interactions

C. Shulman[1,2] *and S. Shmueli*[2], *(1)The School of Social Work, The Hebrew University of Jerusalem, Jerusalem, Israel, (2)The School of Education, The Hebrew University of Jerusalem, Jerusalem, Israel*

Background:

Specific deficits in play distinguish children with autism from typically developing children. These include differences in type, level and duration (Kasari & Chang, 2014). Although symbolic play is significantly associated with later social (Sigman & Ruskin, 1999) and cognitive (Stanley & Konstantareas, 2007) development, equivocal findings regarding levels of play in children with ASD make it particularly important to characterize play patterns and investigate variables associated with better developmental outcomes.

Objectives:

By investigating play between mothers and their children in their homes with their own familiar toys, play can be evaluated naturalistically. Specifically, this study investigates the relationships between maternal sensitivity, maternal initiations and children's level and duration of play in young children with and without ASD. The levels of children's play included sensory manipulation, simple object manipulation, relational play, functional play and symbolic play.

Methods:

Ninety mother-child dyads participated in this study. Forty-five mother-child dyads involved children with ASD and 45 children with typical development, matched for mental age {ASD: M = 53.9 (20.20); TD: M = 56 (15.32)}. Mothers were asked to play with their children "as they typically would" and their play interaction was videotaped for later analysis. Play levels were assessed according to the coding system of Marcu, Oppenheim, Koren-Karie, Dolev, and Yirmiya (2009), with adaptations for home play, and emotional sensitivity was assessed using the Emotional Availability Scales – 4th Edition (Biringen, 2008). Maternal initiations and play act duration were calculated from the videotaped sessions.

Results:

Children with ASD exhibited more play acts, (t[88]=1.92, *p*=0.05), of shorter duration (t[88]=-2.12, *p*=0.02). Their play was characterized by lower levels of play, including simple object manipulation (t[88]=2.39, *p*=0.02), relational play (t[88]=2.01, *p*=0.05), and functional play (t[88]=-1.82, *p*=0.035), than those with TD. Mothers of children with ASD initiated more frequently than mothers of children with TD (t[88]=2.71, *p*=0.008), and interestingly, in both groups when mothers initiated more, their children played on a lower level {ASD: (r=-0.33, *p*=0.04); TD: (r=-0.36, *p*=0.08)} and for a shorter time {ASD: (r=-0.42, *p*=0.007; TD: (r=-0.43, *p*=0.008)}. No differences in maternal sensitivity emerged between groups.

Conclusions:

By evaluating levels of play of young children with and without ASD, and studying the relationship between their play and maternal behavior, this study supports the importance of looking at both the child and the play partner when characterizing variables associated with better outcomes. In addition, the need to study play in familiar contexts with real-life partners is underscored. These findings can serve as a foundation for interventions with young children with ASD, which should focus on socially mediated play using naturalistic strategies.

109 **128.109** Childhood Autism Screening Test (CAST) As a Screening Tool for ASD: Utility in a Community Population in Lagos, Nigeria

***E. A. Campbell**[1], B. Fadipe[1], K. A. Ogunsola[1], Y. Oshodi[2] and A. E. Lamikanra[3], (1)Lagos University Teaching Hospital, Lagos, Nigeria, (2)University of Lagos College of Medicine, Lagos, Nigeria, (3)Blazing Trails International, Frisco, TX*

Background:

Autistic spectrum disorder (ASD) is routinely screened during childhood in developed countries but still missed in developing countries. With increasing awareness about ASD, it has become pertinent for us to use simple tool to assist in early identification due to scarcity of manpower especially in our rural communities.

Childhood Autism Screening Test (CAST) a screening instrument developed as a combination of behavioural symptom of ASD according to International Classification of Disease (ICD-10) and Diagnostic and Statistical Manual fourth edition (DSM-IV) has been widely used in western societies. A few studies have reported use among African-American but none among Africans.

Objectives: To determine the utility of CAST for screening for ASD among individuals with neuro-developmental disorders in Lagos state, Nigeria.

Methods:

Participant were recruited during an annual community screening for autism and other neuro-developmental disorders which is a collaboration between a bank, Blazing Trail International USA (a Non-Governmental Organization) and Centre for Autism and Neuro-developmental Disorders (CANDo) of the College of Medicine, University Lagos. Participants were reached via mails, radio jingles word of mouth and text messages. They were screened in stages using a sociodemographic questionnaire, CAST for those aged 4 and above and diagnosis was based on DSM V criteria for ASD.

Results:

A total of 268 participants attended the screening exercise. Two hundred and eighteen individuals were attending for the first time (81.3%). More than three quarters were eligible for CAST (76.9%) and majority of them (83%) completed CAST. Sensitivity is 70.8%, specificity 60.4% and positive predictive value 52.3%.

Conclusions:

CAST was found to be a user friendly instrument with high specificity and sensitivity in diagnosis of ASDs. It should be considered for larger validation study for autism in Africa.

110 **128.110** Comorbidities and Adaptive Behavior Using the Behavior Assessment System for Children – Version 3 in Children with Autism Spectrum Disorder: Results from the ABC-CT Feasibility Study

***E. Pompan**[1], E. Baker[2], P. Renno[1], S. J. Webb[3], F. Shic[4], A. Naples[5], C. Sugar[6], M. Murias[7], R. Bernier[3], G. Dawson[8], C. A. Nelson[9], J. McPartland[5] and S. Jeste[6], (1)University of California Los Angeles, Los Angeles, CA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (5)Child Study Center, Yale University School of Medicine, New Haven, CT, (6)University of California, Los Angeles, Los Angeles, CA, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (8)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (9)Boston Children's Hospital, Boston, MA*

Background: Approximately 70% of children with autism spectrum disorder (ASD) develop comorbid psychiatric conditions that contribute to greater functional impairment (Simonoff et al., 2008). Despite the high prevalence of psychiatric comorbidities, they are inherently difficult to diagnose in children with ASD, and valid and reliable measures are needed (Lecavalier et al., 2014). Broad-based parent report measures, such as the *Behavior Assessment System for Children-Version 3 (BASC-3)*, can be useful for identifying co-occurring conditions and related functional impairment.

Objectives: This study investigated group differences in psychiatric symptoms and adaptive functioning in children with ASD and typically developing children. In addition, it examined convergent validity of the *BASC-3* in children with ASD and explored the relation between psychiatric symptoms and greater adaptive impairment.

Methods: As part of the Autism Biomarker Consortium for Clinical Trials (ABC-CT) feasibility study, we examined psychiatric symptoms and adaptive behavior in participants with ASD (n=23) and typically developing controls (n=26), ages 4-11 years, with IQ>50. Caregivers completed the *BASC-3,* the *Child & Adolescent Symptom Inventory-5 (CASI-5)/Early Childhood Inventory-5 (ECI-5)* parent questionnaires and the *Vineland Adaptive Behavior Scales, Second Edition (VABS-II)* interview. ASD diagnosis was confirmed using the *Autism Diagnositc Observation Schedule-2* (Lord et al., 2012) and the *Autism Diagnositic Interview-Revised* (Rutter, LeCouteur & Lord, 2003).

Results: Results from independent sample t-tests, revealed children with ASD had significantly higher standard scores on the *BASC-3* Externalizing Problems Composite (*t*(30.834)=-5.567, *p*<.001), Internalizing Problems Composite (*t*(47)=-3.775, *p*<.001), and the Adaptive Skills Composite (*t*(47)=10.558, *p*<.001) than typically developing children.

The *BASC-3* scale scores converged with the *VABS-II* domain scores with the exception of the socialization domain. The *BASC-3* Activities of Daily Living scale correlated with the *VABS-II* Daily Living Skills domain, (*r*=.677, *p*<.001). The *BASC-3* Functional Communication scale correlated with the *VABS-II* Communication domain (*r*=.580, *p*=.004). The *BASC-3* Social Skills scale did not correlate with the *VABS-II* Socialization domain (*r*=.308,

p=.152).

Furthermore, Pearson correlations indicated convergence of *BASC-3* clinical symptom scales and *CASI-5/ECI-5* scales. The *BASC-3* Hyperactivity scale correlated with the *CASI-5/ECI-5* Hyperactive-Impulsive scale (r=.798, p<.001). The *BASC-3* Attention Problems scale correlated with the *CASI-5/ECI-5* Inattentive scale (r=.431, p=.045). The *BASC-3* Anxiety scale correlated with the *CASI-5/ECI-5* Generalized Anxiety scale (r=.878, p<.001). The *BASC-3* Depression scale correlated with *CASI-5/ECI-5* Dysthymic scale (r=.767, p<.001).

The *BASC-3* Internalizing Problems Composite negatively correlated with the *BASC-3* Adaptive Skills Composite (r=-.416, p=.048). There was not a significant correlation between the Externalizing Problems Composite and the Adaptive Skills Composite (r=-.1, p=.65).

Conclusions: Findings indicate the BASC-3 demonstrates adequate convergent validity with more targeted, commonly used measures of psychiatric comorbidity (*CASI-5/ECI-5*) and adaptive functioning (*VABS-II*) in ASD. This study contributes to the growing literature on accurate assessment in ASD and suggests the *BASC-3* may be a useful broad-based parent report measure for identifying psychiatric conditions and adaptive impairment in children with ASD. Furthermore, findings on the relation between greater internalizing problems and poorer adaptive functioning skills may inform intervention research, as adaptive functioning skills may be an important focus of treatment in children with ASD and co-occurring internalizing symptomatology.

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128.111 Day-to-Day Variability in Behavior Via Smartphone Data Collection from Caregivers of Children with Autism

R. M. Jones[1], *T. Tarpey*[2], *A. Hamo*[1], *C. Carberry*[1] *and C. Lord*[3], *(1)Weill Cornell Medicine, New York, NY, (2)Wright State University, Dayton, OH, (3)University of California Los Angeles, Los Angeles, CA*

Background: Mobile phones are woven into the fabric of our daily lives and thus offer the versatility to gather robust daily variations in behavior in a variety of contexts. Recent evidence suggests that smartphones have the ability to supplement and perhaps even replace traditional caregiver-report paper questionnaires that are broadly utilized in developmental research. Whether smartphones offer such promise for autism is unknown.

Objectives: The goal of the present study was to validate single questions on a smartphone completed by a caregiver of a child with autism across 8-weeks, compared to gold-standard, paper questionnaires. The second goal was to determine a method to accurately capture day-to-day fluctuations in caregiver reports about their child's behavior on the smartphone.

Methods: 20 caregivers completed single questions about their child's mood, irritability, disruptive behavior and anxiety on an 8-point scale across 8-weeks with a modified version of the JAKE™ application. Children were diagnosed with autism and were 5-13 years of age. Consistency between caregiver report on a smartphone versus standardized paper questionnaires was analyzed with mixed ordinal logistic regression models. A total variance measure for each smartphone question was calculated by combining the probability of responses on each day, so that total variance values close to 1 reflected high variability of responses to each number on the 0-7 scale across 8-weeks, whereas values close to 0 reflected little variation in smartphone responses. Lastly, we re-calculated the total variance with N days at the beginning and end of the study to determine how many days of data was necessary to accurately capture variability.

Results: All smartphone questions addressing irritability, negative mood, disruptive behavior, and anxiety were significantly associated with the standard caregiver questionnaires and related subscales on the Aberrant Behavior Checklist (ABC), Child Behavior Checklist (CBCL) and the Positive and Negative Affect Schedule (PANAS) (p's < 0.05). Maternal education influenced caregiver reporting, such that the more educated the mother, the more severe children were rated on the smartphone, specifically irritability and disruptive behaviors. We found that greater variability on the smartphone questions that targeted mood, irritability and disruptive behavior across the eight weeks corresponded to more severity on the standard paper questionnaires listed above. Interestingly, increased variance on one smartphone question was associated with increased variance on another. Lastly, 7-10 days at the beginning and 7-10 days at the end of the study were able to capture similar amounts of variance as 8-weeks worth of data.

Conclusions: These findings suggest that the smartphone questions were consistent with standardized measures and thus in the future smartphone questions may be used to save time for studies in lieu of longer questionnaires. In addition, these findings suggest that it may be sufficient to deploy cell phones for a week at the beginning and end of an intervention study in order to reliably capture change. Together the data support the use of smartphones as a flexible method to gather data about a child with autism outside of a clinical setting.

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128.112 Delay of Diagnosis in ASD

L. Verhoeven[1], *D. van Dijk*[2], *P. van Deurzen*[3] *and W. G. Staal*[4,5], *(1)Dr Leo Kannerhuis, Doorwerth, Netherlands, (2)Research, Development & Innovation, Dr Leo Kannerhuis, Doorwerth, Netherlands, (3)Karakter, NIjmegen, Netherlands, (4)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (5)Institute for Brain and Cognition, Leiden University, Leiden, Netherlands*

Background:

Timely diagnosis of autism spectrum disorders (ASD) is of major interest for public health, patients and caregivers. So far, the majority of studies have focused on age of ASD diagnosis. However, the diagnostic process is an important factor to consider when trying to establish an early age of diagnosis. The few studies on this subject indicate a rather long diagnostic process.

Objectives:

The present study emphasizes on the duration of the diagnostic process, the diagnostic delay. The studies aimed to assess the mean diagnostic delay as well as to identify factors associated with this potential delay (predictors).

Methods:

For this purpose a cohort study with retrospective data collection was conducted among a population of individuals with ASD who were referred for diagnosis or care to mental health care centers specialized in ASD in the Netherlands. A random sample of 814 individuals with ASD referred in the period between May 2013 – April 2014 was included.

Eight potential factors (predictors) that could influence the diagnostic process were assed: age at first contact with mental healthcare/welfare, age of ASD diagnosis, gender, intellectual disability, current psychiatric comorbidity, prior diagnosis, year of first contact with mental healthcare/welfare, and the amount of previous mental healthcare/welfare tracks.

Analysis regarding diagnostic delay included expression of the mean, median, and standard deviation and illustrated by a Kaplan Meier curve. Second, the relationships between diagnostic delay and the included predictors of delay were tested. Pearson correlation coefficients were conducted between diagnostic delay and our continuous predictors (number of mental healthcare/welfare tracks, age at first contact with mental healthcare/welfare, age of ASD diagnosis, and year of first contact with mental healthcare/welfare). Student's *t*-test were conducted to asses potential differences in delay regarding the categorical predictors (gender, intellectual disability, the presence of prior diagnosis, and the presence of comorbid diagnosis). As a final step, a linear multiple regression analysis was performed including all predictors.

Results:

Results showed that diagnostic delay ranged from 0 to 366 months with a median of 19 months and a mean of 35.7 months (three years). Of all individuals with ASD, 25% received the ASD diagnosis within 2 months and the last 25 % 'waited' for longer than 4.2 years. A longer diagnostic delay was associated with several factors including a higher number of previous mental healthcare/welfare tracks, an earlier year of first contact with mental healthcare/welfare, an older age of ASD diagnosis, more prior diagnosis, and more comorbidity. Gender and intellectual disability were not related to diagnostic delay.

Conclusions:

Although findings indicated that the diagnostic delay for ASD has been reduced for individuals encountering welfare/mental health care in more recent years, the majority of individuals still show a considerable diagnostic delay. This observed diagnostic delay shows spacious room for improvement in the diagnostic process.

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128.113 Detection of Ignored Autism Spectrum Disorder By Simple External Observation in Kindergarten: A Proof of Concept Study

E. Castagna[1], *R. Pirovano*[2], *A. Castelnuovo*[1], *E. Alfiedi*[1], *G. Lanzi*[1], *F. Bernasconi*[1], *M. Norsi*[1] *and E. Grossi*[2], *(1)Autism Research Unit, Villa Santa Maria, Tavernerio, Italy, (2)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy*

Background:

Kindergarten is a privileged opportunity to observe children's behavior in a natural context. This possibility allows for detecting signs of derangement in motor and neuropsychological development not otherwise previously observed.

Our group has developed a standardized protocol with a checklist containing over 284 items for carefully detecting delay in the acquisition of a given capacity according to age related international developmental nomograms.

Objectives:

The aim of this study is to assess the feasibility and effectiveness in the screening of ASD by simply observing child behavior while at Kindergarten.

Methods:

The protocol included two different tests:

- The Denver Developmental Screening Test (Denver test)is a 41 item test for screening development of infants and preschool-aged children; items cover four general functions: personal social (e.g. smiling), fine motor adaptive (e.g. grasping and drawing), language (e.g. combining words), and gross motor (e.g. walking). Test age range 0-6.
- The Adaptive Behavior Assessment System – Second edition (ABAS – II) containing 216 items is a global and normative assessment scale of behavior that measures daily life skills. The project protocol provides for teacher/caregivers questionnaires regarding subjects aged 2-5. It investigates 10 adaptive areas: Communication, Preschool/School skills, self-Control, Playing/leisure, Socializing, Self-Care, Home Care/School, Environmental Use, Health and Safety, Work.

Expert psychomotor and education therapists with the supervision of a senior neuro-pediatrician (MN), observed and interacted with 62 children, aged 36 - 65 months, attending the "Istituto Comprensivo Don Milani" in Tavernerio (Como, Italy) during two sessions and after obtaining written informed consent.

Seven out of 62 children were found to be affected by neuro-psychiatric disorders (ASD; Down syndrome; delay of psychomotor development; Cerebral Palsy; developmental disorder; hyperactivity)

Our staff was pleasantly accepted in the classroom and was able to collect all the information required. The school teachers learned basic skills to heighten their observation capabilities in child behavior as a result of interacting with our professional staff.

Results:

In the 55 children without previous diagnoses of neuro-psychiatric disorders, the application of the Denver test and ABAS scales pointed out the presence of 7 and 12 cases respectively with at least one (range 1 - 6) item not corresponding to chronological age. The integration of this information with the experience and skills of our staff resulted in the recognition of possible undetected developmental disorders and the subsequent invitation to parents to bring the children in question to a neurodevelopmental diagnostic unit.

In one of these cases, an Autism Spectrum Disorder (ASD) diagnosis was made.

In one of two other cases, parents did not continue with the diagnosis, in the other, a pediatric psychiatrist did not confirm the presence of language developmental delay (table 1).

Conclusions:

This experience shows that structured external observation in a kindergarten is a feasible and promising approach for the screening and the early detection of neurodevelopmental disorders. ABAS II seems to provide increased sensitivity in detecting suspicious cases.

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128.114 Development and Validation of Objective, Eye Tracking-Based Risk and Symptom Measures for Autism

T. W. Frazier[1,2], *E. W. Klingemier*[3], *A. Y. Hardan*[4], *C. Eng*[5], *M. S. Strauss*[6], *L. Speer*[2], *S. Parikh*[2] *and E. Youngstrom*[7], *(1)Autism Speaks, New York, NY, (2)Cleveland Clinic, Cleveland, OH, (3)Cleveland Clinic Center for Autism, Cleveland, OH, (4)Psychiatry and Behavioral Sciences, Stanford University,* *Stanford, CA, (5)Genomic Medicine, Cleveland Clinic, Cleveland, OH, (6)Psychology, University of Pittsburgh, Pittsburgh, PA, (7)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: At present, there are no validated, objective, quantitative, scalable assessment tools for autism spectrum disorder (ASD).
Objectives: To develop and validate eye tracking-based measures for estimating ASD risk and quantifying autism symptom levels.

Methods: Patients were recruited into this cross-sectional, case-control study from a tertiary care, multi-disciplinary, autism diagnostic evaluation clinic. Eye tracking data were collected during a single evaluation visit with administrators blinded to all clinical information. Participants included 201 children referred for evaluation of possible developmental disorder who completed a valid eye tracking assessment (ages 1.6-17.6; 80% male; ASD n=91, non-ASD n=110). Consensus clinical diagnoses were given by the multidisciplinary team based on Autism Diagnostic Observation Schedule-2 (ADOS-2) results, developmental history, physician evaluation, and additional clinical measures. Participants viewed a 5-minute video that included 44 dynamic stimuli from 7 distinct paradigms while gaze was recorded. Five gaze metrics (glances, fixation count, fixation duration percent, first fixation duration, and average fixation duration) were computed for temporally-defined regions-of-interest within each stimulus. Autism risk and symptom indices were created by aggregating across gaze measures showing significant bivariate relationships with ASD diagnosis and ADOS-2 symptom severity levels in a training sample (75%, n=150). Receiver operating characteristic curve analysis and non-parametric correlations were used to cross-validate identification of ASD diagnosis and autism symptom severity in a test sample (25%; n=51).

Results: The autism risk index had excellent accuracy for identifying ASD diagnosis in the training sample (AUC=.92, 95%CI=.88-.96) and maintained high accuracy in the test sub-sample (AUC=.86, 95%CIs=.75-.95; Figure 1). Autism symptom indices were strongly associated with ADOS-2 total, social affect, and restricted/repetitive behavior severity scores (smallest r=.26, p=.040). The autism risk index had high internal consistency reliability (α=.92) and wide quantitative range, with 95% of non-ASD cases falling from z=-2.3 to 1.6 and 95% of ASD cases falling from z=-0.1 to 5.0. The majority of missed cases (68%) fell within +/-0.75 SD of the optimal cut point z=0.74. Autism symptom indices had high internal consistency reliability (α>=.93). Validity of autism risk and symptom indices was not substantively attenuated after adjustment for language, non-verbal cognitive ability, or other psychopathology symptoms (r=.40-.67, p>.001), indicating that the eye-tracking based measures were highly specific to autism.

Conclusions: Eye tracking measures may be useful quantitative, objective measures of ASD risk and autism symptom levels. Future studies with large, multi-site samples are needed to replicate these findings and determine their generalizability, including resistance to sampling differences and minor procedural variations. If replicated and scaled for clinical use, eye tracking-based risk and symptom measures could be used to inform clinical judgment regarding ASD identification and to track autism symptom levels in clinical trials and longitudinal studies.

115 **128.115** Discriminant Validity of the Autism Spectrum Screening Questionnaire Parent Form to Preschool Children

M. Adachi[1], *M. Takahashi*[1], *N. Takayanagi*[2], *S. Yasuda*[3], *Y. Sakamoto*[4], *M. Tanaka*[5], *A. Osato*[4], *S. Kato*[6], *M. Saito*[4] *and K. Nakamura*[4], *(1)Research Center for Child Mental Development, Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (2)Aichi Toho University, Nagoya, Japan, (3)Research Center for Child Mental Development Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (4)Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (5)Hokkai gakuen University, Sapporo, Japan, (6)Aomori Chuo Gakuin University, Aomori, Japan*

Background:The Autism Spectrum Screening Questionnaire(ASSQ;Ehlers et al.,1999) was developed to screen school children for HF-ASD. Although the ASSQ consists of only 27 items, it has shown both validity and reliability, with good sensitivity and specificity in clinical settings. Although the ASSQ has been psychometrically tested in only 7-16-year-old children, an application for younger children than 7-year-old is also expected to make early detection of HF-ASD and prevent secondary maladjustment of them. There have been reports of ASSQ being used for six-year-olds in other studies and earlier practical clinical usages(Kopp et al.,2011). As such, it is important to examine the scale's psychometric properties and discriminant validity, especially when considering the application of the instrument at an earlier age.
Objectives:This study examined the psychometric properties of applying the ASSQ for preschool children.

Methods:Two groups of children took part in the current study. The first "community" group(*N*=1390) who were recruited from a Hirosaki Five-year-old Child Developmental Health Check-up Study, which assessed the mental health of children in the city, from 2013 to 2016. The questionnaires were sent to the parents of five-year-old children after which those who agreed to participate in the study(through their informed consent) answered the questionnaires and sent them back to the municipal health center. The response rate was 74.6%. The second "clinical" group consisted of children from affiliated research centers with Graduate School of Medicine, Hirosaki University. This group consisted of 60 children diagnosed ASD and 94 children with Non-ASD neuropsychiatric diagnoses.

Results:There was a good internal consistency for the ASSQ in both the clinical and community group with Cronbach's alpha of .844-.881. The results from Kruskal-Wallis tests, only one item "Is old-fashioned or precocious" was not able to discriminate between ASD and Community group. Meanwhile, in 19 of 27 items, there was a difference in scores between the ASD and the Non-ASD group, so that certain discriminant validity was also shown within the clinical group. ROC analyses revealed the full extent of the scale's ability to distinguish children with ASD against community children with an area of 0.960 under the curve(95%CI: 0.939–0.981). A score of 6.5 on the ASSQ had a sensitivity of 0.933 and a specificity of 0.835 when it is used as a primary screening tool. On the other hand, discriminatory power within clinical groups was lower than discriminant power of the ASSQ in distinguishing the ASD from the Community children(AUC=0.749, 95%CI=0.671–0.826). A score of 6.5 had a sensitivity of 0.933 and a specificity of 0.319, while a score of 13.5 resulted in sensitivity reducing to 0.650 but specificity increasing to 0.734.

Conclusions:The results showed that, just like in the case of school-aged children, the ASSQ had reliability and validity as a screening instrument in both community and clinical settings for pre-school children. However, the analysis of the ASSQ subscale items showed that only for number 1, namely, "Is old-fashioned or precocious," the score of the community group was higher than that of the ASD group; this revealed the possibility that this decreased the discriminant validity.

116 **128.116** Does Intention Lead to Success? Social Camouflaging in Autistic Girls

L. Hull[1], *K. V. Petrides*[2] *and W. Mandy*[1], *(1)University College London, London, United Kingdom of Great Britain and Northern Ireland, (2)London Psychometric Laboratory, London, United Kingdom*

Background: Social camouflaging (the use of compensation or masking strategies to minimise autistic characteristics during social interactions) has recently come to attention as a behaviour common in autistic women and girls. Qualitative research has suggested that social camouflaging strategies may result in missed or late diagnosis for autistic girls, in addition to poor mental health outcomes resulting from the effort required to camouflage successfully. Previous research into camouflaging has focused on the observable strategies used mostly by adults; no research has yet compared autistic girls' intentions to camouflage with the success of their attempts.
Objectives: To test a recently developed measure of self-reported camouflaging and compare this to other measures of camouflaging, including a measure of camouflaging success, amongst autistic teenage girls. Questions of interest: Do autistic girls report camouflaging at similar levels to autistic women? Is self-reported camouflaging related to objective social skills?

Methods: Approximately 60 autistic girls aged 13-19 will be included in the final sample. Multiple measures of camouflaging are used, including the newly developed and validated Social Camouflaging in Autism Questionnaire, and the discrepancy between an individual's internal experience of autism and their external presentation. Success of camouflaging is measured through blinded observer ratings of autistic girls' sociability and likeability during a social interaction in which they camouflage.

Results: Data collection is ongoing; however, we expect to find that autistic girls report relatively high levels of camouflaging, and that their camouflaging is on the whole successful. In these preliminary results we also report on the relationship between different measures of camouflaging, and how age and cognitive abilities affect camouflaging extent and success

Conclusions: This is the first known study to examine the relationship between different measures of social camouflaging and its impact on the social skills of autistic girls. Reflections on the extent and success of camouflaging strategies in autistic girls will be discussed. Camouflaging is an important behaviour amongst autistic girls and should be considered during diagnosis and by other services when considering support requirements.

117 **128.117** DSM-5 Levels of Support and Autism Severity Ratings

T. Dawkins[1] *and M. Van Bourgondien*[2]*, (1)The University of North Carolina - Chapel Hill, Carrboro, NC, (2)University of North Carolina at Chapel Hill, Carrboro, NC*

Background: Given the variability in symptom severity within individuals with Autism Spectrum Disorder (ASD) and the need for quantifying the severity of symptoms for determining service provision needs, the authors of the DSM-5 ASD criterion included severity ratings in the areas of Social Communication(SC) and Restricted and Repetitive Behaviors (RRB). This severity marker is based on "Levels of Support" and classified in terms of Level 1 ("Requiring support), Level 2 ("Requiring substantial support") and Level 3 ("Requiring very substantial support"). The inclusion of these ratings were not based on any empirical data and to date, few studies in which the relationship between the severity ratings of established measures of autism symptoms and severity such as the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2), the Childhood Autism Rating Scale-Second Edition (CARS2) and the Social Responsiveness Scale-Second Edition (SRS-2) have been published (Reszka, et al, 2014; Weitlauf, et al, 2014). Further, the studies published thus far were conducted prior to the publication of the finalized DSM-5 ASD criterion. Thus, there is a need to examine the relationship between existing measures of autism symptoms, cognitive ability and adaptive skills to better understand how these variables may influence the assignment of DSM-5 severity ratings at the time of diagnosis.
Objectives: The goal of the current study is to investigate the relationship between autism symptoms, associated features of autism (cognitive ability, adaptive skills and language level) and the assignment of DSM-5 levels of support.

Methods: The data included within this study was obtained through a secondary data set pulled from the University of North Carolina TEACCH Autism Program Research Registry. The database contains records of 11, 358 individuals, 754 of whom, were evaluated for autism at one of the 7 outpatient community-based centers of the UNC TEACCH Autism Program in North Carolina, by a local school, or other agency that provided evaluation for autism and a diagnostic report from which the data was pulled and added to the database. DSM-5 Severity ratings of SC as well as RRB were available for all 754 individuals included within the dataset of the present study. The dataset included scores from measures of cognitive development, adaptive skills, and severity of autism (as measured by the ADOS2, CARS2, and/or SRS-2 when available). The TEACCH Centers conduct diagnostic evaluations on all ages from toddlers through adults. Thus, the age range of participants with DSM-5 Severity Ratings was 1 through 68 years.

Results: Preliminary analyses indicate that clinical impression of autism severity (.000), as measured by clinician ratings of severity of autism on the CARS2, scores of adaptive skills (.000), and severity of symptoms as measured by the ADOS (.022) were positively correlated with DSM-5 SC level of severity rating. Clinical impression as rated on the CARS2 (.000), and adaptive scores (.005) were positively correlated with DSM-5 RRB severity rating.

Conclusions: In a community based sample, clinician impressions and direct assessment of autism symptom severity were associated with DSM-5 Level of severity assignment. Implications for clinical diagnosis will be discussed.

118 **128.118** Empathy in Adolescent Girls with Autism; Quantity and Quality of Their Reactions

C. Rieffe[1]*, D. Willems*[2]*, F. R. Sedgewick*[3]*, L. Hull*[4]*, E. M. Blijd-Hoogewys*[5] *and L. Stockmann*[6]*, (1)Leiden University, Leiden, Netherlands, (2)Developmental Psychology, Leiden University, Leiden, Netherlands, (3)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland, (4)University College London, London, United Kingdom of Great Britain and Northern Ireland, (5)INTER-PSY, Groningen, Netherlands, (6)Centrum Autisme Rivierduinen, Leiden, Netherlands*

Background: Autism in girls is receiving increasing attention internationally, but it is still unclear where or how behavior with their male counterpart coincides or deviates. Better social skills in girls have frequently been noted as an possible feature that makes it more difficult to detect autism in females. Another issue that might disguise female autism is that girls without autism react differently to another person in distress than boys. Whereas girls more often offer emotional support, boys more often tend to solve the problem (Banerjee, Rieffe, Meerum Terwogt, Gerlein, & Voutsina, 2006). The question is to what extent this also applies to girls with autism.
Objectives: In this study we examined the extend to which girls with autism act in line with girls without autism, and react emotion-focused to pain in another person; or whether they show the more male oriented behavior and react more problem-focused.

Methods: We presented female and male adolescents (mean age 13 years old, range 110-161 months) with and without autism with an in-vivo empathy task. The experimenter pretended to hurt herself and participants' reactions were video-taped. Based on these recordings, we coded the extent to which the participants paid attention to the event/experimenter when she was showing a pain reaction. In addition, we coded the extent to which participants reacted to the experimenter's pain (emotion-focused), or tried to offer a solution for the problem (problem-focused).

Results: Most female adolescents reacted empathically, regardless their diagnoses of autism or not, and almost all reactions were emotion-focused. Yet, half of the male adolescents in both groups did not react to the distress in the experimenter. Moreover, many male adolescents also avoided to make eye contact with her. Within the group of male adolescents who did react to the event, many gave a problem-focused reaction. The remaining male adolescents gave emotion-focused reactions, but less often than the female adolescents.

Conclusions: The outcomes showed that empathic reactions to a pain episode differ quantitatively and qualitatively between female and male adolescents, in line with the literature on community populations. This finding also extends to adolescents with autism. These outcomes can shed more light on the different phenotype of girls with autism.

119 **128.119** Experiences of the Autism Spectrum Disorder Diagnostic Process from the Perspective of Individuals, Families and Practitioners: A Systematic Review

B. Afsharnejad[1,2,3]*, A. J. Whitehouse*[1,4,5]*, J. Wray*[6]*, V. Eapen*[7,8]*, M. R. Prior*[9] *and K. Evans*[1,4]*, (1)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (2)Autism Research Team, Telethon Kids Institute, Perth, Australia, (3)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (4)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (5)University of Western Australia, Perth, Australia, (6)State Child Development Service, Western Australia Department of Health, Perth, Western Australia, Australia, (7)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (8)School of Psychiatry, University of New South Wales, Sydney, Australia, (9)The University of Melbourne, Melbourne, Australia*

Background: In recent years, an increasing number of individuals have been diagnosed as being on the autism spectrum. The diagnosis of autism spectrum disorder (ASD), along with the diagnostic process, can significantly affect these individuals and their families. However, there is not a consistent understanding of the experiences of these individuals and their families within the existing literature.
Objectives: This systematic review evaluated the extent and quality of the existing published literature regarding diagnostic experiences of individuals on the autism spectrum, their families and their practitioners.

Methods: The systematic review was conducted according to the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta-Analyses). A systematic database search was conducted of the academic literature describing the experiences of individuals on the autism spectrum and/or their families or practitioners during the ASD diagnostic process. The search was limited to journal articles and postgraduate theses published in English during the past decade. Search terms (title, abstract and key word) were establish synonyms for the three concepts of ASD, diagnosis and experience. CINAHL, Cochran Library, Embase, Medline, Proquest, PsychInfo, PubMed, Science Direct, Scopus and Web of Science were searched, resulting in a total of 11,940 documents (5,110 once duplicates were removed). This resulted in 54 articles for inclusion once the abstract and/or full text were reviewed for relevance. A data extraction form was used to summarise the articles, and a thematic data analysis approach was utilised to identify themes. Quality was evaluated by using the 'Kmet forms' for quantitative and qualitative studies or the AMSTAR form for systematic reviews.

Results: Three inter-related themes emerged from the literature: approach, support and process. In relation to approach, a strengths-focused and individual/family centered approach was advocated, where it was recommended the individual's and family's strengths, interests and goals be explored. This was perceived to promote optimism and hope, whilst keeping in perspective that ASD is a significant and lifelong disability. In terms of support, the provision of informational and emotional support during the ASD diagnostic process were appreciated. Providing a comfortable and private environment for sessions, using an empathetic communication style and making referrals for support groups was suggested to address this issue. This was identified as one of the most challenging aspect of diagnosing ASD by the practitioners. Finally, a coordinated, efficient and comprehensive process through-out the diagnostic process was considered important, where accurate and clear information is provided to the family.

Conclusions: The perspective of individuals, families and practitioners illustrated that an ASD diagnosis is often associated with a wide range of positive and negative emotions. The experiences of these key stakeholders suggested that it would be beneficial for an ASD diagnostic process to involve a strengths-focused and individual/family centered approach, provision of informational and emotional support, and a coordinated, efficient and comprehensive process.

120 **128.120** Exploration of Diagnostic Validity of Autism Diagnostic Observation Schedule (ADOS) in Korean Population

G. Bong[1]*, M. Oh*[2]*, I. H. Cho*[3]*, Y. S. Lee*[4]*, M. S. Kim*[5]*, D. W. Han*[6]*, C. Y. Shin*[7] *and H. J. Yoo*[8]*, (1)Psychiatry, Seoul National University Bundang Hospital, Seungnam, Korea, Republic of (South), (2)Psychiatry, Seoul National University Bundang Hospital, Sungnam, Korea, The Republic of, (3)Dr. Cho's Child & Adolescent Psychiatric Clinic, Seongnam, Korea, Republic of (South), (4)Department of Physiology, Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of (South), (5)Department Applied Chemistry, Kyung Hee University, Seoul, Korea, Republic of (South), (6)Dept. of Stem Cell Biology, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South), (7)Department of Neuroscience, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South), (8)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, The Republic of*

Background: Autism Diagnostic Observation Schedule (ADOS) has been widely used as one of the gold standard instruments for the diagnosis of ASD. However, research on the use of the ADOS and its applicability in individuals with ASD across non-English speaking populations is limited.
Objectives: ADOS has been widely used as one of the gold standard instruments for the diagnosis of ASD. However, research on the use of the ADOS and its applicability in individuals with ASD across non-English speaking populations is limited.

Methods: We used pooled data of ADOS from an ASD genetic study, clinical trials of social skills trainings, research on the development of early screening instruments, and clinical records of Seoul National University Bundang Hospital referred to diagnostic evaluation from 2008 to 2017. The subjects were composed of individuals with ASD, their unaffected siblings, children with other developmental delay referred for diagnostic evaluation, and typically developing children volunteered via community channels. Either ADOS or module-T of ADOS-2 were administered and scored by professionals whose research reliability had been established. Autism Diagnostic Interview–Revised (ADI-R) was also administrated.

Other measurements for ASD symptoms were administrated as well, including Social Responsiveness Scale (SRS), Social Communication Questionnaire (SCQ), and Korean version of the Childhood Autism Rating Scale (K-CARS). Clinical best estimate diagnosis was established by two board-certified psychiatrists based on DSM-IV-TR and DSM-5^{TM} criteria. We classified the *Best Estimate Clinical Diagnosis* into ASD (including pervasive developmental disorder and Asperger's syndrome) and non-ASD. *Autism* and *ASD* in ADOS classification and *mild-moderate concern* and *moderate-severe concern* in module-T of ADOS-2 were considered as ASD in the *ADOS Diagnosis*. Statistical analyses were performed to compare those two diagnoses using SPSS 22.0 and *t*-test and Cohen's kappa were used to compare the two groups.

Results: Data from total 1,248 subjects (age 90.29±62.04 months, 912 males, 336 females) were collected (Module-T, n=86; Module-1, n=385; Module-2 n=260; Module-3 n=285; Module-4, n=232). The sensitivity and specificity of ADOS showed sufficient degrees (Module-T=100%, 94.55%; Module-1=100%, 89.36%; Module-2=97.83%, 97.40%, Module-3=98.44%, 96.82%;, Module-4=99.29%, 92.39%) across all modules. Positive Predictive Value (PPV) was 97.37 (91.18 to 98.90) and Negative Predictive Value (NPV) was 98.31 (94.94 to 100), depending on modules. The agreement between all the modules of ADOS and clinical diagnosis were at excellent levels (*k*=.948; Module-T, *k*=.926; Module-1, *k*=.937; Module-2, *k*=.945; Module-3, *k*=.950; Module-4, *k*=.927) and other measurements' were at good to excellent levels (Cohen's kappa of ADI-R, K-CARS, SCQ and SRS with ADI-R =.844, .810, .625, .656, respectively). Individual item analyses showed significant differences in scores for all algorithm items on module 1 to 4 between ASD and non-ASD groups (*p*<.05). In module T, 'D2-Mannerism,' and 'D5-Repetitive Behavior' items were not statistically significant, falling between *two* groups.

Conclusions: The Korean version of ADOS showed high level of diagnostic validity in all modules. This study suggests that ADOS might be a valuable diagnostic instrument for individuals with ASD across countries with different languages and cultural backgrounds. Further analysis is required with larger samples to examine the validity of individual items of Module-T.

121 **128.121** Exploring Autism Symptoms in Individuals with Prader-Willi and Angelman Syndromes

E. K. Baker[1]*, D. E. Godler*[2]*, D. Amor*[3]*, M. Bui*[4]*, C. Rogers*[5]*, M. Field*[6] *and L. Bretherton*[1]*, (1)Murdoch Children's Research Institute, Melbourne, Australia, (2)Genetics, Murdoch Children's Research Institute, Melbourne, Australia, (3)Victorian Clinical Genetics Service, Melbourne, Australia, (4)Centre for Epidemiology and Biostatistics, University of Melbourne, Melbourne, Australia, (5)Hunter Genetics, GOLD Service, Newcastle, Australia, (6)Hunter Genetics, Newcastle, Australia*

Background: Prader-Willi syndrome (PWS) and Angelman syndrome (AS) are imprinting disorders that are caused by genetic or epigenetic changes at the same locus on chromosome 15. PWS results from the loss of paternal genes from chromosome 15q11.2-q13 while AS from the absence of the maternal genes in the same region. Overexpression of maternally imprinted genes in the 15q11-13 region is also a susceptibility factor for autism spectrum disorder (ASD), which is observed in both PWS and AS. Individuals with PWS are reported to have social withdrawal, compulsive behaviours and repetitive speech. In contrast, those with AS are more likely to be eager to communicate and engage socially. However most research to date has relied on parent-report rather than through objective assessment.

Objectives: (1) to explore symptoms of ASD in well-characterized samples of individuals with PWS and AS; (2) to compare rates of ASD between individuals with PWS and AS; and (3) to compare intellectual functioning between those meeting criteria for ASD compared to those classified as non-ASD.

Methods: Twenty-three individuals with PWS (47.8% male; age 1.5 – 32.2 years) and 14 individuals with AS (50.0% male; age 2.8 – 39.7 years) participated in the study. The Autism Diagnostic Observation Schedule-2nd Edition (ADOS-2) was used to assess ASD symptoms. The Mullen Scales of Early Learning was used to assess intellectual functioning in PWS children aged under 3 years and all individuals with AS. For the remaining PWS participants, the age appropriate Wechsler intelligence scale was used to assess intellectual functioning.

Results: The criteria for ASD were met by 16 (69.6%) PWS participants compared to five (35.7%) AS participants, however the difference was not significant ($\chi^2 = 2.801$, *p* = .094). The mean Calibrated Severity Score (CSS) for the total (PWS: Median [*Md*] = 7.00; AS: *Md* = 3.00) and the Social Affect (SA; PWS: *Md* = 6.00; AS: *Md* = 3.00) domains of the ADOS-2 were significantly higher in PWS participants (*p* = .003 and .001, respectively); however the two groups did not differ on Repetitive and Restricted Behaviour (RRB) CSS scores (PWS: *Md* = 6.00; AS: *Md* = 6.00; *p* = .408). Individuals with PWS meeting criteria for ASD on the ADOS-2 had significantly lower VIQ (*p* = .006) and FSIQ (*p* = .018) scores compared to PWS patients not meeting criteria for ASD. In the AS group, no significant differences were found between the two groups on the intellectual functioning domains (*p* > .05). Exploratory analyses revealed that SA behaviours tended to differentiate those meeting criteria for ASD compared to Non-Spectrum cases, rather than RRBs.

Conclusions: ASD symptoms, particularly SA deficits were more common in individuals with PWS compared to individuals with AS; though the rate of ASD did not significantly differ between the two groups. Meeting criteria for ASD was associated with lower intellectual functioning scores in individuals with PWS, but not those with AS; though effect sizes were moderate to large.

122 **128.122** Exploring the Experience of Seeking an Autism Diagnosis As an Adult: Findings from Online Submissions and Interviews

M. De Broize[1,2]*, K. Evans*[2,3]*, A. J. Whitehouse*[2,3,4]*, J. Wray*[5]*, V. Eapen*[6,7]*, M. R. Prior*[8] *and* ***A. Urbanowicz***[2,9]*, (1)Queensland Centre for Intellectual and Developmental Disability, MRI-UQ, The University of Queensland, South Brisbane, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (4)University of Western Australia, Perth, Australia, (5)State Child Development Service, Western Australia Department of Health, Perth, Western Australia, Australia, (6)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (7)School of Psychiatry, University of New South Wales, Sydney, Australia, (8)The University of Melbourne, Melbourne, Australia, (9)Queensland Centre for Intellectual and Developmental Disability, MRI-UQ, The University of Queensland, Brisbane, Australia*

Background: Ideally, diagnosis of Autism Spectrum Disorder (ASD) should occur by three years of age. However, due to a number of factors an accurate assessment often does not occur until between six and eight years old. People who are not diagnosed at early ages experience greater challenges to receiving an accurate diagnosis as time progresses. There is a limited body of research, particularly within the Australian context, describing the experiences of adults who seek an ASD diagnosis.

Objectives: This project aimed to explore the diagnostic experiences of adults who seek an ASD diagnosis as an adult.

Methods: This qualitative study used two unique data sets: online written submissions and interview transcripts. Australian adults who identified as being autistic were eligible to participate. A total of 36 participants were involved in this study, with a median age of 42 years (range = 27 – 80 years) and a gender distribution of 24 females and 12 males. Twenty-two completed an online submission answering the question "From your perspective, what are the most important considerations to address when developing a national guideline for the diagnosis of autism spectrum disorder in Australia?" Online submissions had to be written in English and had a limit of 100 words. Semi-structured interviews were conducted with 14 participants, where experiences before, during and after diagnosis were discussed. Online submissions and interview transcripts were imported into NVivo 11 and were analysed using thematic analysis.

Results: Three major themes emerged from the data describing experiences prior to, during and following an ASD diagnosis in adulthood.

Experiences prior to ASD diagnosis were focused primarily on the motivators that ultimately led to diagnosis, such as other family members having an ASD diagnosis and feelings of being "different" while growing up.

Experiences during the ASD diagnostic process were varied in terms of logistic factors, approaches and barriers. Logistic factors included who, where and how the assessment was conducted. Approaches that were valued included strengths focused assessments where rapport was built with a key contact person and tailored communication was utilised. Frequent barriers to diagnosis included the cost of assessment, availability of appropriately skilled assessors, masking strategies hindering symptom identification (particularly among women) and sensory distress associated with assessment locations.

Experiences following ASD diagnosis were typically positive, characterised by empowerment and self-realisation due to receiving the ASD diagnosis. However, negative experiences were also reported, such as stigma. Many of the participants reported unmet needs and difficulty in accessing important supports following diagnosis.

Conclusions: The online submissions and interviews revealed varied ASD diagnostic experiences of adults in Australia, and unmet needs in the current diagnostic system were highlighted. Participants reported the benefits of having an ASD diagnosis. Access to ASD diagnosis for Australian adults may be improved with the new nationwide diagnostic guideline.

123 **128.123** Gender Difference of Gaze Fixation Patterns in 5-Year -Old Children -the Usefulness of Early Detection of Girls with Autism Spectrum Disorder-

Y. Sakamoto[1]*, M. Saito*[1]*, K. J. Tsuchiya*[2]*, A. Osato*[1]*, S. Kato*[3]*, Y. Matsubara*[4]*, T. Mikami*[5]*, M. Adachi*[6]*, M. Takahashi*[6]*, S. Yasuda*[5] *and K. Nakamura*[1]*, (1)Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (2)Research Center for Child Mental Development, Hamamatsu University School of Medicine, Hamamatsu, Japan, (3)Aomori Chuo Gakuin University, Aomori, Japan, (4)Hirosaki University Graduate School of Medicine, Hirosaki, Japan, (5)Research Center for Child Mental Development Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (6)Research Center for Child Mental Development, Graduate School of Medicine, Hirosaki University, Hirosaki, Japan*

Background: It has been suggested that early intervention can improve developmental outcomes of Autism Spectrum disorder (ASD). Delay in the identification of ASD impedes early access to interventions and causes negative developmental outcomes. However, identifying children with ASD is difficult, especially in girls. We need biomarker considering gender difference. Recently, a lot of studies have identified unique gaze fixation patterns in individuals with ASD using eye-tracking systems. Such gaze fixation patterns in individuals with ASD are considered to be associated with social attention. Recently Gaze fixation patterns have attracted attention as the indicator of sociability.
Objectives: The purpose of this study is to clarify the gender difference of gaze fixation patterns in 5-year-old children and analyze these results statistically along with other existing tools, after then to examine the utility for early diagnosis of ASD.

Methods: In the community health check-up spanning three years (2013-2015, N=3804), the participants screened in the community health check-up were 2923 children. The local government officers invited 440 children (included 31 applicants) to additional assessments and an interview based on the results of the screening. We measured the percentage of gaze fixation time allocated to particular objects depicted in movies by 5-year-old children in a community health check-up (n=438) by the double-blind method. Subjects of analysis are ASD (n=64) who diagnosed by DSM-5 criteria and Typical development (TD, n=68) who had no abnormalities in all the experiment. We compared gaze fixation percentage between the two groups and determined the cut-off point by ROC analysis using all 200 girls. In addition, we compared the fitness and the Odds Ratio of using Gaze fixation patterns with other existing tools by logistic regression.

Results: Analyzed the gaze fixation percentage of 'People' by gender, there was a significant difference only in girls ($p < 0.05$, ES = 0.96). As a result of ROC analysis in girls, AUC was 0.762 ($p<0.001$). It indicates moderate predictive ability and diagnostic ability. When we set the cut-off point to gaze fixation percentage 50% (sensitivity 90%, specificity 59%) and combine it with Autism Spectrum Screening Questionnaire (ASSQ) and Strengths and Difficulties Questionnaire (SDQ), the fitness of logistic analysis and the Odds Ratio rose to 3.3 times. In girls, the combination of Parent-interview ASD Rating Scale - Text Revision (PARS-TR) short-version and gaze fixation percentage 50% showed sensitivity 71.5%, specificity 88.7%.

Conclusions: This study suggested the gender difference in the evaluation of sociability in 5-year-old children. We have to select images considering age and gender. Gazing fixation pattern is useful in objectively evaluating social development. There is the possibility to contribute to early identification of girls with ASD by adding gaze fixation patterns.

124 **128.124** Get It Right, Make It Easy, See It All: Autism Spectrum Disorder Diagnosis in Australia from the Perspective of Autistic Individuals and Their Caregivers

E. D'Arcy[1,2,3]*, M. Falkmer*[3,4,5]*, A. J. Whitehouse*[3,6,7]*, S. J. Girdler*[8,9]*, T. Falkmer*[3,10,11,12]*, J. Wray*[13]*, V. Eapen*[9,14]*, M. R. Prior*[15] *and K. Evans*[3,6]*, (1)Autism Research Team, Telethon Kids Institute, Subiaco, Australia, (2)School of Occupational Therapy and Social Work, Curtin University, Bentley, Australia, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (4)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (5)School of Education and Communication, CHILD programme, Institute of Disability Research, Jönköping University, Jönköping, Jönköping County, Sweden, (6)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (7)University of Western Australia, Perth, Australia, (8)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (9)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (10)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia, (11)Pain and Rehabilitation Centre, and Department of Medical and Health Sciences, Linköping University, Linköping, Sweden, (12)Department for Rehabilitation, Jönköping University, Jönköping, Sweden, (13)State Child Development Service, Western Australia Department of Health, Perth, Western Australia, Australia, (14)School of*

Psychiatry, University of New South Wales, Sydney, Australia, (15)The University of Melbourne, Melbourne, Australia

Background: There is an emerging body of evidence in relation to the perspectives of autistic individuals and their caregivers in relation to the autism spectrum disorder (ASD) diagnostic process. However, these studies have focused on previous experiences that occurred before, during or after diagnosis. There is scarce information describing the future preferences or recommendations of these individuals.
Objectives: This viewpoint survey aimed to understand the relative importance of different aspects of an ASD assessment from the perspective of people with lived experience of autism.

Methods: Thirty-eight autistic adolescents / adults (>12 years, n=12) or caregivers of autistic individuals of any age (n=26) participated in the viewpoint survey. The median age of participants was 42 years (range=12-59), and most were females (n=29). This project employed a Q-methodology, where participants sorted 66 statements regarding the ASD diagnostic process from least important (-5) to most important (5). After extraction from the online Q sort software, the PQMethod software package was used to analyse the results according to the prescribed method. This supported the retention of three factors, hence results were generated through by-person varimax rotation factor analysis. The three-factor varimax solution accounted for 42% of the explained variance in the sample. Factor arrays were created to define the three factors. The factor arrays were interpreted to formulate viewpoints by a group of five researchers familiar with Q methodology research and the ASD diagnostic process.

Results: The first viewpoint, “Get it Right”, was defined by 18 participants (4 autistic individuals and 14 caregivers), and explained 18% of the variance. Individuals in this viewpoint valued trained and experienced diagnosticians, along with a comprehensive assessment process.

The second viewpoint, “Make it Easy”, was defined by 12 participants (5 autistic individuals and 7 caregivers), and accounted for 15% of the variance. This viewpoint was characterised by prioritisation of convenience, accessibility and support, while not compromising accuracy of assessment.

The third viewpoint, “See it All”, was defined by 5 participants (3 autistic individuals and 2 caregivers), and explained 9% of the variance. This viewpoint highlighted the importance of holistically evaluating the needs of the individual and their family, and tailoring the assessment to the unique circumstances.

Conclusions: The complexity of developing an ASD diagnostic process that is acceptable to all autistic individuals and caregivers was highlighted by this viewpoint survey, given the three contrasting perspectives identified. This emphasises the importance of the guideline allowing sufficient flexibility to meet the varied needs and wants of end-users.

125 **128.125** ICF Core Sets for Autism Spectrum Disorder, ADHD and Cerebral Palsy: Commonalities and Differences

S. Bolte[1], *S. Mahdi*[2] *and V. Schiariti*[3], *(1)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women’s and Children’s Health, Karolinska Institutet, Stockholm, Sweden, (2)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (3)Division of Medical Sciences, University of Victoria, Victoria, BC, Canada*

Background: Capturing functional information is crucial in autism spectrum disorder. The International Classification of Functioning, Disability and Health (ICF) Core Sets promote a functional approach in day-to-day practice. Objectives: This study sought to identify content commonalities and differences among the ICF Core Sets for the newly developed Core Sets for Autism Spectrum Disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD), as well as Cerebral Palsy (CP) Methods: Descriptive analyses were conducted to compare the content of the different ICF Core Sets. The categories within each ICF Core Set were aggregated at the component and chapter level prior to the analysis. Results: Activities and participation was the most covered component across all ICF Core Sets. Differences included: 1) overall representation of ICF components, and 2) coverage of chapters within each component. CP included all ICF components, while ADHD and ASD predominantly focused on activities and participation and environmental factors. Environmental factors were highly covered in the ADHD Core Set (40%), as opposed to ASD (28%) and CP (27%). Conclusions: ICF Core Sets for ASD ADHD, and CP capture both common, but also much unique information, showing the importance of creating condition specific ICF-based tools to build accurate functional profiles for each clinical population.

126 **128.126** Linking the Esdm Curriculum Checklist for Young Children with Autism to the ICF-CY Who Comprehensive Classification System

K. Strauss[1], *A. Delle Fratte*[2] *and L. Fava*[2], *(1)Umbrella Autism, Rome, Italy, (2)Association for Treatment and Research in Autism Spectrum Disorders "UmbrellAutism", Rome, Italy*

Background: Children with Autism Spectrum Disorders are characterized by divers patterns of behavior and level of performance. Such variability translate into different intervention needs that makes planning of individualized intervention programs challenging. Curriculum driven tools that guide decision-making process for intervention goals should rely on critical variables that promote a broad range of children's life skills, that are developmental appropriate and include information on the environmental support (Wilczynski et al., 2017). Approaches to evaluate the quality of curriculum based intervention tools in addressing developmental and educational process in children with autism are lacking. The International Classification of Functioning, Disability and Health version for Children and Youth (ICF-CY, WHO, 2007) may offer a framework by which to approach teaching goals of autism intervention curricula.
Objectives: The aim of the research is to document the utility of linking the Early Start Denver Model Curriculum Checklist (Rogers & Dawson, 2010) to the codes of the ICF-CY.

Methods: The ESDM curriculum checklist is a tool for designing teaching objectives for intervention in children with autism spectrum disorders until ages 4-5 and is divided into logical teaching sequences covering broadly nine developmental domains with a total of 446 items. The ICF-CY provides a classification of functioning and disability form both and individual and societal perspective on Body Functions, Activities and Participation, and Environmental Factors. Deductive content analysis was used to make inferences from textual data. The process of analysis has followed a set of sequential steps using the linking rules (Cieza et al., 2005) on the identification of meaningful concepts. Two independent researchers linked the ESDM curriculum items with the full ICF-CY set. Inter-rater agreement was calculated using Kappa Coefficient. Once final coding of ESDM items was achieved, the derived code set as compared for completeness to a code set of meaningful concepts specifically for autism (Castro & Pinto, 2012; Pinto et al., 2013; Boelte et al., 2016) and developmental core sets for 0-2 and 3-5 years (Ellingsen & Simonsson, 2011),

corresponding to the relative age range of the ESDM curriculum.

Results: The ESDM curriculum checklist is addressing mostly the Activities and Participation component of the ICF-CY, focussing essentially on directly observed performance of skills. The Environmental Factors component in which the child is embedded is not addressed, missing inferential characteristics that may be related with limited participation and performance. While the ESDM curriculum checklist covers broadly the developmental core sets, some aspects of meaningful concepts of code sets for children with autism are missing.

Conclusions: The present research document the ICF-CY Environmental Factors component as a supporting tool to improve the intervention goal-setting process in programs for young children with autism. Results may be suggestive of the difficulty in finding a balanced, feel-grounded approach on how to describe disability in pre-school children with autism from a developmental perspective and to address essential aspects of learning and participation for young children with autism in curriculum tools guiding intervention planning.

127 **128.127** Measuring Emotion Regulation in Children with Autism: A Novel Observational Tool

J. K. Lake, P. Tablon Modica, V. Chan (Ting) and J. A. Weiss, Psychology, York University, Toronto, ON, Canada

Background: Children with autism often experience difficulty regulating their emotions, and these difficulties have been associated with a range of emotional and behavioural problems (Mazefsky et al., 2013). While there are a number of self and parent-report questionnaires of emotion regulation (ER), few observational measures exist. To address this gap, we created an observational measure of child ER, adapted from a parent-report measure, the *Emotion Regulation Checklist* (Shields & Cicchetti, 1997). This adapted measure was used to assess child ER processes during a standardized 15-minute *Emotion Discussion Task* (EDT; Suveg, 2008), around situation(s) where the child felt anxious, angry and happy.
Objectives: 1) Examine the reliability and concurrent validity of an observational measure of ER; 2) investigate associations between an observational measure of child ER and parent co-regulation strategies, assessed during the same task; and 3) examine associations between an observational measure of child ER and child internalizing and externalizing problems.

Methods: Preliminary findings are based on 49 children with ASD (aged 8-12 years), however final results will be based on a total of 62 children. To examine the concurrent validity of our observational measure of ER, we correlated scores with scores on standardized, parent and self-report measures of ER. To examine associations between our observational measure and parent co-regulation strategies, we used a behavioural coding scheme (Gulsrud et al., 2010) to assess parent scaffolding and parent co-regulation strategies, during the same EDT task. Finally, to examine associations between our observational measure of child ER and child emotional and behaviour problems, we correlated scores on our observational ER measure with a standardized measure of internalizing and externalizing problems.

Results: Preliminary findings suggest that our observational ER measure has excellent reliability for both subscales: *lability/negativity* (ICC = .94) and *emotion regulation* (ICC = .88). The observational lability/negativity subscale score was associated with parent ratings of emotion lability/negativity (r_s = .31, p = .03), emotion regulation (r_s = -.40, p = .01), and behavioural symptoms (r_s = .31, p = .03). The observational emotion regulation subscale score was associated with parent global scaffolding ratings (emotional: r_s = .33, p = .02; motivational: r_s = .38, p = .02), suggesting that parents who provided higher quality scaffolding during the EDT had children who displayed higher levels of emotion regulation during that interaction. The observational emotion regulation subscale was also associated with child self-reported emotion management (dysregulation: r_s = -.35, p = .02; coping: r_s = .38, p = .01), and parent ratings of child emotion regulation (r_s = .32, p = .03). Finally, internalizing (r_s = -.32, p = .03) and externalizing (r_s = -.44, p = .001) symptoms were also related to our observational emotion regulation subscale, indicating that parents reported greater internalizing and externalizing problems among children observed to display more difficulty with emotion regulation.

Conclusions: Preliminary results support the concurrent validity of an observational measure of ER among children with ASD. Findings also highlight the importance of a multidimensional approach to assessing emotion regulation.

128 **128.128** Miss Asd; A New Screening Instrument for Girls and Women with ASD

*R. H. Grondhuis, M. L. Bezemer and **E. M. Blijd-Hoogewys**, INTER-PSY, Groningen, Netherlands*

Background: The diagnosis for ASD is mainly based on the male ASD phenotype. Consequently, women with ASD are often misdiagnosed or diagnosed much later in life. A screening instrument taking into account the female ASD phenotype could aid in the identification of women who may have undiagnosed ASD. The Autism-spectrum Quotient (AQ, Baron-Cohen et al., 2001), an often-used ASD screening instrument, does not take into account the female ASD phenotype. Typical for a female ASD phenotype is a higher social motivation, better camouflaging techniques, gender specific preoccupations, and vulnerability for emotional problems.
We developed the M-ASD (Miss-ASD), an ASD screening instrument taking into account this phenotype. It includes 120 items derived from extensive literature search on female ASD expressions, clinical impressions of the authors, and data analysis aimed at sex differences in adults with ASD on other questionnaires (N=200 AQ, N=90 SRS-A, N=250 BRIEF-A). The M-ASD has 6 subscales: 1) Social interaction and communication, 2) Rigidity, 3) Coping, compensation and camouflaging behavior, 4) Sensory issues, 5) Information processing, and 6) Miscellaneous.

Objectives: Development, validation and standardization of a new screening instrument, M-ASD, which takes into account the female ASD-phenotype.

Methods: There were 31 participants with ASD (14 men, 17 women; M = 33.31, SD = 12.56 year), diagnosed by trained clinicians. Their estimated intelligence, based on education, is average to superior. All participants completed the AQ and the M-ASD. A cut-off score of 26 is used for the AQ. There are yet no norm scores available for the M-ASD, therefore, in semi-accordance with the AQ, the cut-off is set at >60% of ASD confirmatory answers.

Results: Women have higher M-ASD mean scores (more reported problems) than men, on both total score and all sub-scores (6-14% higher), with the highest mean difference on the subscales 'Sensory issues' and 'Coping, compensation and camouflaging behavior'. T-tests showed a significant difference for 'Sensory issues' and a trend for 'Coping, compensation and camouflaging behavior': women report more problems than men (p = .04, p = 08, respectively). The correlation between AQ and M-ASD was high (r = .72, p = .010).

Conclusions: The M-ASD seems to be suitable in measuring ASD characteristics; the correlation with another ASD questionnaire (AQ) is high. Women diagnosed with ASD score higher on M-ASD subscales that seem to be more characteristic for women. Women have higher M-ASD scores than men, on both the total score and all sub-scores. This might be linked with a higher self-knowledge in women and/or the fact that this tool is more focused on the proposed female ASD phenotype. Coming months, we will continue to collect data. Our ultimate plan is to shorten the M-ASD and focus on validation and standardization of this new screening tool.

129 **128.129** New DSM-5 Severity Level Ratings for Autism Spectrum Disorder: Clinical Use and Associated Factors

M. O. Mazurek[1], *F. Lu*[2], *M. Eric*[3] *and B. Handen*[4], *(1)University of Virginia, Charlottesville, VA, (2)Massachusetts General Hospital, Boston, MA, (3)Harvard Medical School, Boston, MA, (4)University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background:

The newest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) introduced substantial changes to the criteria for autism. The shift from separate diagnostic subcategories into a single category of autism spectrum disorder (ASD) resulted in considerable discussion and research. By contrast, the introduction of new severity level ratings for social communication and restricted and repetitive behavior (RRB) in DSM-5 has received little scientific attention. Although the ratings intended to capture domain-specific severity, clear-cut operational definitions are lacking. Thus, it is unclear how these rating will be used and whether they will reflect symptom severity alone or be influenced by other indices of impairment.

Objectives:

The study objectives were to evaluate the use of DSM-5 severity level ratings in a large sample of children with ASD and to examine their relation to standardized measures of ASD severity and other clinical features, particularly cognitive and behavioral functioning.

Methods:

Participants included 248 children and adolescents with ASD (ages 2-17, 82% male) who received comprehensive diagnostic evaluations for autism at one of six Autism Treatment Network sites. Each assessment included a review of records, diagnostic clinical interview, Autism Diagnostic Observation Schedule – 2nd Edition (ADOS-2), cognitive assessment, assessment of behavioral functioning (Child Behavior Checklist, CBCL, and Aberrant Behavior Checklist, ABC), and completion of a DSM-5 Checklist.

Results:

Twenty-six percent of the sample was rated as having the lowest severity (Level 1, "requiring support") in both domains, while 15% was rated as having the highest severity (Level 3, "requiring very substantial support") in both domains. Bivariate analyses (cumulative logistic regression for the three levels of severity, binary logistic regression for lowest severity, and linear regression) all indicated that higher severity ratings in both domains were significantly associated with younger age, lower IQ, and greater ADOS-2 domain-specific symptom severity ($p < .05$ for all). The strength of associations was moderate/large for age (Spearman's correlations of $r_s = -.51$ and -.43) and IQ ($r_s = -.61$ and -.47), and small for ADOS-2 domains ($r_s = .23$ and .29). Greater DSM-5 RRB severity was also associated with higher parent-reported stereotyped behaviors (measured by the ABC) in two of three bivariate models. Severity ratings were not associated with emotional or behavioral problems (measured by the CBCL). Multiple regression models indicated that age, IQ, and ADOS-2 social affect were significant independent predictors of social communication severity ($p < .05$ across all models), and that age, IQ, and ADOS-2 RRB were significant independent predictors of DSM-5 RRB severity ($p < .05$ across all models).

Conclusions:

These findings partially support the concurrent and discriminant validity of the new DSM-5 severity ratings. Clinician ratings of severity in both domains were significantly associated with behavioral observations of autism severity, but not with measures of other behavioral or emotional symptoms. However, the strong associations between IQ and DSM-5 severity ratings in both domains may suggest that clinicians are including cognitive functioning in their overall determination of symptom severity. Further research is needed to examine clinician decision-making and interpretation of these specifiers.

130 **128.130** Structural and Convergent Validity of the Autism Impact Measure (AIM)

M. O. Mazurek[1], *C. Carlson*[2], *M. Baker-Ericzén*[3], *E. Butter*[4], *M. Norris*[4] *and S. M. Kanne*[5], *(1)University of Virginia, Charlottesville, VA, (2)Department of Psychology, University of Houston, Houston, TX, (3)Rady Children's Hospital, San Diego, CA, (4)Nationwide Children's Hospital, Columbus, OH, (5)Thompson Center for Autism & Neurodevelopmental Disorders, Columbia, MO*

Background: Psychometrically sound outcome tools are needed to evaluate the effects of autism treatments in both clinical and research settings. The Autism Impact Measure (AIM) was designed to enable efficient measurement of incremental changes in both frequency and impact of core ASD symptoms. The initial psychometric study of the AIM indicated strong to moderate test-retest reliability and inter-rater reliability (Kanne et al., 2014). However, a larger sample was needed to further establish structural validity and scoring guidance. An extensive battery of domain-specific measures of communication, social functioning, and repetitive behaviors was also necessary to thoroughly examine convergent validity.
Objectives: The objective of the current study was to examine the structural and convergent validity of the AIM in a large sample of children with ASD.

Methods: Participants included 890 children and adolescents with ASD. The study included a primary sample ($n = 450$, 82% male) used in both convergent and structural validity analyses and a secondary sample ($n = 440$, 84% male) used only in structural validity analyses. The following convergent validity measures were administered (Sample 1): Repetitive Behavior Scale – Revised (RBS-R), Aberrant Behavior Checklist (ABC), Social Responsiveness Scale (SRS-2), Autism Diagnostic Observation Schedule – 2nd Edition (ADOS-2), Ohio Autism Clinical Global Impression Severity Scale (OACIS-S), Vineland Adaptive Behavior Scales (VABS-II), MacArthur Communicative Development Inventory (CDI), Pediatric Quality of Life Inventory (PedsQL).

Results:

A series of exploratory (EFA) and confirmatory (CFA) factor analyses was conducted to establish construct and structural validity of the AIM. AIM item scores were calculated by adding the Frequency and Impact scores for each item, yielding a single summative item metric representing overall severity. EFA was conducted first, followed by cross-validation using CFA with a hold-out sample of subjects. To accomplish this, the total sample was randomly assigned to one of two groups (each consisting of half the sample). EFA was conducted on the first randomly established sample, while the CFA was conducted on the second randomly established hold-out sample. The results yielded a final model with five theoretically and empirically meaningful subdomains: Repetitive Behavior, Atypical Behavior, Communication, Social Reciprocity, and Peer Interaction. The final model showed very good fit both overall and for each of the five factors (RMSEA <.06, CFI and TLI >.95), indicating excellent structural validity. Convergent validity analyses indicated that AIM subdomain scores were significantly correlated with measures of similar constructs across all five domains.

Conclusions: The current study examined the construct and structural validity of the AIM in a sample of 890 children with ASD. The study extended prior research on the AIM by including a larger sample and using a more comprehensive measurement battery to test convergent validity. The results indicate that the psychometric properties of the AIM are strong, including excellent structural validity and solid convergent validity. The results suggest that the AIM may be useful for efficient assessment of short-term improvements in core ASD symptoms across five empirically-derived and clinically meaningful symptom domains.

131 **128.131** Pilot Analyses of the Feasibility and Validity of Autism Spectrum Disorder Screening Instruments: Social Communication and Interaction Screening in Toddlers (SISO)

H. J. Yoo[1], *G. Bong*[2], *M. Oh*[3], *J. Kim*[4], *H. Sunwoo*[5], *J. Jeon*[6], *J. Jang*[7], *K. S. Lee*[8], *S. Jung*[9], *Y. S. Lee*[10], *M. S. Kim*[11], *D. W. Han*[12] *and C. Y. Shin*[13], *(1)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, The Republic of, (2)Psychiatry, Seoul National University Bundang Hospital, Seungnam, Korea, Republic of (South), (3)Psychiatry, Seoul National University Bundang Hospital, Sungnam, Korea, The Republic of, (4)Psychiatry, Seoul National University Bundang Hospital, Seoul, Korea, Republic of (South), (5)Psychiatry, Soonchunhyang University Hospital, Seoul, Seoul, Korea, Republic of (South), (6)Seoul National University Bundang Hospital, Seoul, Korea, Republic of (South), (7)Incheon Center for Developmental Disabilities, Incheon, Korea, Republic of (South), (8)Hanshin University, Osan-SI, Korea, The Republic of, (9)Sewon Infant Child Development Center, Seoul, Korea, Republic of (South), (10)Department of Physiology, Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea, Republic of (South), (11)Department Applied Chemistry, Kyung Hee University, Seoul, Korea, Republic of (South), (12)Dept. of Stem Cell Biology, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South), (13)Department of Neuroscience, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South)*

Background: Early diagnosis is the critical first step for early intervention for autism spectrum disorders (ASD), which is crucial for prognosis. However, there have been limited early ASD screening instruments available in Korea.
Objectives: The objectives of this study are 1) to develop an early screening instrument of ASD for infants/toddlers in Korea, named "Social Communication and Interaction Screening in tOddlers (SISO)," and 2) to verify feasibility and validity of the instrument by comparing with clinical best estimate diagnosis.

Methods: 1) We primarily identified the lists of social and communication behaviors that might be manifested in infants/toddlers with ASD by age range, each of which is relevant to DSM-5^{TM} criteria. Behaviors in the lists were paralleled by those observed in typically developing infants/toddlers in each age range. We developed preliminary interview questions and play-based activities to detect such behaviors clearly. 2) Focus group interviews were conducted on 30 daycare center/kindergarten teachers and 11 professionals, in order to select the most relevant items, draw appropriate examples regarding children's play in everyday life, and refine item wordings and expressions for better understanding. 3) Finally, we developed SISO-P (Play-based observation of toddlers, 3~14 items) and SISO-I (Interview questions for caregivers/teachers, 11~19 items). Both instruments covers five age ranges: 9~11, 12~17, 18~23, 24~35, and 36~42 months. 4) Subjects included for validity analyses were toddlers at age 12 to 42 months with no significant physical/neurological/sensory problems interfering the diagnostic procedures. For all participants, SISO-P and SISO-I were conducted along with the diagnostic procedures using CARS, ADOS, and ADI-R. We analyzed sensitivity, specificity, positive predictive value, and negative predictive value of the SISO Classification in relation to the clinical best estimate diagnosis that provides ASD/non-ASD classification. χ^2-test and *t*-test were used to analyze validity of individual items.

Results: Total 251 infants/toddlers participated (9~11, n=3; 12~17, n=20; 18~23, n=30; 24~35, n=110; 36~42, n=88). 1) For overall subjects, sensitivity was 97.84% in SISO-P, and 95.00% in SISO-I. Specificity was 34.55% in SISO-P, and 56.25% in SISO-I. For SISO-P, PPV was 65.38 and NPV was 92.68. For SISO-I, PPV was 73.08 and NPV was 90.00. 2) For SISO-P, individual item analyses on 24~35 month-olds (ASD, n=61; non-ASD, n=48) and 36~42 month-olds (ASD, n=71; non-ASD, n=17) showed significant differences in scores for all items ($p<.05$) and significant differences in frequencies of screen-positive and -negative scores between ASD and non-ASD groups for all items ($p<.05$). The results showed that, for SISO-I, differences in scores for 'Social Interest to others' item in 24 months and 'Eye Contact', 'Social Smile', and 'Social interest to others' items in 36 months are not statistically significant across two groups, suggesting that the interview questions might need to be revised in a way that better differentiates toddlers' behaviors towards others and caregivers.
Conclusions:

The present study suggests that SISO might be feasible and highly sensitive but is a less specific screening instrument for ASD in toddlers. Further study is needed on a larger number of subjects to find out which items are adequately specific in screening ASD.

132 **128.132** Profiles of Autistic Symptoms in Individuals with 22q11.2 Duplication or Deletion Syndromes, Regardless of Autism Diagnosis

C. C. Clements[1], *J. R. Bertollo*[1], *A. Zoltowski*[2], *A. de Marchena*[3], *L. DePolo*[4], *E. Zackai*[5], *B. Emanuel*[5], *D. McDonald-McGinn*[5], *T. Wenger*[6], *R. T. Schultz*[1], *J. S. Miller*[7] *and O. Ousley*[8], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Vanderbilt University, Nashville, TN, (3)University of the Sciences, Philadelphia, PA, (4)Children's Hospital of Philadelphia, Philadelphia, PA, (5)Department of Pediatrics, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)Department of Pediatrics, Seattle Children's Hospital, Seattle, WA, (7)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (8)Department of Psychiatry and Behavioral Sciences, Emory Autism Center, Emory University School of Medicine, Atlanta, GA*

Background: Genetic syndromes associated with Autism Spectrum Disorder (ASD) may hold promise for understanding its underlying biology, but such insights depend on a solid understanding of human phenotypes. Our groups recently reported increased prevalence of ASD among individuals with 22q11.2 Deletion (DS; Ousley et al., 2017) and Duplication Syndromes (DupS; Wenger et al, 2016). Many studies note pervasive autism-like symptoms in individuals with 22q11.2DS/DupS, *regardless* of ASD diagnosis, highlighting social communication impairments (SCI) such as reduced facial expression and difficulty initiating in 22q11.2DS, and high rates of restricted or repetitive behaviors and interests (RRBI) in 22q11.2DupS. Thus, possessing either one or three copies of the 22q11.2 region appears to yield at least some SCI or RRBI symptoms in most individuals. It remains unknown how or why autistic symptom profiles differ between deletions and duplications, which could inform clinical practice at 22q11.2 clinics as well as 22q11.2 animal models of ASD.

Objectives: To compare and describe the profile of autistic symptoms between individuals with 22q11.2 duplication and deletion.

Methods: We recruited participants with 22q11.2DupS (n=20; ages 4-14; 80% male) or DS (n=61; ages 4-29, 50.8% male) confirmed by SNP, MLPA, or FISH testing. We examined differences in RRBI and SCI between and within groups on the subsets that completed the ADI-R, ADOS, and DSM5 checklist. We computed the proportion of possible algorithm points (or possible symptom count for DSM5 checklist) endorsed in each domain to facilitate comparisons across domains and measures. We used MANOVA followed by Bonferroni-corrected (adjusted-p=0.004) nonparametric posthoc Wilcoxon within- and between-group tests to account for small, non-normal distributions and ordinal data. We report effect sizes to aid interpretation given our small sample.

Results: Results showed no significant differences in levels of SCI or RRBI between deletions or duplications of 22q11.2. Posthoc tests revealed small effect sizes for most comparisons (r's 0.006-0.23), and negligible effect sizes for the most powered between-group analysis, the ADI-R (SCI r=0.006, RRBI r=0.015; see figure). Preliminary ADOS results showed two large, non-significant effects driven by low RRBI scores for deletions (ADOS SCI vs. RRBI within deletions: r=0.72, p=0.042; ADOS RRBI between groups: r=0.58, p=0.35). Future analyses available by May 2018 will include clinically useful descriptions of item endorsement rates for each group.

Conclusions: Individuals with duplication or deletion of 22q11.2 appear to show similar ADI-R profiles of SCI and RRBI symptoms in the full sample. These surprising results open questions about 'dosage' effects of genes in the region, as both too many and too few copies yield similar autistic profiles. Animal models might be particularly suited to probe these questions; recent work with 22q11.2DS mouse models reported partial relief of schizophrenia phenotypes, and similar advances may be possible with ASD. Furthermore, Auerbach and colleagues (2012) studied such 'dosage' effects and relieved autistic phenotypes by cross-breeding two mouse models (TSC and FragX) with excessive or insufficient synaptic protein synthesis. Our study will provide nuanced information about the autistic phenotypes that can be expected in individuals with 22q11.2DS and DupS.

133 **128.133** Psychometric Properties of the Merrill-Palmer-Revised Scales of Development in Preschool-Aged Children with Autism Spectrum Disorder

E. E. Dempsey[1], *I. M. Smith*[2], *H. E. Flanagan*[3], *E. Duku*[4], *L. Zwaigenbaum*[5], *P. Szatmari*[6], *M. Elsabbagh*[7], *T. Bennett*[8], *J. Volden*[5], *S. Georgiades*[4], *W. J. Ungar*[9], *P. Mirenda*[10], *T. Vaillancourt*[11] *and C. Waddell*[12], *(1)Psychology and Neuroscience, Dalhousie University, Halifax, NS, Canada, (2)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (3)IWK Health Centre, Halifax, NS, Canada, (4)McMaster University, Hamilton, ON, Canada, (5)University of Alberta, Edmonton, AB, Canada, (6)Centre for Addiction and Mental Health, Toronto, ON, Canada, (7)McGill University, Montreal, PQ, Canada, (8)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (9)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (10)University of British Columbia, Vancouver, BC, Canada, (11)University of Ottawa, Ottawa, ON, Canada, (12)Simon Fraser University, Vancouver, BC, Canada*

Background:

Best practice diagnostic assessment of children suspected of having autism spectrum disorder (ASD) includes cognitive testing; psychometrically strong cognitive measures are also indispensable in longitudinal research. Assessment of cognition in ASD is complicated by variable skill levels and uneven profiles of strengths and weaknesses, as well as inherent social communication differences. Few tests have been validated for use with this population. The Merrill-Palmer-Revised Scales of Development (M-P-R) is a standardized cognitive assessment that is well-validated and reliable for use with typically developing preschoolers. However, the suitability of the M-P-R for assessing cognition in children with ASD has not been well-researched.

Objectives:

The current study's aim was to investigate the criterion validity of the M-P-R for assessing cognition in a large group of preschoolers with ASD whose abilities span a broad range of intellectual functioning.

Methods:

Participants (N = 391; 84% male; M_{age} = 41.25 months) were drawn from an ongoing multi-site longitudinal study examining the development of children with ASD (*Pathways in ASD* study, Szatmari et al., 2015). Bayesian analytic methods were used to assess the criterion validity of the M-P-R. Standard scores of all Domains and Indices of the M-P-R are reported. Concurrent validity was assessed by calculating the correlation between the Receptive Language domain of the M-P-R to the Auditory Comprehension subscale of the PLS-4. Predictive validity was assessed by calculating the correlation between M-P-R scores and later WISC-4 scores at age 8 or 9. Concurrent validity was further assessed by comparing profiles of cognitive strengths and weaknesses with those previously described (e.g., Coolican, Bryson, & Zwaigenbaum, 2008).

Results:

Children in our sample scored below norms on all Domains and the Developmental Index of the M-P-R (see Table 1). The M-P-R Receptive Language domain was strongly positively correlated with the PLS-4 Auditory Comprehension subscale (r = .73). The Cognitive domain of the M-P-R was weakly positively correlated with later WISC-4 scores (r = .37). Cognitive strengths and weaknesses assessed using the M-P-R mirrored those previously described, with children obtaining higher standard scores on the Cognitive (nonverbal): 64, $HDI_{95\%}$ [61 – 66] than the Receptive Language domain: 55, $HDI_{95\%}$ [52 – 59].

Conclusions:

The M-P-R showed good concurrent validity and acceptable predictive validity in a large, well-characterized sample of preschoolers with ASD whose cognitive functioning ranged from severely impaired to above average. The M-P-R shows promise for assessing cognitive abilities in the ASD population.

134 **128.134** Sex Differences in Clinical Presentation Among Children with ASD

E. A. DeLucia[1], *K. Pelphrey*[2], *A. Pomales*[1], *R. L. Gruen*[1], *C. C. Kautz*[1], *L. L. Booth*[1] *and P. E. Ventola*[3], *(1)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (2)Autism and Neurodevelopment Disorders Institute, George Washington University and Children's National Medical Center, Washington, DC, (3)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background:
The sex ratio in ASD is estimated to be 4:1 and as high as 8:1 in cognitively-able children (Fombonne, 2009; Werling & Geschwind, 2013); however, the literature is less clear regarding sex differences in clinical presentation of children with ASD. The existing literature suggests that girls with ASD have lower IQs and exhibit fewer restrictive and repetitive behaviors (RRBs) than boys (Volkmar, Szatmari & Sparrow, 1993; Hartley & Sikora, 2009). Findings on internalizing and externalizing symptoms have been mixed, and it is unclear whether boys and girls with ASD experience different developmental trajectories. It is important to understand differences between boys and girls with ASD across development in order to improve clinical care.

Objectives: The present study examines sex differences in clinical presentation of children with ASD between 3-17 years of age.

Methods:

The study sample included 396 children ages 3-17 who were diagnosed with ASD and had IQ scores in the average range. All study participants received an Autism Diagnostic Observation Schedule (ADOS) assessment. A subset of participants also received the Vineland Adaptive Behavior Scale (n=289), Child Behavior Checklist (CBCL; n=260), Differential Ability Scale (DAS; n=351), Social Responsiveness Scale (SRS; n=104), and Repetitive Behavior Scale – Revised (RBS; n=207). Sex differences on these measures were examined using independent samples t-tests.

Results:

Independent samples t-tests demonstrated markedly higher general conceptual ability scores on the DAS for boys compared to girls (male M=97.5, female M=91.4, t(351)=2.17, p=0.031), driven primarily by higher spatial ability scores (male M= 97.5, female M=90.9, t(347)=2.75, p=0.006). Boys exhibited more severe ASD symptoms, as assessed by the Calibrated Severity Scale (CSS) of the ADOS (male M=7.59, female M=7.05, t(365)=2.44, p=0.015). Additionally, males exhibited marginally higher scores on the restricted behavior subscale of the RBS (male M=3.46, female M=2.58, t(207)=1.94, p=0.053). On the CBCL, boys under 5 (preschool-aged children) scored significantly higher on the Oppositional Defiant subscale (male M=59.4, female M=52.8, t(26)=2.57, p=0.032) and the ADD/ADHD subscale (male M= 59.0, female M=53.6, t(26)=2.57, p= 0.018). In children ages 9:0-12:0 (school-aged children), girls received higher t-scores on the following subscales of the CBCL: Internalizing Symptoms (male M=59.5, female M=65.3, t(62)=-2.22, p=0.030), Externalizing Symptoms (male M= 53.9, female M= 60.9, t(62)=-2.27, p= 0.027), Anxiety Problems (male M=59.7, female M=65.9, t(61)=-2.61, p=0.012), Anxious/Depressed (male M=59.4, female M=65.4, t(61)=-2.12, p=0.038), and ADD/ADHD (male M=59.7, female M=65.3, t(60)=-2.21, p=0.031). There were no sex-based differences in children ages 13-17 (adolescents).

Conclusions:

Boys displayed more severe autism symptoms in a clinical setting, despite having higher IQs than girls. These more severe symptoms, coupled with increased dysregulation boys exhibited at young ages, may contribute to earlier diagnosis among boys with ASD (Chen, Marvin & Lipkin, 2015). Importantly, school-aged girls exhibited more externalizing and internalizing symptoms than boys. Clinically, these results suggest the importance of symptom monitoring over time, as pre-adolescent girls may experience a period of heightened risk for both internalizing and externalizing symptoms. Future studies should focus on developing effective screening and treatment methods for comorbid psychopathology, particularly for pre-adolescent girls with ASD.

135 **128.135** Temperament in Individuals with Autism Spectrum Disorder (ASD): A Systematic Review

L. Chetcuti[1], *K. Hudry*[1], *K. Ellis-Davies*[2], *S. Putnam*[3], *M. R. Prior*[4] *and M. Uljarevic*[5,6], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Cambridge University, Cambridge, United Kingdom, (3)Department of Psychology, Bowdoin College, Brunswick, ME, (4)The University of Melbourne, Melbourne, Australia, (5)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (6)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA*

Background: Individuals with Autism Spectrum Disorder (ASD) vary considerably in the onset and course of their condition, for both core and co-morbid symptoms and, ultimately, in terms of life outcomes. Despite being well-recognized, heterogeneity in ASD is not fully captured by current diagnostic classification systems, nor adequately explained by disorder-specific features. Hence it remains difficult to predict longer-term outcomes on the basis of early presentation. A large body of research outside the context of ASD has demonstrated that particular dimensions of temperament can have both direct and indirect positive and negative influences on development across the lifespan, across a broad range of domains including social, emotional, and behavioural outcomes. Research on temperament in the context of ASD could therefore hold significant potential for furthering our understanding of heterogeneity inherent in this condition.
Objectives: We conducted a systematic review of the literature to integrate existing findings concerning temperament in the context of ASD within a proposed unified taxonomy of overarching temperament traits in order to identify consistencies in the evidence base and gaps which still require attention.

Methods: Medline, PsychInfo and Scopus databases were searched for published articles available through July 2017. Forty studies were identified, including 30 cross-sectional and 10 prospective longitudinal studies.

Results: Current research is complicated by different conceptualisations and measures of temperament across studies. However, when integrated within the proposed unified taxonomy, findings converge to suggest that individuals with ASD may be temperamentally different from both typically developing and other clinical non-ASD groups at a higher-order level. Consistent with research on typically developing children, correlational findings suggest that lower self-regulation and higher negative emotionality are associated with increased internalizing and externalizing problems in ASD samples. Longitudinal studies suggest the possibility that, from as early as 6-months, certain temperament traits can be useful in discriminating among infants who do and do not develop ASD.

Despite promising findings, current research is limited in that it remains largely descriptive, and the nature of the relationship between temperament and core ASD symptoms needs to be explored further. Methodological considerations and directions for future research are highlighted, including the need for more longitudinal investigations into temperament in ASD and the use of more refined statistical techniques. We also suggest that researchers exploring temperament in ASD adopt the proposed overarching temperament dimensions of negative emotionality, surgency and self-regulation in their work to enable generalization of findings across studies.

Conclusions: This field is still in its relative infancy, with many methodological issues to be considered and research gaps to be filled. Nonetheless, work in this area holds promise to further our knowledge of the early developmental pathway/s toward ASD diagnosis, and predictors of outcomes beyond this point.

136 **128.136** The Development and Validation of the Dutch Contextual Assessment of Social Skills (CASS): An Independent Observational Outcome Measure of Social Skills in Adolescents with Autism Spectrum Disorder

***S. Idris**[1,2], F. ten Hoeve[3], A. B. Ratto[4], S. W. White[5] and K. Greaves-Lord[1], (1)Erasmus MC, Rotterdam, Netherlands, (2)Discipline of Psychological and Behavioral Medicine, Faculty of Medicine, Universiti Teknologi MARA, Selangor, Malaysia, (3)Faculty of Social Sciences, Erasmus University, Rotterdam, Netherlands, (4)Children's National Health System, Washington, DC, (5)Psychology, The University of Alabama, Tuscaloosa, AL*

Background: Social skills interventions are considered to be efficacious if social skills are improved as a result of an intervention. Nevertheless, the objective assessment of social skills is hindered by a lack of sensitive and validated measures. To measure the change in social skills after an intervention, questionnaires reported by parents, clinicians and/ or teachers are commonly used. Yet, observations are the most ecologically valid method of assessing improvements of social skills after an intervention. For this purpose, The Program for the Educational and Enrichment of Relational Skills (PEERS) was developed for adolescents, in order to teach them the age-appropriate skills needed to participate in society (Laugeson, Frankel, Mogil, & Dillon, 2009). It is an evidence-based intervention for adolescents with ASD that taught ecologically valid social skills techniques.

Objectives: The current study aims to describe the development and psychometric evaluation of the Dutch Contextual Assessment of Social Skills (CASS), an observational outcome measure of social skills for adolescents with Autism Spectrum Disorder (ASD) (Ratto et al., 2011).

Methods: 34 adolescents (M = 14.68, SD = 1.41, 71% boys) with ASD performed the CASS before and after a social skills intervention (i.e. PEERS *or* the active control condition). Each adolescent completed a 3-minutes conversation with a confederate. The conversation was prompt as a natural introduction between two-unfamiliar, similarly ages, and opposite sex peers who meet for the first time. The adolescent and the confederate completed a brief questionnaire about the conversation (Conversation Rating Scale).

Results: Results indicated sufficient psychometric properties. The Dutch CASS has a high level of internal consistency (Cronbach's α coefficients = 0.84). Data supported the convergent validity (i.e. significant correlated with the Social Skills Improvement System (SSiS). The Dutch CASS did not significantly correlate with the autistic mannerism subscale from Social Responsiveness Scale (SRS), thus proved the divergent validity. Based on scorings made by raters who were kept blind to the time points, reliable change index were computed to assess the change in social skills. With regard to the content validity, only the learning objectives of the first two meetings of PEERS about conversational skills relatively matched with rating domains of the CASS. Due to this underrepresentation, we found an existing observational measure (TOPICC) that covers some of the other learning objectives of PEERS. TOPICC covers 22% of the learning objectives of PEERS about conversational skills, meanwhile CASS is 45%. Unfortunately, 33% of the learning objectives of PEERS was not covered by CASS or TOPICC.

Conclusions: Recommendations are made to improve the psychometric properties and content validity of the Dutch CASS.

137 **128.137** The Effect of Comorbidity on Cognitive Efficiency in ASD

***B. Lewis**, K. A. McNaughton, A. Naples and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Previous studies have found intact working memory in individuals with autism spectrum disorder (ASD), but deficits in processing speed and mixed impairments in executive functioning. Psychiatric comorbidity has negative consequences on cognitive functioning. Understanding whether comorbidity has unique or shared impact on ASD compared to other diagnostic groups has important implications for assessment and treatment.

Objectives: To study the effect of comorbidity on cognitive efficiency in individuals with ASD compared to individuals with diagnoses other than autism.

Methods: Retrospective analyses were conducted on a clinical pediatric sample of 421 individuals (73% Male; Caucasian: 37%, Asian: 2%, African American: <2%, Indian: <1%, Multi-racial: 2%) who presented to a developmental disabilities clinic. Cognitive assessments were conducted by licensed psychologists, and final consensus diagnosis was determined by a multidisciplinary team consisting of psychology, psychiatry, and speech/language specialists following comprehensive evaluation. Analyses consisted of group comparisons of individuals diagnosed with ASD (*n*=307) and individuals receiving another diagnosis (non-ASD group, *n*=110; Learning Disability 28%; ADHD 15%; Anxiety Disorder 15%; Language Disorder 14%; Mood Disorder 5%; and behavior disorders, tic disorders, OCD, and thought disorders, each <4%). Those given no diagnosis or those with Intellectual Disability as a primary or comorbid condition were excluded. Cognitive functioning was measured using standardized scores across *WISC-III, WISC-IV, and WAIS-III*, with the Working Memory Index and Freedom from Distractibility Index combined to create a composite score. The *Behavior Rating Inventory of Executive Function (BRIEF)* was also analyzed.

Results: Comorbid conditions were diagnosed in 8% (*n*=26) of individuals with ASD, and 20% (*n*=22) of individuals in the non-ASD group (χ^2=10.57, *p*<.01). Individuals with ASD were younger than the non-ASD group [ASD: *M*=9.76±3.75; non-ASD: *M*=10.82±3.83; *t*(402)=-2.49, *p*=.02]. There was a significant difference in Full Scale IQ (FSIQ) across diagnostic groups [ASD: *M*=94, *SD*=22; non-ASD: *M*=101, *SD*=20; *t*(397)=-2.93, *p*<.01). This difference remained true when factoring in comorbidity; only diagnostic groups without comorbidity had significantly different FSIQ [*F*(3,396)=3.24, *p*=.02]. FSIQ differences were driven by lower verbal and nonverbal reasoning index scores.

Within the ASD group, working memory index scores did not differ with comorbidity [non-comorbid: *M*=97, *SD*=21; comorbid: *M*=90, *SD*=18; *t*(214)=1.33, *p*=.19), nor did processing speed index scores [non-comorbid: *M*=88, *SD*=17; comorbid: *M*=87, *SD*=18; *t*(210)=0.30, *p*=.77]. The same was found within the non-ASD group for working memory [non-comorbid: *M*=100, *SD*=20; comorbid: *M*=95, *SD*=19; *t*(78)=1.05, *p*=.30] and processing speed [non-comorbid: *M*=91, *SD*=17; comorbid: *M*=88, *SD*=17; *t*(76)=0.61, *p*=.54]. Detailed evaluation of executive functioning from the *BRIEF* indicated more pronounced deficits in self-monitoring for individuals who received a diagnosis other than ASD [non-ASD: *M*=68, *SD*=9; ASD: *M*=63, *SD*=11; *t*(107)=-2.36, *p*=.02]. There were no other significant differences in executive functioning between diagnostic groups or within groups based on comorbidity.

Conclusions: Overall, individuals with ASD and other psychiatric diagnoses demonstrated similar cognitive efficiency profiles as measured by working memory and processing speed. Executive functioning across ASD and other diagnostic groups was also similar with the exception of self-monitoring which was more impaired in the non-ASD group. Comorbidity did not further impair one’s cognitive efficiency or executive functioning.

138 **128.138** The Utility of a Parent and Teacher-Rated ASD Self-Awareness Scale

***T. Warren**[1], S. Bent[1], F. Widjaja[1], K. Delucchi[1], E. Johnson[2] and R. Hendren[1], (1)Psychiatry, University of California, San Francisco, San Francisco, CA,* *(2)Meristem, Fair Oaks, CA*

Background: Research has linked self-awareness about mental health and capabilities to better social and functional outcomes, possibly because awareness may result in increased motivation to improve or compensate for mental difficulties. However, scales that measure this self-awareness in people with developmental disabilities are lacking in the literature. Instead, autism spectrum disorder (ASD) outcomes have traditionally been measured through concretely operationalized aspects of behavior, communication, and functional abilities.
Objectives: The objective of this study was to examine the utility of a novel scale given to parents and teachers to separately measure capability and awareness in several domains for young adults with ASD and related developmental disorders.

Methods: This was an 8-month observational study from October 2016 to May 2017 done at Meristem, a program for young adults with ASD and related neurodevelopmental disabilities in Fair Oaks, California. The Meristem staff and study team developed a 10-item measure, the Meristem Capability and Awareness Scale (MCAS), to assess outcomes in five domains (Practical Work Skills, Spatial Integration, Independent Living Skills, Wellbeing, and Social & Communication Skills), on two subscales (Capability, rated 1-5, and Independence/Awareness, rated 1-10) (Table 1). All students at the school were invited to participate, and all chose to participate (n=29, mean age=21.7). Parents and teachers rated students at baseline (October 2016) and at the end of the study (May 2017). Teachers additionally rated students midway through the school year (January 2016). Parent and teacher MCAS ratings were tested for significant change over time using a linear regression model. Additionally, Pearson's correlations were calculated for each MCAS domain's Capability score and Independence/Awareness score.

Results: Parent MCAS ratings showed trending improved scores on the Independence/Awareness subscale in the Practical Work Skills domain (0.13 points/month, p=0.15) and Social & Communication Skills domain (0.16 points/month, p=0.09), as well as on the overall Independence/Awareness subscale (average of Independence/Awareness scores) (0.13 points/month, p=0.15). Teacher MCAS ratings showed trending improved scores on the overall Independence/Awareness subscale (0.10 points/month, p=0.13) and significant improvement on the Independence/Awareness subscale in the Social & Communication Skills domain (0.41 points/month, p=0.04). No other subscales or domains showed significant or trending change. Pearson's correlations between the Capability and Independence/Awareness scores for each subscale ranged from r=0.37 to r=0.57, and p-values ranged from p=0.02 to p=0.0002 (Table 2).

Conclusions: Despite limitations including a small sample size, short time frame, and lack of comparison with standardized measures, greater improvement on Independence/Awareness than on Capability may indicate that self-awareness of challenges precedes the ability to work on them. Additionally, strong correlations between Independence/Awareness and Capability are an indication of good internal validity and show that scores on the two subscales may move together. However, correlations show enough difference between the subscales to provide evidence that the concepts of capability and awareness are distinct and may merit individual measurement. These findings support the use of a specialized awareness scale in outcome measurement for people with developmental disabilities. Such a scale may capture important change and should be considered in the development of future outcome measures.

139 **128.139** Validation of a Broader Autism Phenotype Interview in Families of Individuals with High-Functioning Autism Spectrum Disorder

C. C. Green[1], *A. E. Richard*[2], *S. J. Wilson*[3] *and I. E. Scheffer*[4], *(1)Olga Tennison Autism Research Centre, La Trobe University, Bundoora, VIC, Australia, (2)Autism Research Centre, IWK, Halifax, NS, Canada, (3)Florey Institute of Neuroscience and Mental Health, Melbourne, VIC, Australia, (4)Department of Medicine, The University of Melbourne, Melbourne, Australia*

Background:
The Broader Autism Phenotype (BAP) is characterised by sub-clinical traits of Autism Spectrum Disorder (ASD), however there is no gold standard assessment for the BAP. The BAP is commonly found in relatives of individuals with ASD, and is most often measured using self- and informant-ratings of ASD traits, and occasionally using a lengthy family history interview as well.

Objectives:

We aimed to 1) validate a brief interview of BAP traits; and 2) elucidate the BAP profile in first-degree relatives of individuals with ASD with at least average cognitive abilities, where genetic factors may more likely be involved in its aetiology.

Methods:

Parents and siblings from 30 families of individuals with high-functioning ASD (HFA) were assessed for the BAP and associated traits using a 2.5 hour protocol. Clinical best estimate of BAP status was determined using a 30-45 minute interview of BAP traits rated on the Broader Autism Phenotype Rating Scale (BAPRS). To validate the interview, ASD and BAP traits were also measured using self- and informant- ratings on the Social Responsiveness Scale, 2nd ed. (SRS-2) and through self-ratings on the Broad Autism Phenotype Questionnaire (BAP-Q). Psychiatric symptoms and adaptive functioning were measured through self- and informant-ratings using the Achenbach System of Empirically Based Assessment, including the Adult Behaviour Checklist (ABCL). General cognitive abilities were measured using the Wechsler Abbreviated Scale of Intelligence, 2nd ed. (WASI-II).

Results: Clinical ratings of BAP traits significantly correlated with self- and informant-ratings of BAP traits. Individuals with the BAP exhibited similar but fewer ASD traits than individuals with ASD. A graded expression of psychiatric symptoms was also observed between the groups, with individuals with ASD having significantly more traits than those with the BAP, who in turn had significantly more traits than unaffected individuals. Participants with the BAP exhibited an uneven cognitive profile, similar to participants with ASD. Individuals with the BAP showed significant differences between their verbal and perceptual abilities, in contrast to unaffected participants who had an even cognitive profile.

Conclusions: A brief BAP interview was validated in a sample of families of individuals with HFA. Using this classification of the BAP, it was evident that individuals with the BAP exhibited similar but fewer ASD traits than their relatives with ASD, and had an intermediate expression of psychiatric symptoms including internalising and externalising behaviour, and a similar cognitive profile to individuals with ASD.

140 **128.140** What Australian Medical, Allied Health and Educational Experts Want from an Autism Spectrum Disorder Diagnostic Process

K. Evans[1,2], *J. Wray*[3], *V. Eapen*[4,5], *M. R. Prior*[6] *and A. J. Whitehouse*[1,2,7], *(1)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)State Child Development Service,* *Western Australia Department of Health, Perth, Western Australia, Australia, (4)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (5)School of Psychiatry, University of New South Wales, Sydney, Australia, (6)The University of Melbourne, Melbourne, Australia, (7)University of Western Australia, Perth, Australia*

Background: In the absence of empirical evidence regarding the accuracy of various autism spectrum disorder (ASD) diagnostic practices, numerous clinical guidelines on the topic rely on expert consensus. However, the process for attaining this consensus is not often articulated.
Objectives: This Delphi survey sought to generate consensus recommendations regarding assessment and diagnosis from medical, allied health and educational experts in Australia.

Methods: Steering committee members from medical, allied health, education and ASD specific backgrounds were invited to nominate up to 20 experts in the ASD assessment field. This resulted in 118 professionals being invited to participate, with a total of 77 participants from a wide variety of disciplines completing (n = 66) or partially completing (n = 11) the first round of the Delphi survey. The majority of participants were diagnosticians (n=48), with other participants reporting their involvement in other aspects of the clinical or educational management of autistic children or adults. Participants had been involved in the assessment process for ASD for a median of 15 years (range = <1–40 years). Participants practiced within public and private settings, including community, hospital and university environments. The participants worked with individuals on the autism spectrum with a wide age range, from babies to older adults. A total of 42 participants provided responses on the Round 2 survey.

The questions contained within Round 1 of the Delphi Survey were developed on the basis of a scoping review. A range of potential assessment components were provided with a five point scale to allow participants to indicate their agreement regarding if each component should be part of an ASD assessment. Participants were provided with an opportunity to make comments after each question, each section and at the end of the survey. The questions contained within Round 2 of the Delphi Survey were developed on the basis of Round 1 quantitative and qualitative results, with a focus on items where agreement had not been achieved.

Two methods were utilised to determine if consensus had been achieved for a recommendation, based on the median / interquartile range and proportion of agreement. Agreement was considered to exist if both criteria were met and partial agreement was achieved if only one of the two criteria was met.

Results: Agreement was obtained for many recommendations regarding who, where and how an ASD assessment should be conducted. The strongest agreement was obtained for recommendations addressing the prerequisite knowledge and experience of professionals conducting ASD assessments, topics to be addressed during an ASD assessment (in particular history and symptoms), and assessment approaches (observation and interview).

Conclusions: Results of the Delphi survey provide clear support for guideline recommendations that are considered acceptable by medical, allied health and educational professionals.

141 **128.141** Variables at the Time of ASD Diagnosis in Toddler Years Predict Outcome in Adaptive Functioning and ADHD Co-Morbidity in Adolescence: A Long-Term Follow-up Study

E. Ben-Itzchak[1] *and D. A. Zachor*[2]*, (1)Bruckner Center for Research in Autism, Communication Disorder, Ariel University, Ariel, Israel, (2)The Autism Center/Pediatrics, Tel Aviv University / Assaf Harofeh Medical Center, Zerifin, Israel*

Background:
Some children with autism spectrum disorder (ASD), show limited progress, while others make rapid, remarkable gains. Short-term follow-up studies in ASD reported that higher cognitive ability, less severe autism symptoms, better adaptive functioning, and younger diagnosis age predicted better outcome in different domains. Adolescents with ASD have shown high rates of attention deficit/hyperactivity disorder (ADHD) co-morbidity.

Objectives:

To examine how measures of age of diagnosis, cognitive ability, autism severity and adaptive skills at diagnosis can predict long-term outcomes in adaptive skills and ADHD symptoms.

Methods:

The study included 61 participants, 55 males and 6 females, with an age range of 10:5 – 17:10 years (M=13:6±1:10y). All the participants were diagnosed with ASD (T1) in the age range of 1:3-3:1 years (M=2:2±0:5y) and were reassessed (T2) after 8:7-15:7 years (M=11:5±1:10y). ASD diagnosis at baseline employed two standardized tests, the Autism Diagnosis Interview-Revised (ADI) and the Autism Diagnosis Observation Schedule (ADOS), including the calibrated severity scale (CSS). Outcome measures included: Vineland adaptive behavior scales (VABS) composite score for adaptive skills; ADOS social-affect calibrated severity scale (SA-CSS) and restrictive and repetitive behaviors CSS (RRB-CSS) (≥4-ASD) at T1 and T2 to measure autism severity; Inattention and Hyperactivity/Impulsivity scores from the Conners' Rating Scales–Revised (CRS-R***)*** (score>60 is considered significant) at T2.

Results:

At T2, four participants (6.7%) received a score of <3 for the ADOS-SCC. Seventy percent received a score >60 for the Conners Inattention scale and 58.3% a score >60 for the Conners Hyperactivity/Impulsivity scale. To explore which variables at T1 predicted outcome in functioning (VABS composite scores) and ADHD symptoms (Inattention and Hyperactivity/Impulsivity scores) at T2, we performed three hierarchical regression models for these dependent variables.

Independent variables in each model included: T1 DQ in the first step, T1 VABS score in the second step, ADOS-SA-CSS and ADOS-RRB-CSS scores in the third step and age of diagnosis in the fourth step.

The first model, where the VABS score served as the dependent variable, explained 19.7% of the variance. ADOS-SA-SCC score ($\beta=-.36$, $p<.01$) and age of diagnosis ($\beta=-.23$, $p<.05$) correlated negatively and significantly with VABS score at T2. The second model, where the Conners Hyperactivity/Impulsivity score served as the dependent variable, explained 27.5% of the variance. DQ score at T1 ($\beta=.33$, $p<.05$) correlated significantly and positively and VABS score at T1 ($\beta=-.33$, $p<.05$) correlated significantly and negatively with the Conners Hyperactivity/Impulsivity score. The third model, where the Conners Inattention score served as the dependent variable, explained 17.7% of the variance. DQ score at T1 ($\beta=.27$, $p<.05$) and ADOS-RRB-CSS at T1 ($\beta=.36$, $p<.05$) correlated significantly and positively with the Conners inattention score.

Conclusions:

Less severe social-communication symptoms and younger ASD diagnosis age predicted better functioning in adolescence. Baseline lower adaptive skills and higher cognitive abilities predicted more severe symptoms of hyperactivity/impulsivity in adolescence. More severe RRB symptoms and higher cognitive abilities at the time of ASD diagnosis predicted more severe inattention symptoms in adolescence. Autism severity and level of functioning in early diagnosis of ASD predicted adaptive skills and ADHD co-morbidity.

142 **128.142** Measurement Invariance of the Child Behavior Checklist in a Large Sample of Children with Autism Spectrum Disorder with and without Intellectual Disability

***K. N. Medeiros**, Health Psychology, University of Missouri, Columbia, MO*

Background: Autism spectrum disorder (ASD) is characterized by core impairments in social communication and restricted and repetitive behaviors, with high rates of co-occurring emotional and behavioral problems. The Child Behavior Checklist (CBCL) is one of the most widely accepted rating scales used to assess childhood emotional and behavioral problems, and it has been used in many large-scale studies of children with ASD. Recently, conflicting research assessed whether the previously established factor model sufficiently accounts for symptom patterns in children with ASD. However, these samples have included a mix of children with and without concurrent intellectual disability (ID).
Objectives: The aim of this study was to determine whether the CBCL has the same validity in a sample of children with ASD who had ID compared to a sample of children with ASD who did not have ID. I aimed to decipher which elements of the factor models could confirm measurement invariance.

Methods: I used a multi-group confirmatory factor analysis of the CBCL subscales for young children (ages 1.5-5) and older children (ages 6-18) across those with (n=107) and without (n=301) ID. I used nested models to set progressively more constraints to test for various types of invariance across the two groups. The configural model had no constraints, and the groups were free to vary. The metric model constrained factor loadings to be equal across groups. The scalar model added that item intercepts were equal across groups. The residual model added that error variances were equal across groups. The structural model set factor variances equal across groups. Nested chi square tests assessed the null hypothesis that the more constrained model is correct under the assumption that the less constrained model is correct. I examined the seven CBCL subscales for young children: Emotionally Reactive, Anxious/Depressed, Somatic Complaints, Withdrawn, Sleep Problems, Attention Problems, and Aggressive Behavior. I examined the eight CBCL subscales for older children: Anxious/Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behavior, and Aggressive Behavior.

Results: For young children, the configural model was the best fit for the emotional reactivity, anxiety/depression, and somatic complaints subscales. Sleep problems held metric invariance, and withdrawn behavior held residual invariance. The structural model was the best fit for both attention problems and aggression. For older children with ASD, the configural model was the best fit for the anxiety/depression, somatic complaints, social problems, attention problems, and rule-breaking behavior subscales. Whereas, withdrawn/depression, thought problems, and aggression held metric invariance.

Conclusions: The equality of factor loadings held for sleep problems in younger children, and for conduct/behavior regulation problems in older children (i.e., withdrawn, thought problems, aggression), suggesting that the CBCL measures the same latent traits in both groups, but with a bias in the manner in which trait levels are estimated. However, for young children with ASD, the CBCL measured attention and aggression problems equally across ID groups. Results of the current study suggest that cross-group comparisons of CBCL scores between children with ASD with and without ID may not always be appropriate.

143 **128.143** Tablet-Based Mobile Eye Tracking for Studying Visual Preference in Children with ASD: Proof-of-Concept and Feasibility Study

***A. Atyabi**[1], Q. Wang[2], C. Foster[2], E. Barney[3], Y. A. Ahn[4], M. Kim[4], B. Li[4,5], C. A. Paisley[6], S. M. Abdullahi[7], M. L. Braconnier[7], J. Lei[7], C. C. Kautz[8], L. L. Booth[8], M. Lyons[2], P. E. Ventola[9] and F. Shic[3], (1)Seattle Children's Research institute University of Washington, Seattle, WA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (4)Seattle Children's Research Institute, Seattle, WA, (5)Computer Science and Engineering, University of Washington, Seattle, WA, (6)The University of Alabama, Tuscaloosa, AL, (7)Yale Child Study Center, New Haven, CT, (8)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (9)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Eye-tracking has been used for over 15 years to study atypical visual social cognition in ASD. Current access to eye-tracking technologies is limited due to the expense of eye-tracking devices, the need for highly controlled laboratory settings, and the necessity of trained personnel. This study reports on the development of a tablet-based eye-tracking platform designed to examine the feasibility of mobile eye tracking, a step towards significantly increasing the accessibility of eye tracking for clinical applications.
Objectives: To (1) examine the feasibility of tablet-based (iPad) eye-tracking; (2) provide preliminary results regarding differences between children with and without ASD; (3) conduct a machine learning investigation of diagnostic prediction using acquired data.

Methods: Three 6-minute sessions comprising side-by-side presentations of age-appropriate social target movies with distractor movies (moving machinery, sporting events, animals, or random clips from another movie) were administered to 6-12-year-old children (ASD n=29 , non-ASD n=33). Each session included five calibration sets (three 5-point calibrations and two smooth-pursuit-trajectories with animations). Sessions paused automatically when participants' faces were not detected for more than 5 seconds.

Results: Data Quality: 92% of sessions had <2.5 degrees of calibration error. >80% valid tracking data was recorded in 83% of sessions. Across groups, valid-looking-time was 86% (SD=7%), and calibration-error 1.49° (SD=1.19°). These results indicated robust recording and participant attention. Data Quality Group Differences: Univariate ANOVAs on calibration quality indicated group differences in smooth-pursuit calibration, with the non-ASD group following both the left-half (p<.01) and the right-half (p=.056) of the pursuit better than the ASD group. No 5-point calibrations differences emerged. Looking Pattern Group/Condition Effects: A main effect of distractor condition on %Distractor (p<.001) was found with a trend toward a diagnosis*condition interaction (p=.063). Pairwise comparisons indicated children looked more at machine distractors, compared to animals (p<.001) and dynamic-naturalistic-scenes (p<.01); and more at sports compared to animals (p<.001). Participants with ASD looked more at the animal distractors than the non-ASD group (p<.05). A main effect of condition on GazeOffscreen% (p<.01) and a diagnosis*condition interaction (p<.05) was also observed. Pairwise comparisons showed that children looked offscreen more during animal distractor videos than machines (p<.001) and sports (p<.01). Participants with ASD looked offscreen less during animal distractors than the non-ASD group (p<.05). Machine Learning: Using linear support-vector-machines (SVM) on predictors (GazeOffscreen%, Distractor%, %Target, and associated timings) in a repeated (n=5) leave-one-out cross-validation with nested-bootstraps (n=10, group balancing), we achieved 79% average group-membership-prediction accuracy.

Conclusions: These analyses provide evidence for tablet-based eye tracking as a viable option for remotely quantifying eye movements in children with and without ASD. We piloted a preferential looking task to social videos and smooth-pursuit trajectories. The results revealed that children with ASD showed smooth-pursuit tracking difficulties, with nuanced differences in scanning patterns potentially relating to attentional biases relative to controls towards animal distractors. Results will be presented in the context of design choices and challenges of tablet-based eye tracking.

144 **128.144** Utility of Heart Rate Increase for Prediction of Challenging Behavior Episodes in Preschoolers with Autism

***H. J. Nuske**[1], E. Finkel[2], L. Tomczuk[3], D. Hedley[4], V. Parma[5], M. Pellecchia[6], J. D. Herrington[7], D. S. Mandell[1] and C. Dissanayake[4], (1)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (2)Department of Psychology, University of Pennsylvania, Philadelphia, PA, (3)Neuroscience Department, Dickinson College, Carlisle, USA, Carlisle, PA, (4)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (5)William James Center for Research, ISPA - Instituto Universitário, Lisbon, Portugal, (6)University of Pennsylvania, Philadelphia, PA, (7)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Understanding the triggers to challenging behavior is difficult in some children with autism due, in large part, to their limited communication abilities generally, and communicating emotions in particular. Physiological indicators such as increase in heart rate are well-established, fine-grained measures of emotional stress; they may provide important insights on the triggers to challenging behavior.
Objectives: The study aim was to determine the predictive utility of increase in heart rate to indicate a challenging behaviour episode in children with autism with frequent challenging behaviors.

Methods: Whilst wearing a ECG monitor, 41 children with autism recruited as part of a larger study aged 2-4 years participated in tasks from the Laboratory Temperament Assessment Battery, which mimic everyday life experiences requiring emotional regulation in low-level stress situations (e.g., waiting for a snack). Coders blind to diagnostic group coded challenging behaviors during the 1-1.5 hour-long sessions (i.e., aggression, self-injury, property destruction, loud noises and non-compliance, n=212) and random non-challenging behaviors (n=106). Only 13/41 participants exhibited challenging behaviors. Baseline-corrected heart rate (HR) was computed for each behaviour. The predictive utility of HR in challenging vs. non-challenging behaviors was examined via Receiver Operating Curve (ROC) analysis and a binary logistic regression model was run to examine the contribution of participant characteristics on the association between HR and challenging vs. non-challenging behaviors.

Results: On average, children with autism showed a 21±10% HR increase from baseline, 58±22 s before the onset of a challenging behaviour. The ROC analysis indicated that the peak HR change predicts fairly well the onset of a challenging behaviour vs. non-challenging behaviors (area under the curve= .71, p< .001, 95% CI= .66 - .77), see Figure 1. However, across children there was considerable variation in area under the curve coefficients (.28, p= .20; - .95, p= 04). Binary logistic regression results indicated that the behavioral outcome (challenging vs. non-challenging behavior) was explained by peak HR change (*Nagelkerke* R^2= .21, p< .001), and additionally by participants' gender [female] and age [older] (*Nagelkerke* $R^{2\ \mathrm{change}}$= .06, p= .002). Autism severity and developmental ability did not significantly contribute variance to the model (see Table 1).

Conclusions: Results indicate that physiological stress predicts challenging behaviour episodes in preschoolers with autism, particularly for girls and older preschoolers. Given the recent technological advances in wearable biosensing, our results indicate that incorporating HR monitoring in intervention for autism may be helpful for some children. By signalling children's stress, such wearables may allow parents and teachers to intervene and create learning opportunities for emotional expression and regulation. However, given the strength of the prediction and likelihood of false positives, individualised human-computer interaction and machine learning algorithms may be needed to increase the utility of including such information in moment-to-moment treatment planning.

145 **128.145** A Diagnostic Tool for Reciprocal Behavior in Children, Adolescents and Adults with ASD

***S. Begeer**[1], T. Backer van Ommeren[2], H. M. Koot[3], M. Vreugdenhil[4] and A. Scheeren[5], (1)VU University Amsterdam, Amsterdam, Netherlands, (2)Clinical Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, (3)Clinical, Neuro and Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands, (4)Clinical Developmental Psychology, Vrije Universiteit Amsterdam, Amsterdam, New Caledonia, (5)Psychology, University of Tilburg, TIlburt, Netherlands*

Background: Individuals with Autism Spectrum Disorder (ASD) are characterized by a poor understanding of the social norms for reciprocal behavior. The DSM-5 now includes deficits in reciprocity as a *necessary* criterion for an ASD diagnosis, whereas the DSM-IV included it as a possible criterion (APA 2000, 2013). Qualitative differences in social reciprocal skills of individual with Autism Spectrum Disorder (ASD) across gender, IQ levels and ages have not been studied to date. A new test for reciprocity, the Interactive Drawing Test (IDT; Backer van Ommeren, et al,. 2012; 2015; 2017[a], 2017[b]), was shown to be a valid measure of the quality of reciprocal behavior, and highly sensitive to differences between individuals with and without ASD.
Objectives: To measure the sensitivity of the IDT for differences in reciprocal behavior in participants with or without ASD, across age and intelligence levels.

Methods: Reciprocal behaviors of individuals with autism were analyzed using the Interactive Drawing Test (IDT), a valid instrument to assess reciprocal behavior. In 5 studies, we analyzed over 500 individuals with or without ASD, including children, adolescents, and adults, intellectually disabled or normally intelligent, male and female. In addition to the paper version, we also tested a digital touch table version of the test.

Results: The IDT showed a high sensitivity to ASD. Large effect sizes indicated strong differences between ASD and TD participants in the quality of reciprocal behavior. These differences were independent of gender, IQ and age. ASD girls performed better than ASD boys, but both groups showed more limitations compared to TD children. Specific response patterns will be discussed, including comparisons to ADOS. The digital version of the IDT showed equal sensitivity to ASD.

Conclusions: The IDT seems highly suitable to assess impairments in reciprocal behavior and to differentiate between performances of ASD and TD children and adolescents with and without MID. The administration is short and cheap, participants appreciate the procedure (making a mutual drawing), and the IDT will be a welcome addition to standardized test batteries for ASD.

Poster Session
129 - Medical and Psychiatric Comorbidity
5:30 PM - 7:00 PM - Hall Grote Zaal

146 **129.146** A Dimensional Relationship between Autistic and Paraphilic Traits

*E. Deakins[1], W. Simpson[2] and **M. Belmonte**[3], (1)Division of Psyhcology, Nottingham Trent University, Nottingham, United Kingdom, (2)Division of Psychology, Nottingham Trent University, Nottingham, United Kingdom, (3)Com DEALL Trust, Bangalore, India*

Background: Autism spectrum conditions (ASC) are typified by visual thinking, that is, by the attachment of meaning and significance to concrete visual representations, and by an aversion to the unpredictable and unscripted nature of conventional social interaction. Also typified by attachment of undue significance to sensory (usually visual) stimuli and a tendency to scripted behaviour is paraphilia, in which a stimulus or situation that is not conventionally sexual becomes an occasion for sexual arousal. Most paraphilias are innocuous (e.g. involving specific clothing, or scripted roleplay) except insofar as compulsive interest in the paraphilic sexual outlet may displace interest in the human partner, interfering with formation and maintenance of healthy relationships. Our own case data suggest heightened incidence of such effects in ASC and the broader autism phenotype (BAP). Paraphilic traits, like autistic traits, may vary dimensionally and in subclinical cases may simply constitute unusual object-centred and/or scripted interests integrated into healthy sexual relationships.

Objectives: We queried whether paraphilic traits extend transdiagnostically, and whether scripted and sensory aspects of such dimensional paraphilic traits correlate with dimensional autistic traits.

Methods: Qualitative interviews with 16 young adults (7 male) generated common paraphilic themes within the bounds of typical sexual outlet. The resulting items were included in a 220-item questionnaire administered to 300 typical individuals (107 men, 187 women, 6 unspecified gender, age 23.72±8.26, range 18-56), 161 of whom (62 men, 99 women) thereafter consented also to complete the Autism Spectrum Quotient (AQ) and the Broader Autism Phenotype Questionnaire (BAPQ). Principal components analysis was conducted on the paraphilia questionnaire, resulting factors were labelled, and items not loading strongly (>0.4) on any single factor were dropped, yielding a 190-item scale. Loadings were used to compute factor scores for each individual. Each of the three BAPQ subscales and the AQ was entered alongside gender as a predictor in an analysis of covariance with each of these factor scores, using Type III sums of squares. Holm-Bonferroni correction was applied to tail probabilities.

Results: Principal components analysis generated fourteen factors accounting for 51.13% of variance in reported paraphilic interest, all but one of which were significantly greater in males. Nine of these fourteen paraphilic trait factors correlated significantly with measures of autistic traits. The AQ captured a subset of the relationships captured by BAPQ subscales. BAPQ Aloof predicted a cluster of factors relating to desire to be violated (*e.g.* wet-and-messy fetishes, submission, desire to be victimised). Similarly BAPQ Aloof, and in males also BAPQ Rigid, predicted a cluster relating to desire to replay a defeat as a victory (*e.g.* transvestism, frotteurism, voyeurism). BAPQ Rigid predicted a cluster relating to desire to be disempowered (positive effect on desire to be mothered, negative effect on desire to dominate).

Conclusions: Autistic traits correlate with paraphilic traits in the general population. Paraphilic interests thus are likely to be of high incidence in autism and in its broader phenotype. Knowledge of this association can inform relationship counselling for couples affected by ASC/BAP, dispelling stigma and aiding integration of paraphilic interests into healthy relationships.

147 **129.147** A Longitudinal Study of Sleep Disturbance and Parent Stress in Children with ASD at 4 and 6 Years of Age: A Mediational Model

***A. Estes**[1], T. Ward[2], J. N. Collett[1], K. E. MacDuffie[3] and J. Munson[4], (1)University of Washington, Seattle, WA, (2)School of Nursing, University of Washington, Seattle, WA, (3)Speech and Hearing Sciences, University of Washington, Seattle, WA, (4)UW Autism Center, University of Washington, Seattle, WA*

Background: It is estimated that 70% of 2-6 year olds with ASD experience sleep disturbances, a rate two to three times that of typically developing 2-6 year olds (15-40%). Emerging evidence suggests young children with ASD may suffer from sleep-onset difficulties, frequent night awakenings, irregular sleep patterns, and reduced sleep duration in comparison to children with developmental delays and typical development. Early childhood is particularly important for establishing healthy sleep patterns to support rapid physical growth, cognitive development, and self-regulation skills. Untreated sleep disturbances are known to pose significant adverse consequences including cognitive deficits and daytime sleepiness in typically developing children, and may exacerbate symptoms and negatively affect social interactions in children with medical problems. Parents may also be negatively impacted by child sleep disturbances. Little is known about the impact of sleep disturbances on cognitive and behavioral functioning in children with ASD or the impact of child sleep disturbances on stress in parents of children with ASD.

Objectives: To examine 1) the nature and extent of parent-reported sleep disturbances in children with ASD longitudinally at ages 4 and 6, 2) the association of sleep disturbances with child cognitive abilities and problem behaviors, and 3) whether the association between child sleep disturbances and parenting-related stress is mediated by increased problem behaviors.

Methods: Participants were a sample of children (n = 38 at age 4; n = 36 at age 6) who met DSM-IV criteria for a Pervasive Developmental Disorder based on direct assessment (ADI-R, ADOS) by research reliable examiners using all available information. All participants had data from the Child Sleep Habits Questionnaire (CSHQ), a parent-report of a child's sleep behavior over the previous week. Child cognitive ability (Mullen Scales of Early Learning age 4; Differential Abilities Scale age 6), child problem behavior (Aberrant Behavior Checklist), and parenting-related stress (Questionnaire on Resources and Stress) were assessed when children were age 4 and 6.

Results: Over 73% of children met criteria for sleep disturbance at age 4 (28/38) and over 83% at age 6 (30/36). Longitudinally, 22/30 children (73%) showed sleep disturbances at both time points. Cognitive ability was not significantly related to sleep at either age. At age 4, sleep was not related to problem behavior or parenting stress. However, at age 6, sleep disturbance was related to both increased problem behavior and parenting stress. Mediation was not testable at age 4, as child sleep was not related to parenting stress. However, at age 6, problem behaviors completely mediated the effect of sleep disturbance on parent stress (Sobel test: $Z = 2.79$, $p = .005$).

Conclusions: Sleep disturbances in children with ASD appear highly stable from age 4 to 6. By age 6, sleep disturbances are related to problem behavior and parent stress. The preschool years may be well-suited for implementing parent-delivered sleep interventions to support the development of adequate, well regulated sleep in young children with ASD and could reduce caregiver stress associated with child sleep disturbances and related problem behaviors.

148 **129.148** Anxiety and Sleep Disturbance in Youth with Autism Spectrum Disorder

***P. Renno**[1], L. Sterling[2], J. Yang[3] and J. J. Wood[4], (1)University of California Los Angeles, Los Angeles, CA, (2)California State University Long Beach, Long Beach, CA, (3)Department of Psychiatry and Biobehavioral Sciences, UCLA, Los Angeles, CA, (4)Human Development & Psychology, University of California, Los Angeles, Los Angeles, CA*

Background: Sleep problems are prevalent in individuals with ASD, with up to 50-80% of children with ASD experiencing sleep disturbance (Williams, Sears & Allard, 2004). There are many factors that may contribute to insomnia in children with ASD. In the typically developing literature, anxiety symptoms are related to sleep disturbance (Alfano, Beidel, Tuner, & Lewin, 2006). In ASD, greater anxiety has also been related to sleep problems in broad samples of children and adolescents with ASD using parent-report questionnaires (Mazurek & Petroski, 2015). However, little is known about specific anxiety subtypes that may be related to greater sleep disturbance in youth with ASD.
Objectives: This study aimed to investigate the relation between specific anxiety subtypes and sleep disturbance in a well-characterized sample of youth with ASD.

Methods: Participants were 43 youth with ASD (aged: 7-14; IQ > 70). Sleep diaries were completed by parents at home for three nights. Parent (*i.e., Multidimensional Anxiety Scale for Children-parent version; MASC-P*), child (i,e., *Multidimensional Anxiety Scale for Children-child version; MASC-C*) and diagnostician (i.e., *Pediatric Anxiety Rating Scale; PARS*) reports of anxiety symptoms were collected.

Results: Preliminary results from correlational analyses suggest sleep disturbance is related to parent, child, and clinician-reports of anxiety. More nighttime awakenings were significantly related to greater total anxiety reported on the *MASC-P* (*r*=.657, *p*=.001), *MASC-C* (*r*=.438, *p*=.041), and P*ARS* (*r*=.434, *p*=.038). Sleep quality was also significantly related to anxiety symptoms. Poorer sleep quality was related to greater overall anxiety on the *MASC-P* (*r*=-.513, *p*=.009). In regard to specific anxiety types, greater separation anxiety reported on the *PARS* and *MASC-P* was related to poorer sleep quality (*r*=-.466, *p*=.033; *r*=-.513, *p*=.009, respectively). Additionally, more nighttime awakenings were related to social anxiety symptoms reported on the *MASC-P* (*r*=.514, *p*=.014).

Conclusions: Findings from this study suggest anxiety may contribute to sleep disturbance in youth with ASD and no intellectual disability. In particular, sleep problems may be especially prevalent in children with separation anxiety and social anxiety. These results indicate that sleep is an important treatment target for anxious youth with ASD. Future research should continue to investigate insomnia as a determinant and/or consequence of anxiety in youth with ASD and examine other factors that may contribute to insomnia and anxiety in these youth.

149 **129.149** Autistic Characteristics in Anorexia Nervosa and Its Relationship with Anxiety, Depression and Eating Habits

*J. Lugo-Marín[1], M. P. López[2], M. Alviani Rodríguez-Franco[3], E. Diez Villoria[4] and **R. Canal-Bedia**[5], (1)Hospital Universitario Nuestra Señora de Candelaria, Tenerife., Spain, (2)Unidad de Trastornos de la Conducta Alimentaria, Hospital Universitario de Canarias, Tenerife, Spain, (3)Servicio de Psiquiatría, Hospital Universitario Nuestra Señora de Candelaria, Tenerife, Spain, (4)Universidad de Salamanca, Salamanca, Spain, (5)University of Salamanca, Salamanca, Spain*

Background: The Autism Quotient (AQ) (Baron-Cohen et al., 2001) is a 50-item screening questionnaire that is broadly used in clinical practice regarding the identification of autistic characteristics in adult population. The participant must choose the most suitable out of four alternatives ('Strongly agree', 'Slightly agree', 'Slightly disagree', 'Strongly disagree'). This tool has been shown to be useful in the detection of autistic characteristics in different psychiatric populations (Sizoo et al., 2009; Lugnegård, 2015). A special case is that of anorexia nervosa (AN). In a meta-analysis on the use of AQ in population with AN (Westwood et al., 2016), it was found that patients with AN presented higher scores in AQ compared to healthy controls. This suggests a possible relationship between autistic traits and the development of eating disorders.
Objectives: The aim of this study is to explore the relation of autistic characteristics with eating behaviors in a sample of young people with AN, as well as their relation with anxiety and depression symptoms.

Methods: Thirty adolescents and young adults (27 women and 3 men; mean age 16.43 years, sd 2.5) were asked to complete the AQ, as well as the Beck Anxiety Inventory (BAI) (Beck & Steer, 1988), the Beck Depression Inventory (BDI-II) (Beck, Steer & Brown, 1996), and the Eating Disorder Inventory (EDI-3) (Garner, 2002). The sample was divided by taking the median in the AQ score as the cutoff point and comparing the scores in the BAI, BDI-II and EDI-3. Finally, correlations between autism scores and measures of anxiety and depression, as well as eating behaviors were explored.

Results: The results suggest that there are no differences between both, above- and below-AQ median groups, in the three clinical measures (p <.05). Scores on anxiety, depression and eating behaviors do not present significant correlations with the AQ total score. One of the five subscale of the AQ (Communication) shows significantly correlations with anxiety (r=0.63), depression (r=0.67), and eating behaviors (r=0.61), but only in the above-AQ median sample.

Conclusions: These findings shed light on the role of autistic traits in young population suffering from AN. The results found here suggest that eating disorders are not directly related with the presence of autistic traits. Also, it seems that autistic characteristics do not play a main role in the emergence of anxious or depressive symptoms among these population. A lack of communication skills seems to be related to the psychiatric symptoms described above. Some limitations of this study are the reduced number of participants, as well as the lack of a comparison non-clinical group. Further investigation of autistic traits in this population, as well as their first-degree relatives, could be of interest.

150 **129.150** Autistic Traits and Further Clinical Manifestations in Phelan-Mcdermid Syndrome (22q13 deletion syndrome)

***M. Burdeus**, Instituto de Investigación Biomédica Gregorio Marañon , CIBERSAM, IISGM, Madrid, Spain*

Background: Phelan-McDermid syndrome (22q13.3 deletion syndrome or PMS), is a genetic disorder characterized by global developmental delay, severe speech impairments, intellectual disability, hypotonia and autism spectrum disorder to a variable degree. The loss of a functional copy of the SHANK3 gene, responsible for the codification of a scaffolding protein in the postsynaptic density, causes the clinical phenotype of PMS. Recent studies suggest that deletions or mutations compromising SHANK3 can cause a monogenic form of both ASD and intellectual disability, accounting for around 1% of the overall ASD cases [Guilmatre et al 2012; Durand et al 2007; Moessner et al 2007] and 0.3-1% of the ID [Cooper et al 2011; Gong et al 2012]. Literature also reports a higher prevalence of medical and psychiatric comorbidities and developmental regression in patients with 22q13.3 deletions [Scoorya et al 2013; Denayer et al 2012].
Objectives: To describe the clinical phenotype of a sample of participants with PMS, using standardized tools for the assessment of repetitive or otherwise altered behaviors, global adaptive functioning and ASD. Furthermore, we seek correlations between the clinical phenotype and the information provided by previous genetic reports regarding length of deletion and other abnormalities, such as ring chromosomes, deletions or duplications in multiple regions or mosaicisms, among others.

Methods: Forty-four participants were recruited in coordination with the PMS Association in Spain or through direct contact with their clinicians at the HGUGM in Madrid. Mean age is 10.41 and the sample shows an equal gender distribution.

Clinical assessment was conducted through a variety of questionnaires and scales measuring altered behavior (CBCL, ABC-C, RBS-R), adaptive behavior (Vineland-3) and social responsiveness (SRS). We assessed ASD –related development and symptoms by means of gold-standard diagnostic instruments, ADI-R and ADOS-2.

Results: Preliminary results of 30 participants are available, showing great variability in their clinical symptoms. Despite all patients showing mild to severe intellectual disability and deficiencies in language acquisition, the severity of the difficulties in social communication and restrictive, stereotyped or altered behavior appears to be variable, with some individuals presenting behavioral abnormalities (self-injuries, sleep disturbances, attention deficit or hyperactivity, among others). A majority of participants showed impaired development with autistic traits during early childhood; however, only some of them meet criteria for ASD at present evaluation, according to DSM-5 . Developmental regression or stark developmental standstill affecting language, motor or daily living skills is possibly present in 6 to 10 cases, with an age of onset ranging from two years to adolescence.

Evaluations are still taking place; these results may therefore suffer modifications.

Conclusions: Clinical manifestations of the Phelan-McDermid syndrome are heterogeneous, showing a wide range of symptom severity. We observe differences between present moment and early years in relation to autistic-like behaviors. Neuropsychiatric disturbances and aberrant behaviors are also reported. Developmental regression may begin at a later age (early adolescence) and occur in combination with a period of psychiatric distress. Further investigation is required to ascertain possible associations between clinical features and genotype-phenotype correlations.

151 **129.151** Differences in the Anxiety Profiles of Middle Childhood Boys and Girls with ASD

L. Libero[1]*, B. Winder-Patel*[2]*, M. Solomon*[3]*, C. W. Nordahl*[1] *and D. G. Amaral*[1]*, (1)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (2)MIND Institute, University of California, Davis, Sacramento, CA, (3)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA*

Background: Symptoms of anxiety are reported commonly in ASD, with approximately 30-50% of individuals with ASD meeting criteria for an anxiety disorder. In typical development, anxiety disorders affect boys and girls at similar rates during early childhood, but at higher rates in females by adolescence. It is unclear whether these sex differences exist in the context of ASD. The current study evaluates a longitudinal dataset of children with ASD to examine potential predictors of the development of clinically significant anxiety in children with ASD.
Objectives: To examine anxiety prevalence and severity in boys and girls with ASD. To define early childhood predictors of the development of clinically significant anxiety at middle childhood.

Methods: Participants studied to date include 30 children with ASD (20 male/10 female; IQ range 39-123; ADOS-2 composite score range 5-10) enrolled in the ongoing Autism Phenome Project. Early childhood behavioral measures (Autism Diagnostic Observation Schedule-Generic [ADOS-G], Childhood Behavior Checklist for Ages 1½-5 [CBCL], Short Sensory Profile [SSP], and Vineland Adaptive Behavior Scales-II [VABS-II]) were collected at approximately 3 years-of-age. The children are currently between 9 and 13 years of age and clinically significant anxiety was evaluated using the clinician administered Anxiety Disorders Interview Schedule (ADIS-IV) parent version with the Autism Spectrum Addendum. Children with a clinical severity rating of 4 or greater were classified as having an anxiety disorder.

Results: In middle childhood, there is a trend towards a greater proportion of girls with ASD who have clinically significant anxiety than boys with ASD (80% of girls vs. 65% of boys, X^2=0.71, p=0.39). Girls with ASD also have more severe anxiety than boys as measured by the ADIS-IV clinical severity rating (girls=5.20, boys=3.70, F=5.6, p=0.024). Interestingly, for girls with ASD, but not for boys, parent-ratings of behavior on the CBCL at 3 years-of-age predicts anxiety severity in middle childhood for three subscale scores: Internalizing t-score (F=17.62, p=0.002, R^2=0.716), Withdrawn t-score (F=10.01, p=0.016, R^2=0.539) and Emotionally Reactive t-score (F=12.96, p=0.009, R^2=0.649). Scores on the ADOS-G, SSP, and VABS-II were not predictive of anxiety for boys or girls.

Conclusions: By middle childhood, a greater proportion of girls with ASD develop anxiety disorders and with greater severity, compared to boys with ASD. In typical development, sex differences in the prevalence of significant anxiety are present around this age (approximately 12% of girls versus 8% of boys have an anxiety disorder). It should be noted that both girls and boys with ASD are presenting with anxiety at rates much higher than their typically developing peers. In girls, the CBCL also may provide an early predictor for the future development of anxiety, which holds clinical implications for specific early intervention of anxiety symptoms. This study provides evidence for sex differences in the anxiety profiles of girls and boys with ASD.

152 **129.152** Discharge from Children's Services: Experiences and Predictors of Mental Health Outcomes

H. Merrick[1]*, C. King*[2]*, H. McConachie*[1]*, J. R. Parr*[3] *and A. LeCouteur*[1]*, (1)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (2)Northumberland, Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background:

Young people (YP) with mental health problems can get 'lost' following discharge from child and adolescent mental health services. Adult services may have different referral criteria or there may not be an appropriate service for young people to be referred to. This disruption of care may especially adversely affect the health, wellbeing and longer-term outcomes of YP on the autism spectrum. Mental healthcare transition occurs at approximately the same time as other developmentally appropriate transitions such as leaving school, moving to further education or employment, or seeking some degree of independence. For YP with ASD these transitions may be further complicated with a lack of support and post-education options.

Objectives:

The overall aim of this study was to describe the lived experience and outcomes for YP with ASD and an additional mental health problem leaving child and adolescent mental health services (CAMHS) and how this relates to their mental health and wellbeing.

Methods:

Participants were YP aged 14-18 years, with a diagnosis of ASD without additional intellectual impairment who were accessing CAMHS, from a 3-year longitudinal study. YP completed measures on their mental health (Hospital Anxiety and Depression Scale; HADS), wellbeing (Warwick and Edinburgh Mental Wellbeing Scale), and frequency of social participation. Additional qualitative contextual (clinical, family, social and education) information about the YP and their families was recorded by the research assistant. Qualitative and quantitative data were used to identify mental health outcomes and potential predictors of transfer locations (general practitioner or adult mental health services). Framework analysis was used to identify themes in the YP's lived experiences over the course of the longitudinal study.

Results:

In total, 118 YP with ASD and additional mental health problems completed baseline measures (mean age= 16.1 yrs). 88 (74.6%) YP completed a final visit (either 3 or all four visits). By the final visit, 60 YP were in full time education, 5 YP were in full time employment, 1 in part time, 3 doing volunteer work, 3 in vocational training, 6 were looking for work, and 7 were unemployed and not looking for work (3 missing data). Only 24 YP (27.3%) transferred to adult mental health services, 44 (50%) were under general practitioner care and 20 (22.7%) remained in children's mental health services. Predictors of transfer location will be reported.

Wellbeing was consistently below general population norms and the proportion of YP with an 'abnormal' HADS score on the 'anxiety' and 'depression' domains remained the same over the 4 visits. The qualitative themes allowed us to understand in more detail the YP lived experiences of transition and identify variables associated with ongoing problems or with positive outcomes.

Conclusions:

This study has identified the health and social factors that are relevant for young people with ASD as they are discharged from children's services. For some young people adulthood is a new beginning. For others ongoing mental health difficulties, social needs and lack of access to adult services remain key risk factors for outcome in adulthood.

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129.153 Does Autism Risk Confer a Greater Risk for Sleep Problems?

A. J. Schwichtenberg[1]*, E. A. Abel*[1]*, A. M. Kellerman*[1]*, P. L. H. Chong*[1]*, M. Miller*[2] *and S. Ozonoff*[3]*, (1)Purdue University, West Lafayette, IN, (2)University of California, Davis, MIND Institute, Sacramento, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA*

Background: Elevated rates of sleep problems have been reported in children with autism spectrum disorder (ASD), their parents, and their younger siblings. In families raising children with ASD the mechanisms for familial sleep problems are unclear. Sleep problems may align with ASD risk and simply reflect an element of the broader autism phenotype. Conversely, sleep (particularly in young children) implicates parents; therefore, sleep disruption in families could evolve from one child having a sleep problem. The proposed study explores these hypotheses by assessing maternal and sibling sleep in families raising children with ASD (and a comparison group).

Objectives: The overall goals of this study were to: (1) assess if elevated autism risk is associated with elevated maternal and sibling sleep problems, (2) assess whether sleep problems align with developmental functioning/concerns, and (3) assess whether maternal sleep problems are associated with child sleep problems.

Methods: Participants included families raising children with ASD (high-risk group; *n*=45) and families with no history of ASD (low-risk group, *n*=55) who were part of a prospective, longitudinal study. When children were 30 or 36 months of age, mothers completed the Children's Sleep Habits Questionnaire (CSHQ), the Child Behavior Checklist (CBCL), and the Pittsburgh Sleep Quality Index (PSQI). At 30 or 36 months children also completed a detailed developmental battery and were classified as having developmental concerns (DC group, *n*=36) or typical development (TYP group, *n*=36). Additionally, between 18 and 24 months of age a subgroup of children (*n*=72) wore an actigraph to objectively record their sleep for 7 consecutive 24-hour periods.

Results: General linear models were employed with terms for infant sex and family income where appropriate. Risk group status was not associated with sleep problems reported on the CSHQ or CBCL. Similarly, actigraphy indexed sleep patterns were not significantly different across the risk groups. When comparing children in the DC and TYP groups, sleep problems on the CSHQ were elevated for children in the DC group for sleep onset delay ($p<.05$), sleep anxiety ($p<.05$), and were slightly elevated for bedtime resistance ($p=.05$). On the CBCL, general sleep problem reports were also elevated for children in the DC group ($p<.01$). Additionally, children in the DC group slept less at night ($p<.05$) and had more variable nighttime sleep ($p<.01$). Maternal reports of their own sleep did not differ across risk groups or DC and TYP groups. However, mothers were more likely to endorse problems with their own sleep if their child had high nighttime sleep variability (measured via actigraphy), short sleep duration, sleep distress, and general sleep problems (all $p<.05$).

Conclusions: Sleep problems in families raising children with autism do not appear to align with general ASD risk. Rather sleep problems in this study were associated with developmental concerns. For parents, having a child with a sleep problem, not simply a child with ASD, was associated with elevated problems with their sleep. This study demonstrates the strong interconnectedness of family sleep in families with and without a history of ASD.

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129.154 Early Life Developmental Deviances and Prediction of Psychosis in 22q11.2 Syndrome

D. Fraguas[1] *and M. Bravo*[2]*, (1)Child and Adolescent Psychiatry, Hospital Gregorio Marañon, CIBERSAM, IISGM, Madrid, Spain, (2)Hospital Gregorio Marañon, Madrid, Spain*

Background: The chromosomal region 22q11.2 is particularly vulnerable to aberrant rearrangements, generating deletions or duplications, and producing a set of developmental anomalies. The 22q11 deletion syndrome (22q11.2DS) occurs at a frequency of around 1 in every 2,000-4,000 live births, making it the most common known interstitial deletion in humans.

This syndrome is one of the most common genetic causes of neurodevelopmental disorders, such as attention deficit hyperactivity disorder (ADHD) or autism spectrum disorders (ASD). It has also become one of the better known risk factors for developing psychotic symptoms. It has been estimated that the risk of developing schizophrenia for an individual with 22q11DS approaches 20 times the risk in the general population.

Objectives: The objective of this analysis was to evaluate the predictive value of the presence of developmental alterations in early childhood (retrospective assessment at age 4) on the risk of psychosis in late childhood and adolescence (current assessment).

Methods: 55 individuals with 22q11.2DS were recruited consecutively from the outpatient unit "Genetics and Mental Health Program" in the Child and Adolescent Psychiatry Service of the University Hospital Gregorio Marañón, Madrid.

We collected data on sociodemographic characteristics, retrospective neurodevelopment and social functioning in early childhood (by means of the social communication questionnaire, SCQ), and current psychotic symptoms and diagnosis (by means of diagnostic interviews, K-SADS or SCID, according to the age of participants, and the clinical scales PANSS and SIPS).

The objective of this analysis was to evaluate the predictive value of the presence of developmental alterations in early childhood (retrospective assessment at age 4) on the risk of psychosis in late childhood and adolescence (current assessment).

Results: The presence of aberrant neurodevelopmental processes in early childhood, measured by the SCQ, was associated with an increased risk of psychosis in late childhood and adolescence, Odds Ratio=1.16, Cohen's D=1.08, p<0.001.

Conclusions: To the best of our knowledge, this is the first report describing an excess risk of psychosis in a sample of patients with 22q11.2DS with abnormal neurodevelopmental indicators during early childhood. These data support the importance of the so-called "personalized medicine" to develop strategies to get early detection and early intervention in specific populations such as subjects with 22q11.2DS.

155 **129.155** Emotion Dysregulation in Youth Presenting for Evaluation to a Specialized Autism Clinic

R. A. Vasa[1,2]*, A. Keefer*[2]*, V. Singh*[2]*, L. Kalb*[2]*, J. S. Hong*[2] *and C. A. Mazefsky*[3]*, (1)Kennedy Krieger Institute, Baltimore, MD, (2)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (3)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Research suggests that emotion dysregulation (ED) is an associated feature of autism spectrum disorder (ASD) and may contribute to the high rates of psychopathology in this population (Mazefsky and White, 2014). Few studies, however, have attempted to identify clinical features that distinguish ED in youth with and without ASD. This information could be helpful in recognizing ED, and developing customized treatments for each group.

Objectives: To compare (1) the prevalence of ED among youth with and without ASD and (2) whether youth with and without ASD differ in ED symptom profiles, parenting stress and treatment utilization.

Methods: Data were from 1099 youth (n=727 with ASD; n =372 without ASD), ages 6 to 18 years (M=10.2, SD=3.0), who were seen by a clinician for evaluation at a specialized ASD clinic between 2014-2017. ASD diagnosis was confirmed via clinical evaluation. Parents completed the Child Behavior Checklist (CBCL), the Parenting Stress Index-4th Edition, and customized clinic forms that asked about current mental health treatments. ED was assessed using the Dysregulation Profile from the CBCL, which is a composite T score of the aggression, anxious/depressed, and attention problems subscales (Achenbach, 1991). Moderate and severe ED were defined as T scores between 180-210 and above 210, respectively. Bivariate (Chi-square and t-tests) and multivariate (logistic, multinomial and linear regressions) analyses were employed to examine the associations between ED, ASD, parental stress, recipient of treatment, and demographics (age, gender, race, and insurance status).

Results: Overall, 55% of youth with ASD and 67% of youth without ASD met the cutoff for ED. Youth without ASD were more likely to have severe ED (27% vs. 15%), however, the proportion of youth with moderate ED was comparable across the groups (40% for both groups). After adjusting for demographics, youth with ASD had a significantly lower probability of having moderate/severe ED (OR = 0.62; p < 0.001), specifically severe ED (0.41; p < .001). When examining symptom profiles, all three Dysregulation Profile subscales were significantly lower in the ASD group (all p < .05). Parenting stress levels were significantly related to increasing levels of ED, regardless of ASD diagnosis, (p < 0.001). Overall, 37% of youth with ED were receiving no treatment and 21% were receiving both pharmacotherapy and behavioral therapy.

Conclusions: The majority of youth presenting to an ASD clinic had moderate or severe ED. Severe ED was more common in youth who did not end up with an ASD diagnosis. This finding likely reflects the complex mental health issues of youth who present for ASD evaluations but do not have ASD. It is therefore critical that clinicians not rely on ED as a specific feature of ASD, but rather maintain focus on obtaining a thorough developmental history of core ASD features. The high levels of parenting stress and alarmingly limited number of youth with ED engaged in treatment demonstrates the importance of early detection and facilitating access to care for all youth with ED.

156 **129.156** Enhancing Health, Well-Being and Physical Activity Among Adolescents with Autism Spectrum Disorder

P. Jachyra[1]*, E. Anagnostou*[2]*, B. Gladstone*[3]*, R. Renwick*[4] *and B. Gibson*[5]*, (1)University of Toronto & Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada, (4)Occupational Therapy, University of Toronto, Toronto, ON, Canada, (5)Physical Therapy and Bloorview Research Institute, University of Toronto and Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: Despite the numerous health/social benefits of regular physical activity participation (PAP), adolescents with Autism Spectrum Disorder (ASD) are less likely to be physically active compared to their age-related peers. Research suggests that they become even less active during adolescence in both school/community settings. With declining PAP during adolescence, side effects of psychotropic medication treating core symptoms often resulting in weight gain, and high levels of sedentary activity participation, they are at significantly higher risk to develop complex acute/chronic health conditions such as cardiovascular disease, psychological disorders, and musculoskeletal disorders. Given these

health complications, there is a need then to examine how to potentially increase PAP in an attempt to mitigate some of these preventable health complications. To date, much of the research examining PAP has drawn from the somato-motor performance (issues with balance, gait and joint flexibility) deficits associated with ASD. As such there is a paucity of research, and no research in Canada that has examined how non-bio-physical factors influence PAP.
Objectives: The purpose of this study was to examine the social, psychological, and behavioural, factors which influence PAP.

Methods: A qualitative study was conducted to elicit an in-depth examination and understanding of the factors which facilitate/constrain PAP. Ten adolescents with ASD (aged 11-18 years) and ten caregivers were interviewed from Ontario, Canada to maximize the depth/breadth of perspectives. Data was analyzed thematically where interview transcripts were coded to develop a preliminary understanding of the data. Codes with common patterns were then clustered and themes were generated. Negative cases within the data were used to test the rigour of the interpretations. Analytic memo writing and final integrative writing about PAP were employed to ensure findings were grounded in participant data. Participant quotes were drawn out to support research findings.

Results: Among adolescents, little exposure to PAP during childhood, bullying/traumatic experiences, and feeling an incessant pressure to camouflage in order to act ‘normal to fit in’ functioned to dissuade participation. Caregivers outlined that they prioritized behavioural/communication interventions over PAP throughout their child’s life, and the lack of participation during formative childhood years shaped physical activity interests during adolescence. Caregivers also described experiencing systemic challenges when accessing physical activity programs, including a lack of awareness about ASD among service providers, funding challenges, and limited/few program options. The lack of PAP individualization and competing commitments contributed to tremendous strain on families where caregivers expressed a need for guidance to help them balance family life, schooling, and therapies with PAP.

Conclusions: Study findings demonstrate that the lack of PAP among adolescents with ASD is not merely influenced by bio-physical deficits. Rather, findings suggest that inactivity is tied within complex psycho-social/behavioural mechanisms which intersect at individual, community, and policy levels. Findings suggest that there is a need to work collaboratively with policy makers and service providers in the community in an effort to create optimal physical, social, cultural, sensory, and behavioural conditions that could facilitate PAP. Solutions on how to potentially achieve such conditions of possibility will be discussed.

157 **129.157** How Should We Talk about Obesity and Weight-Related Topics with Children with Autism Spectrum Disorders and Their Families?

*A. C. McPherson[1], **P. Jachyra**[2], C. Petta[1], S. Cosgrove[1], L. Chen[1], L. Capano[3], L. Moltisanti[4], T. J. Knibbe[5] and E. Anagnostou[4], (1)Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)University of Toronto & Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Autism Research Centre, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Research, Abilities Centre, Whitby, ON, Canada*

Background: Obesity is a global health concern and can significantly impact the physical and psycho-social health of children. Children with Autism Spectrum Disorder (ASD) appear to be at a higher risk of having obesity than their typically developing peers. One particular risk factor is the use of psychotropic medications to help control mood and impulsivity, which frequently can contribute to significant weight gain. Although it has been recommended that health care providers (HCPs) speak to families about the potential health risks of unhealthy weight in ASD, no previous research has explored exactly how HCPs communicate with children with ASD and their families about this topic.
Objectives: To explore the experiences of children with ASD, their families and HCPs when discussing weight-related topics in healthcare consultations.

Methods: Individual, in-depth qualitative interviews were conducted with children with ASD aged 10-18 years with verbal fluency who were attending a tertiary psycho-pharmacology clinic and whose Body Mass Index was greater than the 85th percentile. Their parents were also invited to take part in a separate interview, as were all HCPs who worked in the clinic. Thematic analysis using an interpretive phenomenological approach was used to analyze the verbatim transcripts. Emerging themes were analyzed and discussed by the whole team comprising multi-disciplinary HCPs, researchers and a parent of two children with ASD.

Results: Eight children with ASD, eight parents, and five HCPs were interviewed. Three main themes were identified: 1) Layers of complexity: Weight and health issues were complicated by a combination of medication side-effects, social dynamics within the home, and overall quality of life considerations. Narratives of ‘the lazy child’ and ‘non-compliant parent’ were strongly rejected; 2) Uncertainties of communication: Clinicians were often hesitant to start weight-related conversations when families came to see them for other issues. Others worried what impact such a discussion would have on the therapeutic relationship with the families. Parents wanted HCPs to raise the topic early, but were frustrated when realistic solutions were not offered; 3) Wellness over weight: Parents, children and HCPs all identified a need to move from predominantly focusing on a child’s weight, and instead promoting overall wellness throughout the life course. Overall recommendations included: Acknowledging the complexity of the situation; Engaging child in the discussion where possible; Using clear visuals and examples; Establishing a trusting relationship with the family; Using a strengths-based approach.

Conclusions: Children, caregivers and HCPs all recognized the potential short and long term health risks of overweight/obesity, and identified a need to work collaborative to positively impact the health status of children. Tools are needed to help HCPs foster positive conversations about weight-related topics and lifelong wellness.

158 **129.158** Exome Sequencing and Clinical Correlates in 250 ASD Trios

***J. Gonzalez-Peñas**, Child and Adolescent Psychiatry, Fundación investigación Biomedica Gregorio Marañón, CIBERSAM, Madrid, Spain*

Background: The diagnoses of ASD is mainly based on i) defficiencies in social interaction and communication and ii) restrictive and repetitive behavioral patters, interests or activities, including sensorial alterations. The behavioral assessment sufficient for a clinical diagnosis has limited use in research field and it is also likely that it will also have limited use for personalized medicine approaches, where trying to identify different biological subtypes seems the appropriate move forward .
In addition to important polygenic component, a great variety of single-gene disorders and chromosomal abnormalities have been described across latest genetic studies. Proper biological pathways and/or specific physiopathological mechanisms involved such as chromatin remodeling,

redox system regulation or transcriptional regulation processes have been identified as candidate gene sets enriched in deleterious rare, inherited and *de novo* variation [Lai et al. 2013; de Rubeis et al 2014; Kosmicki 2017].

Objectives: In this study, we aimed to differentiate ASD patients based on rare disrupting and common genetic predisposing variation found to be enriched in main gene networks previously reported in ASD, as synapse, chromatin remodelling or transcription regulation. We extensively phenotipically characterize each group based on clinical manifestations, including restricted and repetitive behaviors, unusual interests, developmental regression, epilepsy or gastrointestinal disease.

Methods: 250 Spanish ASD trios were recruited at Hospital Universitario Gregorio Marañón. Demographic, clinical and neuropsychological variables were collected from trios samples to perform cluster analysis with a combination of hierarchical and k-mean methodology. Exome from blood DNA was sequenced as part of the Autism Sequencing Consortium (ASC) dataset. Bioinformatic pipeline was constructed based on Broad Institute recommendations from alignment, base Quality Control or variant calling, and ANNOVAR was used for variant annotation from vcf files. For rare variant analysisi, we filtered rare (MAF < 0.1) and deleterous variation, making use of a myriad of existent and recently published algorithms to described funtional, brain-expressed and intolerant variation. To analyze common polygenic variation, we imputed whole genome variants using Michigan Imputation Server, utilized PGC available data as discovery sample and used PRSice to poligenic risk score calculations in our target sample. General linear model was used to statistically analyze associations between genetic and phenotypic variables collected.

Results: ASD sample was biologically characterized based on both rare and common predisposing genetic variation. We found disctintive patterns of common varaition and de novo rare disrupting variation affecting intolerant genes (pLI > 0.9) across identified groups. Biological groups were exhaustively characterized, according to several clinical variables as intelectual disability (ID), developmental regression, psychiatric comorbility, gastrointestinal pathology or pro-inflamatory status. We also report suggestive results in specific traits with several types of variation, as epilepsy and disrupting mutations within astrocyte related genes ($p = 4.5 \times 10^{-4}$) or post-zygotic mutations dependence with diagnostic categories ($P = 5 \times 10^{-5}$).

Conclusions: We claim the usefulness of differentiating biological clusters with diagnosable atributes not only to allow the establishment of stratification criteria for clinical purposes, but also to improve decision making about clinical trials designs to improve pharmacological treatment choice.

159 **129.159** Experience of Mental Health Diagnosis and Medication in Autistic and Non-Autistic Individuals: An Online Study.

S. Au-Yeung[1]*, S. A. Cassidy*[2]*, L. Bradley*[3] *and R. Shaw*[4]*, (1)Coventry University, Coventry, United Kingdom of Great Britain and Northern Ireland, (2)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (3)Coventry University, Coventry, United Kingdom, (4)NHS Coventry and Warwickshire Partnership Trust, Warwickshire, United Kingdom*

Background: Although previous research showed high levels of psychiatric co-morbidities among individuals with autism spectrum conditions and psychotropic medication are frequently prescribed for these individuals (Buck et al., 2014), little is known about autistic people's agreement with their mental health diagnoses and their experience of medication prescribed for their mental health conditions.
Objectives: The purpose of this study is to investigate and compare the experience of mental health diagnoses and medication between autistic and non-autistic adults.

Methods: Participants with or without a diagnosis of Autism Spectrum Conditions (ASC) completed an online survey collecting both qualitative and quantitative data regarding mental health or other diagnoses they received, and whether they agree with their diagnoses and why. Participants were also asked to report any current medication for their mental health condition, duration they have been taking them and any side effects. In addition, they were asked to rate the helpfulness and satisfaction of their medication and to report their experience of taking medication for their mental health condition.

Results: Preliminary analyses revealed that autistic individuals were more likely to receive diagnosis for mental health or other conditions, were less likely to agree with their diagnoses, were more likely to be on medication for their mental health condition, and were less satisfied with their medication than non-autistic individuals. There were no significant between-group differences in helpfulness rating and likelihood of experiencing side effects of their medication. Further qualitative findings will be reported in this presentation.

Conclusions: The current study revealed higher rate of diagnosis for mental health problems in autistic people, although they were less likely to agree with these diagnoses and were more likely to be prescribed medication which they may not necessarily be satisfied with. Autism awareness training as well as training staff to provide modified therapy in clinical practice could potential improve these experiences for autistic individuals

160 **129.160** Experiences of Suicide and Suicidal Thoughts Amongst Adults with an Autism Spectrum Condition.

L. Bradley[1]*, S. A. Cassidy*[2,3] *and J. Rodgers*[3]*, (1)Coventry University, Coventry, United Kingdom, (2)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background: Currently, depression and suicide risk assessment tools are a 'one size fits all' design. However, they may need to be adapted for adults with an Autism Spectrum Condition (ASC), due to difficulties such as literal interpretation, identifying and communicating internal emotional states. The clinical implication being that these questionnaires may not accurately measure depression or suicide risk in adults with an ASC. This is worrying given high rates of depression and suicidal ideation in this group.
Objectives: To explore how adults with an ASC interpret questions in current clinical measures of depression and suicide risk, in order to inform development of new tools adapted for this group.

Methods: 15 adults with ASC took part in cognitive interviews while completing the Suicide Behaviour Questionnaire-Revised (SBQ-R), and Patient Health Questionnaire-9 item (PHQ-9). During the cognitive interviews, participants described what they were thinking and reading about when completing these questionnaires. Interviewers subsequently probed participants' responses to further explore how participants interpreted the questions.

Results: A conversational analysis approach was used to analyse the data. The extracts presented focus on key moments within the interaction when the participants talk about suicide and the future, their ongoing thoughts of suicide, and how they believe these to be autism specific and different from those without autism. These indicate that adults with ASC: 1) interpret the questions literally and in turn provide literal answers which do not always fit the question being asked; 2) find some questions unclear in terms of what information is required to ensure they provide an appropriate answer; and 3) report some questions are describing traits or behaviours typically associated with autism and therefore not appropriate markers of a mental health difficulty for them.

Conclusions: Results suggest that current measures of depression and suicide risk need to be adapted for adults with ASC, in order to accurately identify these difficulties in this group. Results will be used to inform adaptations to these measures, and guidelines for clinicians assessing depression and suicide risk in adults with ASC.

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129.161 Inflammatory Profile in ASD Children with and without Functional Gastrointestinal Disorders

M. J. Penzol Alonso[1], *B. García-Bueno*[2], *K. S. MacDowell*[3], *J. C. Leza*[4], *A. Alcón*[5] *and M. Parellada*[6], *(1)HOSPITAL UNIVERSITARIO GREGORIO MARAÑON, MADRID, Spain, (2)Pharmacology,, Universidad Complutense, CIBERSAM, Madrid, Spain, Madrid, Spain, (3)Pharmacology, School of Medicine, UCM, Madrid, Spain, (4)Pharmacology, School of Medicine, UCM, CIBERSAM, Madrid, Spain, (5)Hospital Universitario Gregorio Marañón. Child and Adolescent Psychiatry. IISGM. CIBERSAM, Madrid, Spain, (6)Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background: There is considerable evidence that the gut-brain axis is involved in the physiopathology of some subjects with autism spectrum disorders (ASD). A number of studies point out towards a high prevalence of functional gastrointestinal disorders in children suffering from autism and a correlation between this symptoms and the severity of psychopathology. Published research suggests that part of the symptomatology in ASD could be mediated by systemic pro-inflammatory processes. Authors have described a neuroinflammatory status up to 65% of patients with ASD (Kern et al. 2015). This inflammatory status became detectable through blood markers, such as chemokines TNFα, IL-1β e IL-12, TLR-4, etc. Chemokines and their receptors might provide unique targets for the development of innovative therapies for these disorders. Functional Gastrointestinal Disorders (fGID), very prevalent in ASD, has been lucubrated to be a reflection of a systemic pro-inflammatory status.
Objectives: The main objective of this project is the identification of immunological markers involved in the pathogenesis of a subgroup of children with ASD. We hypothesized that children with ASD and gastrointestinal symptoms will also have markers of a systemic pro-inflammatory status.

Methods: We recruited 4 groups of participants (3 to 10 years old), selected for by the presence or absence of ASD diagnosis and the presence/absence of gastrointestinal (GI) functional symptoms: 1) ASD + fGID , group 2) ASD no fGID, group 3) healthy controls (HC) + fGID, group 4) HC; mean age was 6.67 (±1.9). 90% were male. ASD was diagnosed following the AACAP recommendations (Volkmar, 2014) and fGID were assessed with the ROMA-III. Plasma and peripheral blood mononuclear cell (PBMC) inflammatory biomarkers were analyzed: plasma TNFa, IL-1b, IL-6, , IFNg, LPS, LBP, IL-10, CD26act, CD26 exp; PBMC levels of Tool-Like receptor-4 (TLR-4), TLR-2, Myeloid differentiation primary response gene 88 (MyD88), TIR-domain containing protein TRIF, NFKb and TLR-3.

Results: One way-analysis of variance (ANOVA) analyses were conducted to determine statistically significant differences between groups for each biomarker; post hoc Dunn's Multiple Comparison Test was used to identify group pairs differences. The following markers differed between groups: LBP ($\chi 2=10.74$; $p=0.09$), IL-10, CD26act ($\chi 2=10.77$; $p=0.09$), Tool-Like receptor-4 (TLR-4) ($\chi 2=23.13$; $p=0.001$), Myeloid differentiation primary response gene 88 (MyD88) ($\chi 2=13.67$; $p=0.00$), TRIF ($\chi 2=16.15$; $p=0.00$), TLR3 ($\chi 2=8.76$; $p=0.03$), NFKb ($\chi 2=12.45$; $p=0.01$). Post-hoc analysis showed that ASD+fGID and HC+fGID groups did not differ in any of the markers analyzed. Significant differences were detected in all other comparisons between groups for several inflammatory markers. Bivariate analyses were conducted in order to compare the levels of the different markers between subjects with ASD and without ASD and patients with and without fGID. Specific differences will be fully reported together with clinical correlates.

Conclusions: Very early markers of activation of the innate immune system is seen in patients with ASD irrespective of the presence of fGID. This may reflect a that may indicate a systemic pro-inflammatory status in these patients. The study of the immunological pathophysiology in warranted in ASD, in order to identify a subgroup within ASD that may benefit from specific interventions.

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129.162 Intellectual Disability in ASD. Paternal and Obstetric Factors in Relation with Cognitive LEVEL Outcome

A. Alcón[1] *and D. Gerez*[2], *(1)Hospital Universitario Gregorio Marañón. Child and Adolescent Psychiatry. IISGM. CIBERSAM, Madrid, Spain, (2)Child and Adolescent Psychiatry, Hospital Gregorio Marañon, CIBERSAM, IISGM, 28035, Spain*

Background: Different environmental and family factors have been associated with increased risk of Autism Spectrum Disorders (ASD) and/or its severity. Among these, advanced parental age (APA) is associated with increased risk of ASD [Janecka et al 2017; McGrath et al 2014] and one of the mechanisms proposed is that autistic traits in the parents may lead to delay age at conception [Gratten et al 2016]. Perinatal factors such as the use of oxytocin in labour have been associated with the severity of ASD [Smallwood 2016].
Objectives: In this presentation we aim to report on the effect of some parental and perinatal factors on the severity of ASD, as indicated by cognitive development [8].

Methods: Eighty patients with ASD (DSM-IV-TR diagnosis), mean age 13.25 ±7.7SD, 87.5% male, 92.5% Caucasian) were recruited at Hospital General Universitario Gregorio Marañón. Intelligence quotient (IQ) was assessed with the Wechsler Intelligence Scales for Children or Adults, as appropriate. Parental autism traits were evaluated with the Autism Spectrum Quotient (AQ). The presence of obstetric complications was evaluated with the Lewis-Murray Obstetric Complications Scale. After confirming the normality of data, Pearson correlation analyses were used to assess the relationship between parental autism traits and age at conception, and between and multiple linear regression were used to assess the potential association of patients IQ with the parental (APA, psychiatric history and autism traits), and obstetric predictors (birthweight, obstetric complications or labour oxytocin use). Statistical analyses were performed with SPSS 18. Statistically significance threshold $p<0.05$.

Results: 66.3% of the sample had fluent language and 31.3% only words/simple phrases (as per ADOS criteria). Mothers aged from 23 to 41 years old, mean age 31.99 SD=4.072 and fathers aged from 22 to 47, mean age 34.23 SD=5.31. 23.75% of parents had a positive psychiatric history. ASD birthweight was 3260.5±497.04SD [1950-4300] g; 62.5% of the cases had a positive history of obstetric complications.

Fathers of ASD probands had a mean AQ of 16.6 ±6 and mothers had a mean AQ of 14.8 ±6.7. Paternal or maternal autistic traits did not correlate with their age at ASD birth ($r=.209$, $p=.145$ and $r=.035$, $p=.798$ respectively). The use of oxytocin during labour was significantly associated with proband IQ (IQ mean 84.251 ±25SD [40-133], association with oxytocin use $t=2469$, $p=.016$). With regard to associations among risk variables, the presence of obstetric complications significantly correlated with birthweight ($t=2.155$, $s=.034$), maternal age at birth ($t=-2.256$, $s=.027$) and parental autism traits (t=-2.004, s=.051). Labour oxytocin was associated with the presence of ASD diagnosis before 1 year of age (s=.010). Multiple regression analysis showed that oxytocin use predicts IQ (B=-13.673, s=.016) , after controlling for age, sex and ethnicity (R2=.073).

Conclusions: Labour oxytocin use does partially predict IQ in ASD patients. Contrary to our hypothesis, parental autism traits does not predict IQ outcome. The direction of the relationship oxytocin use-IQ in ASD patients is, hitherto, unknown and needs further investigation.

163 **129.163** Investigating the Factor-Structure of the Child Behavior Checklist Dysregulation Profile in Youth with ASD

A. Keefer[1,2]*, V. Singh*[1]*, L. Kalb*[1,3]*, C. A. Mazefsky*[4]*, J. S. Hong*[1] *and R. A. Vasa*[1,2]*, (1)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (2)Johns Hopkins School of Medicine, Baltimore, MD, (3)Department of Mental Health, Johns Hopkins University, Baltimore, MD, (4)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Emotion dysregulation (ED) is a common feature of autism spectrum disorder (ASD). Few studies have assessed the factor structure or established the internal construct validity of measures used to assess ED in the ASD population. Examining the factor structure of one such measure, the Child Behavior Checklist Dysregulation Profile, which combines the Anxious/Depressed (AD), Aggressive Behavior (AGG), and Attention Problems (AP) subscales of the CBCL (Achenbach, 2001), can guide understanding of the latent relationships that exist between ED and associated symptoms.

Objectives: To explore the factor structure of the CBCL Dysregulation Profile in a large clinical sample of youth with ASD.

Methods: Parents of 727 youth aged 6 through 18 years (Mean=10.28, SD=2.99) completed the CBCL prior to their initial appointment at an ASD clinic within a university-based medical center. ASD diagnostic status was determined by an expert physician or psychologist. A series of four confirmatory factor analytic (CFA) models were employed to explore the latent structure of the ED construct and its interrelations with the AD, AGG, and AP subscales: a uni-dimensional model in which there is only an ED factor, a second order model in which ED is an overarching factor that explains each of the subscales, a three specific factors model in which each of the subscales exist independently with no relationship to ED, and a bi-factor model in which ED is measured as a general factor capturing the majority of the variance alongside separate subscales. The best fitting model was then used to conduct an EFA in which the factors were allowed to load freely.

Results: Results of the CFA indicated that a bi-factor model which includes a general factor of ED and three specific factors of AD, AGG, and AP provided the best overall fit (RMSEA=0.06; SRMR=0.06; CFI=0.08). Results of the EFA revealed that most items loaded onto the ED factor. However, most items from the AD subscale loaded only on the ED factor, while items from the AGG subscale loaded on both the AGG and the ED factors. Although two items from the AP subscale loaded on the ED factor, most items loaded only on the AP factor. One AP item did not load on any factor.

Conclusions: The bi-factor structure of the Dysregulation Profile mirrors findings in non-ASD youth, supporting the validity of this measure in the assessment of ED in ASD youth. Per the results of the EFA, anxiety/depression items were explained almost completely by ED, suggesting that these symptoms may be ubiquitous to ED in the ASD population. Aggressive behaviors appear related to ED but also have independent associations apart from this construct. Although some attention problems are related to ED, many appear to exist independently from ED. These findings support current understanding of ED as a common factor underlying both internalizing and externalizing symptoms but suggest that ED does not contribute to some aspects of attention dysregulation.

164 **129.164** Molecular Characterization of Right-Sided Colonic Hypomotility in GI Symptomatic Children with ASD

S. J. Walker[1]*, C. D. Langefeld*[2]*, K. D. Zimmerman*[2] *and A. Krigsman*[3]*, (1)Wake Forest University Health Sciences, Winston Salem, NC, (2)Department of Biostatistical Sciences, Division of Public Health Sciences, Wake Forest University Health Sciences, Winston Salem, NC, (3)Pediatric Gastroenterology Resources of New York and Texas, Austin, TX*

Background: Constipation is a common and clinically heterogeneous finding in GI-symptomatic children with autistic spectrum disorder (ASD). One recurrent pattern we have observed in children with constipation as their primary gastrointestinal (GI) symptom is fecal loading ("soft stool constipation"), most prominent in the cecum and ascending colon. Regarding this pattern, a divergent clinical course suggests two distinct clinical subtypes characterized as: (1) following the initial colonic cleanout, a continued state of symptomatic remission while on maintenance anti-inflammatory therapy [*acute*] or, (2) recurrent right-sided fecal loading requiring regular colon cleanouts [*chronic*]. These observations raise the possibility of a localized dysmotility within the cecum and ascending colon which may contribute to the underlying etiology of constipation in children with ASD.

Objectives: The goal of this study was to compare gene expression in the right (ascending) colon from two groups of GI-symptomatic children with ASD and constipation (acute versus chronic fecal loading). We hypothesize that molecular examination of mucosal biopsy tissue from affected regions of the colon can provide mechanistic insights regarding transient versus chronic right-sided colonic hypomotility in the setting of enterocolitis in children with ASD.

Methods: RNASeq was used to measure the transcriptome in mucosal biopsy samples that had been collected from the ascending colon during elective colonoscopy in GI-symptomatic children with ASD. The children were all diagnosed with enterocolitis and had, as one of their presenting symptoms, constipation with right sided fecal loading (confirmed by abdominal x-ray). Gene expression in tissue from patients who, following an initial colon clean out, continued in a state of remission (acute; "controls") was compared to gene expression in the second group who continued to require regular colon clean outs (chronic; "cases").

Results: Hierarchical clustering of colonic gene expression profiles from all cases and controls initially revealed three clusters consisting of: 12 cases (cluster 1), 9 cases + 1 control (cluster 2) and, a mixture of the other 13 cases and controls (cluster 3). Analysis of differential gene expression between *all* cases (20) versus *all* controls (15) resulted in no transcripts that reached statistical significance. Gene expression profiles comparing only cases in the first cluster (N=12) and controls in the second cluster (N=9), 441 transcripts found to be significantly differentially expressed. The molecular pathways that were over-represented in this gene set are involved in host inflammatory response (e.g. granulocyte adhesion and diapedesis, T and B cell signaling, and communication between innate and adaptive immune cells). The top molecular and cellular functions that were found to differ between those with acute versus chronic dysmotility relate cell-to-cell signaling and interaction, cellular movement, and cellular growth and proliferation.

Conclusions: This initial comparison of gene expression profiles in the ascending colon from a subset of patients with ASD and chronic versus acute constipation (right-sided colonic hypomotility) revealed a down regulation of hundreds of transcripts that are involved in cell-to-cell communication and cellular growth and proliferation. These findings are suggestive of a coordinate down regulation of genes that may be necessary for normal cellular function in the lower gastrointestinal tract.

165 **129.165** Monitoring the Safety of Second Generation Antipsychotics in Children and Adolescents with Autism Spectrum Disorder

J. H. Filliter[1], *M. Kerr*[2], *S. Shea*[1], *I. M. Smith*[1], *J. MacCuspie*[1], *A. Hawkins*[1] *and T. Fraboni*[1], *(1)IWK Health Centre / Dalhousie University, Halifax, NS, Canada, (2)Dalhousie University, Halifax, NS, Canada*

Background: Approximately 17.5% of youth with autism spectrum disorder (ASD) are being treated with second-generation antipsychotics (SGAs; Park et al., 2016). While SGAs have been found to reduce irritability and associated behaviours (e.g., aggression and self-injury) in youth with ASD, a range of side effects (e.g., sedation, weight gain, extrapyramidal symptoms, and metabolic changes) has been reported. Therefore, careful monitoring of youth taking these medications is imperative. However, as the core and associated symptoms of ASD can make medical procedures challenging, monitoring the safety of SGAs may be particularly difficult in this population. The potential for undetected SGA side effects is a significant concern, given rates of SGA prescription to youth with ASD. To date, no investigations have been published describing how closely physicians monitor SGA side effects in youth with ASD or the barriers that they face in doing so.
Objectives: To begin to understand physicians' current practices in SGA monitoring and the challenges of monitoring SGAs in youth with ASD.

Methods: We designed an online questionnaire that was completed by 31 specialist physicians (General Pediatricians, Developmental Pediatricians, Psychiatrists, and Neurologists) serving children and adolescents with ASD in one region of Canada. Our survey examined physicians' reports of ordering vs. completion of monitoring tasks recommended by the Canadian Alliance for Monitoring Effectiveness and Safety of Antipsychotic Medications in Children, as well as their perceptions of factors relevant to SGA safety monitoring in youth with ASD.

Results: Of the monitoring tasks queried, physicians were most likely to measure height, weight, and blood pressure at baseline and as part of ongoing follow-up (>75% attempted these tasks 76-100% of the time). Waist circumference measurements and electrocardiograms (ECGs) were the monitoring tasks least often carried out at both time points (>50% attempted/ordered these tasks 0-25% of the time). Fasting and non-fasting bloodwork were frequently not ordered at baseline (>45% ordered these tasks 0-25% of the time), but were somewhat more likely to be ordered at follow-up. Neurological exams were attempted 76-100% of the time by 68% of physicians at baseline and 48% of physicians at follow-up. As expected, physicians indicated that ECG and fasting and non-fasting bloodwork were the procedures that youth with ASD have the most difficulty completing successfully. When asked their perspectives on child, family, physician, and other/system factors that impede completion of these procedures, physicians identified youth distress, activity level, and refusal, as well as family anticipatory anxiety, previous failed attempts, and competing commitments, as the most significant barriers.

Conclusions: Given rates of prescription of SGAs to youth with ASD and the side effects associated with these medications, careful monitoring is necessary. However, our results indicate inconsistent physician practices in ordering/completing various monitoring tasks at baseline and follow-up. Further, our findings suggest that many youth with ASD struggle to complete successfully the medical procedures required for thorough SGA monitoring. Additional research is indicated aimed at supporting physicians in their monitoring of SGAs and youth with ASD and their families in successfully completing associated monitoring tasks.

166 **129.166** Parent-Rated Anxiety Symptoms in Youth with ASD and Their Association with Problem Behaviors in an Inpatient Setting

R. Mahajan[1], *H. Nichols*[1], *B. Troen*[1] *and C. A. Mazefsky*[2], *(1)Sheppard Pratt Health System, Towson, MD, (2)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background:
Youth with autism spectrum disorder (ASD) are frequently diagnosed with anxiety disorders, which may have a significant negative impact on their functioning; these symptoms may also impede their development and learning. Furthermore, severe problem behaviors (PB; aggression, disruptive and self-injurious behaviors, SIB) in these youth, may require inpatient hospitalization for safety and stabilization. Due to their internalizing nature, anxiety symptoms may be overlooked by clinicians in contrast to externalizing behaviors. Even though anxiety disorders are among the most prevalent co-occurring psychiatric conditions in these youth, little is known about anxiety symptoms' potential impact upon PB, in youth with ASD needing inpatient treatment.

Objectives:

This study aims to characterize parent-rated anxiety symptoms in youth with ASD in an inpatient setting, by examining the relationship between parent-rated anxiety symptoms, externalizing behaviors, and SIB.

Methods:

Participants were 282 youth (78% male) ages 5-20 years (mean age 12.9 years; SD ±3.2), with ADOS-confirmed ASD, enrolled through the Autism Inpatient Collection (AIC), a multisite study of youth with ASD hospitalized on 6 specialized inpatient psychiatric units across the U. S. Data were collected from parents on the youth's, communication, externalizing behaviors, emotion regulation, and SIB. Child and Adolescent Symptom Inventory (CASI-5) was used for parent-reported psychiatric symptoms including anxiety. Using previous research, 20 items from the original CASI-5 anxiety items were selected for analyses. Hierarchical linear regression and independent samples t-tests were used to determine the relationship between anxiety symptoms, externalizing behaviors, and self-injurious behaviors.

Results:

Prevalence of anxiety disorders was as follows: simple phobia (65%), generalized anxiety disorder (38%), somatization disorder (30%), panic disorder (28%), separation anxiety (21%), and social phobia (18%). Mean scores for externalizing behaviors were significantly higher for youth who met criteria for panic disorder ($p < .001$) and somatization disorder ($p = .003$). Mean scores for SIB were significantly higher for youth who met criteria for simple phobia ($p = .005$), social phobia ($p = .031$), and separation anxiety ($p = .005$). Separate regression models for each type of anxiety were conducted based on significant bivariate results and controlled for age, gender, race, income, and verbal ability. Both panic and somatization disorders were no longer significantly related to externalizing behaviors, after control variables were added. Simple phobia (b = .98, $t(233) = 2.85$, $p = .005$), social phobia (b = .40, $t(240) = 2.08$, $p = .039$), and separation anxiety (b = .30, $t(240) = 3.96$, $p < .001$), remained significant in their respective models predicting SIB.

Conclusions:

Youth with ASD requiring inpatient stabilization for problem behavior may also experience significant anxiety symptoms. Presence of externalizing behaviors or SIB should prompt an assessment of specific anxiety disorders. Future research should explore whether anxiety is driving or maintaining problem behaviors.

167 **129.167** Parental Anxiety and Family Functioning: A Comparison between Children with ASD and Comorbid Anxiety Disorders, Children with Anxiety Disorders, and Typically Developing Children

F. van Steensel[1] *and S. M. Bögels*[2]*, (1)University of Amsterdam, Amsterdam, Netherlands, (2)Research Institute of Child Development and Education, University of Amsterdam, Amsterdam, Netherlands*

Background: Anxiety disorders in children with ASD are commonly observed. It is however less clear which factors are related to the anxiety presentation in children with ASD. To date, little consideration is given to the association between anxiety and family factors (like parental anxiety and family functioning – which have found to be associated with child anxiety in typically developing and clinical samples using children with anxiety disorders).

Objectives: This study's aim was to examine parents' anxiety and the family functioning.

Methods: Families of children with (1) Autism Spectrum Disorder and anxiety disorders (ASD+AD; N = 80), (2) anxiety disorders (AD; N = 108) and (3) typically developing children (controls; N = 90) completed questionnaires.

Results: Parents' odds of having clinical anxiety levels was 3.5 times higher when their child had AD, and fathers' risk was further increased when their child also had ASD. AD was associated with lower family relationship scores and ASD further lowered this score, while only ASD was associated with elevated family system maintenance scores.

Conclusions: The findings suggest that having a child with (ASD+)AD co-occurs with parental health and family functioning problems, but the direction of this relationship remains to be examined.

168 **129.168** Possible Factors Associated with High Prevalence of Overweight and Obesity in Toddlers with Autistic Spectrum Disorder

O. E. Stolar[1]*, R. Ben-Zeev*[2]*, E. Gal*[3] *and T. Sinai*[4]*, (1)Autism Center, Assaf Harofeh Medical Center, zerifin, Israel, (2)School of Nutritional Sciences, The Hebrew University, Jerusalem., Israel, (3)Department of Occupational Therapy, University of Haifa, Haifa, Israel, (4)School of Nutritional Sciences, The Hebrew University, Jerusalem, Israel*

Background:

Autism spectrum disorder (ASD) is characterized by persistent deficits in social communication and social interaction along with restricted and repetitive behaviors. In addition, abnormal sensory processing and difficulties with oral motor skills are more common in children with ASD. These challenges, play an important role in eating patterns and dietary consumption. Food aversion/refusal or food selectivity is common. These feeding difficulties, may lead to inadequate nutritional intake and impaired growth parameters in children.

Objectives:

This study examined the incidence of overweight and obesity among toddlers diagnosed with ASD, and its relation to demographic and clinical parameters, as well as the severity of the core symptoms.

Methods:

Toddlers 1-3 years of age, with ASD who were enrolled in the 2015 or 2016 school year –in one of 11 different Early Intervention Day Care Centers (EIDCC) participated in the study. All of the toddlers were diagnosed with ASD based on DSM - 5 criteria. Demographic, parental and clinical data were collected. Weight and Height were measured and age and gender specific z-scores were determined according to the World Health Organization (WHO) child growth standards. Social and communication performance was evaluated using the Social Communication Questionnaire (SCQ). Exclusion criteria included genetic syndromes, chronic diseases and endocrine abnormalities. Statistical analyses were performed utilizing SPSS.

Results:

The study participants (n=142) included 98 males (69%), and 44 females (31%), aged 2.5±0.4 years. Of prenatal data that were available from 118-122 participants, 18 (15.3%) were born after IVF treatment and 51 (42.9%%) by Caesarean section, 15 (12.7%) are one of twins. Higher incidence of birth weight classified as large for gestational age (LGA) was noted (n=27): 22.3% versus 10%, as expected when compared to the general population ($p<0.05$). Total SCQ score ranged from 5 to 32 (n=133). Height – z scores corresponded to international averages with mean of -0.06±1.34 versus 0, $p>0.05$. In contrast, significantly increased BMI-z scores were found : 0.65±1.21 versus 0, $p<0.05$. Fifty- two participants had BMI z sore >1 SD and classified as overweight (13.4%) or obese (23.2%), while only one toddler presented underweight. In order to find which parameters may be related to overweight/obesity, comparisons were made between those with high z-scores versus those with normal BMI (n=89). No statistical differences were noted in age, gender distribution, height-z scores, parent's age and education, any of the prenatal and perinatal factors, nor SCQ scores ($p>0.05$).

Conclusions:

Our results from a multi-center sample of toddlers with ASD, suggest that there is an elevated risk for unhealthy weight status, which presents at a very young age. Since no associations were found with ASD symptoms severity, perinatal history or demographic parameters, it may be concluded that the tendency to obesity is related to eating habits and possibly low physical activity. This study emphasizes the importance of increasing awareness and providing education for caregivers and developing intervention strategies to prevent early – onset obesity that has known deleterious consequences on health over the lifespan.

169 **129.169** Predicting Aggression Onset in Minimally-Verbal Youth with Autism Spectrum Disorder Using Preceding Physiological Signals

***M. S. Goodwin**[1], C. Cumpanasoiu[1], A. Stedman[2], C. Peura[2], O. Ozdenizci[1], P. Tian[1], Y. Guo[1], S. Ioannidis[1], D. Erdogmus[1], C. A. Mazefsky[3] and M. Siegel[4], (1)Northeastern University, Boston, MA, (2)Spring Harbor Hospital, Westbrook, ME, (3)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (4)Maine Medical Center - Tufts School of Medicine, Westbrook, ME*

Background: Unpredictable and potentially dangerous aggressive behavior by youth with autism spectrum disorder (ASD) isolates them from foundational educational, social, and familial activities, thereby markedly exacerbating the morbidity and costs associated with the condition. As many as 2/3 of youth with ASD display aggression, which is one of the primary reasons they use behavioral healthcare services. Aggression presents imminent safety risks for the individual and others in the environment. Families report that aggression increases their stress, isolation, and financial burden, and decreases available support options. Aggression to others is particularly impairing and treatment refractory in the 30-40% of youth with ASD who are minimally verbal (MV-ASD). Their inability to self-report distress can lead to behaviors that seem to occur without warning, sometimes long after any observable trigger.

Objectives: Aggression to others may represent a maladaptive attempt to express or modulate physiological arousal arising from distress. Thus, we hypothesize that physiological arousal precedes aggressive behavior. Our objective is to test whether the proximal onset of aggression can be predicted from preceding physiological signals.

Methods: In this IRB approved study, we collected physiological data from the wrist using the commercially available E4 by Empatica, Inc. that wirelessly measures heart rate, heart rate variability, electrodermal activity, skin temperature, and physical motion from 20 MV-ASD inpatient youth. E4 signal parameters were derived using time-series statistics in a past interval of time (t_p). Ridge-regularized logistic regression models were used for binary decision making for aggression onset in an upcoming time interval (t_f) using temporal (time elapsed since last observed aggression) and E4 signals. Model prediction performance was calculated using 5-fold cross-validation. For all binary prediction models, receiver operator characteristic (ROC) curves and their corresponding area under the curve (AUC) values were calculated to represent accuracy based on true (sensitivity)/false (1-specificity) positive rates. Classification of varying values of t_p and t_f was assessed using both global (a single classifier consisting of concatenated time-series data across all sessions and participants) and person-dependent (data only pooled across sessions within person) models.

Results: All participants tolerated the E4 after desensitization and usable data was obtained in all cases. Sixty-nine independent naturalistic observational sessions were collected, totaling 87hrs. Out of 548 total aggressions observed with concurrent E4 data, our results [Fig 1] demonstrate that, on average, models with all signals included (i.e., time since last aggression and E4 signals) predict the onset of aggression 1min before it occurs using 3min of prior data with 0.71 AUC for global and 0.84 AUC for person-dependent models.

Conclusions: By linking observable aggressive behavior to preceding physiological signals in MV-ASD, we move the field of problem behavior assessment towards a new biologically-based, data-informed approach that is focused on prospective monitoring, prevention, and eventually real-time intervention, addressing a historically intractable problem for a segment of the ASD population who is arguably the most in need of innovative approaches.

170 **129.170** Relations between Executive Function and Sleep in ASD Children with Comorbid ADHD Symptoms

***A. M. Cremone-Caira**[1], J. Buirkle[2], K. Trier[2], R. Gilbert[2] and S. Faja[2], (1)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (2)Boston Children's Hospital, Boston, MA*

Background: Approximately 50% of children with ASD have concurrent symptoms of ADHD (Rommelse et al., 2010). Alongside the hallmark symptoms of these disorders, children with ASD and ADHD commonly have executive function (EF) deficits and sleep disturbances (Corbett et al., 2009; Thomas et al., 2015). Whether sleep or EF predict comorbidity of ADHD symptoms in ASD is unknown. Understanding factors that contribute to, or exacerbate, comorbidity may improve interventions and clinical outcomes in these populations.

Objectives: To determine whether EF and sleep disturbances predict comorbid ADHD symptoms in children with ASD.

Methods: Caregivers of 108 children with ASD (17 females; M_{age}=9.13±1.38 years) completed the BRIEF (*n*=103) and Children's Sleep Habits Questionnaire (CSHQ; *n*=99) to gauge EF and sleep. The Total CSHQ Score was used to index global sleep disturbance and differentiate children with (*n*=64) and without (*n*=35) clinically significant levels of sleep problems (Total CSHQ Score >41; Owens, Spirito, & McGuinn, 2000). The ADHD subscale of the CBCL was used to assess comorbid ADHD symptoms (*n*=103). Higher scores on these measures reflect greater impairment in functioning.

Results: BRIEF Index Scores and ADHD symptoms did not differ between children with and without clinically significant sleep problems (*p's*^{3}0.210). BRIEF outcomes were positively correlated with ADHD symptoms in both groups (*r's*^{3}0.270, *p's*£0.046). In a linear regression model, greater deficits on the BRIEF Metacognitive Index (*β*=0.419, *p*=0.001) and greater Total CSHQ Scores (*β*=0.214, *p*=0.060) were independently associated with increased ADHD symptoms among children with clinical sleep problems. Total CSHQ Scores did not predict ADHD symptoms in the group of children without clinical sleep problems (*β*=-0.024, *p*=0.881). Among children with clinical sleep problems, follow-up analysis of subscales included in the Metacognitive Index indicated that more problems with Working Memory (WM) were associated with increased ADHD symptoms (*β*=0.550, *p*£0.001). Total CSHQ Score was also significantly related to increased ADHD symptoms (*β*=0.228, *p*=0.028) in this model. However, WM and Total CSHQ did not interact to predict additional variance in ADHD symptoms (*β*=0.096, *p*=0.437).

Conclusions: Preliminary analyses indicate that children with ASD who have EF deficits and clinically significant sleep problems are more likely to have ADHD symptoms than children without sleep problems. These findings are consistent with work suggesting that both EF deficits and poor sleep contribute to comorbid neurodevelopmental disorders. Previous literature indicates that poor sleep is related to WM deficits in typically developing children (Steenari et al., 2003). As WM is impaired in ASD and ADHD (Andersen et al., 2015), the results of the current study suggest that targeting sleep may improve WM and, consequently, improve clinical outcomes in children with comorbid diagnoses. Importantly, however, WM and Total CSHQ Score did not interact to predict comorbid ADHD symptoms in this sample, suggesting that EF and sleep act through independent mechanisms to increase vulnerability for comorbidity. Future analyses will evaluate the role of specific sleep deficits (CSHQ subscales) and objective measures of EF in predicting comorbid outcomes.

171 **129.171** Repetitive Behaviors in Autism Spectrum Disorder: Associations with Internalizing Symptoms

***D. Swain**[1], A. Muskett[1], N. N. Capriola[2], A. Scarpa[3] and A. V. Dahiya-Singh[4], (1)Virginia Polytechnic Institute and State University, Blacksburg, VA, (2)Psychology, The University of Alabama, Tuscaloosa, AL, (3)Virginia Polytechnic Institute & State University, Blacksburg, VA, (4)Virginia Tech,* *Blacksburg, VA*

Background: Youth with Autism Spectrum Disorder (ASD) receive diagnoses of depression and anxiety at higher rates than typically developing children (Kim et al., 2000). Despite the high prevalence of internalizing problems among youth with ASD, little research has examined how depression and anxiety might be associated with core ASD features, such as Restricted and Repetitive Behaviors (RRBs). Although many theories have been posited, it is unclear exactly why children with ASD engage in RRBs. One common theory suggests that RRBs serve the purpose of assisting children with ASD in emotion regulation (Samson, Phillips, Parker, Gross, & Hardan, 2014). Within the context of this theory, it would be expected that RRBs would increase during intense emotional experiences such as depression and anxiety.

Objectives: The goal of the current study was to examine potential behavioral markers of depression and anxiety in terms of RRBs. We hypothesized that youth with clinically significant depressive and anxiety symptoms would be demonstrate greater RRBs relative to youth with sub-clinical levels of internalizing symptoms.

Methods: Participants included children ages three to seventeen years ($M = 7.25$, $SD = 3.85$). The children and adolescents were predominantly male (82.46%) and Caucasian (87.72%). Parents completed a series of measures including the Child Behavior Checklist (CBCL; Achenbach, 1991) and Repetitive Behavior Scale-Revised (RBS-R; Bodfish, Symons, & Lewis, 1999). The affective and anxiety subscales of the CBCL and all subscales of the RBS-R were used for the current analyses.

The institutional review board for human subject research approved the larger study (i.e. assessment database). Two Multivariate Analysis of Variances (MANOVA) were conducted to examine group status (i.e., ASD+/-Depression and ASD+/-Anxiety) as the independent variable and the six RBS-R sub-scale scores as dependent variables.

Results: The multivariate results demonstrated significant findings for group status comparing ASD+D to ASD-D as well as ASD+A to ASD-A. For comparisons in co-morbid depression, Univariate *F*-tests indicated a significant difference between the groups for Self-Injurious Behavior, $F(1,43) = 19.56$, $p = .001$, Compulsive Behavior, $F(1,43) = 9.71$, $p = .003$, and Sameness Behavior, $F(1,43) = 5.91$, $p = .02$. Additionally, for anxiety groups, significant difference between the ASD plus high anxiety and ASD low anxiety groups for Self-Injurious Behavior, $F(1,43) = 8.7$, $p = .01$, Compulsive Behavior, $F(1,43) = 16.43$, $p < .01$, Ritualistic Behavior $F(1,43) = 8.79$, $p = .01$, and Sameness Behavior, $F(1,43) = 12.88$, $p < .01$.

Conclusions: The presence of clinically elevated levels of co-occurring depression and anxiety in youth with ASD, when compared to individuals with ASD and sub-clinical internalizing symptoms, reveals significant differences in parent report of observable core ASD symptomology. It is unclear, however, whether depression and anxiety lead to increases in RRBs or more severe ASD symptomology leads to increased anxiety and depression.

172 **129.172** Similarity of Citizen-Science American Gut Project to Published ASD Studies on Gut Microbiota

C. Holingue[1], *N. Nueller*[2] *and M. D. Fallin*[1], *(1)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

Background:

The gut microbiome has been hypothesized to play a role in gastrointestinal and behavioral symptoms in autism spectrum disorder (ASD). Existing studies have sought to identify differentially methylated taxa between ASD and non-ASD samples, but are limited in sample size. The recently established “American Gut Project” (AGP) is a “citizen science” approach that invites participation from the general public, and includes some individuals with self-reported ASD.

Objectives:

In this study we analyzed publically available microbiota data among participants of the AGP who self-reported ASD, and pursued a descriptive comparison of these profiles to published microbiome profiles from non-crowd sourced ASD-specific studies. This provides important information about the potential utility of AGP for gut studies of ASD.

Methods:

We included 33 AGP participants who completed a fecal sample as well as reported having ASD [diagnosed by a medical professional, by an alternative medicine practitioner, or being self-diagnosed]. Fecal samples were collected at home using a swab. Samples were processed according to the 16s Illumina Amplicon Protocol, targeting the V4 region of the 16s small ribosomal subunits rRNA. Closed-reference OTU picking was used, according to 97% similarity with the Greengenes database. The top 10 phyla, classes, orders, families, genera, and species were summarized across the ASD sample. We descriptively compared AGP taxa to taxa from a sample of 20 children with ASD published by Son et al., PLoS One 2015, and to a sample of 66 children with ASD from the Simons Simplex Community, published by Kang et al., PLoS One 2013.

Results:

All taxa identified in the AGP ASD sample belonged to the Bacteria or Archaea kingdom. The top 10 phyla were Firmicutes, Bacteroidetes, Proteobacteria, Actinobacteria, Verrucomicrobia, Tenericutes, Euryarchaeota, Synergistetes, Cyanobacteria, and Fusobacteria. The top 10 genera were Bacteroides, Prevotella, Faecalibacterium, Ruminococcus, Blautia, Coprococcus, Parabacteroides, Akkermansia, Roseburia, and Dialister. The top 10 species were copri, prausnitzii, muciniphila, fragilis, bromii, distasonis, faecis, adolescentis, oxytoca, and uniformis. These findings are consistent with existing published studies that found that Firmicutes, Bacteroidetes, Actinobacteria, Proteobacteria, and Verrucomicrobia tend to be the top 5 phyla in ASD samples. The top genera were also consistent with published studies, with the exception of genera Subdoligranulum, which has previously been reported as a top 5 genera in ASD, but was not observed in the AGP sample.

Conclusions:

The top phyla and genera from the citizen science-based American Gut Project ASD samples are largely consistent with published rankings based on ASD-specific datasets. This suggests that crowdsourcing may be a useful approach to sampling gut microbiome data that is representative of ASD populations, although larger samples are still needed to confirm this.

173 **129.173** Sleep As a Predictor of Emotional and Behavioral Presentation in Children with Autism Spectrum Disorder (ASD) at Discharge from Specialized Psychiatric Inpatient Units

B. J. Taylor[1], *C. A. Mazefsky*[2], *K. Pedersen*[3] *and M. Siegel*[4], *(1)Psychiatry, Maine Medical Center Research Institute, Portland, ME, (2)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (3)Department of Psychiatry, Maine Medical Center, Portland, ME, (4)Maine*

Medical Center - Tufts School of Medicine, Westbrook, ME

Background:

Children with Autism Spectrum Disorder (ASD) are disproportionately hospitalized for psychiatric treatment. Converging evidence suggests that sleep disturbances are associated with compromised emotional and behavioral health in children with ASD; however, the role of sleep in psychiatric inpatient treatment is largely unknown. Moreover, published studies examining sleep in relation to externalizing symptoms in children with ASD have relied on parent-report questionnaires of sleep which may be biased by the extent to which parent sleep is disturbed. Finally, inpatient psychiatric hospital settings, characterized by stimulus control, highly structured daily routines and low-distraction sleep environments, provide a unique opportunity to examine sleep in relation to clinical outcomes in the context of good sleep hygiene.

Objectives:

The goal of the current study was to examine observed sleep during psychiatric hospitalization as a predictor of parent-reported improvement in irritability, hyperactivity, and emotion regulation in children with ASD at discharge.

Methods:

Total Sleep Time (TST), number of arousals from sleep (NUMA), and minutes of wakefulness after sleep onset (WASO) were observed in 158 children with ASD (confirmed by research-reliable ADOS-2) between the ages of 4 and 20 (mean = 12.7 ± 3.3) across six inpatient units, drawn from the Autism Inpatient Collection (AIC). Nightly TST, NUMA, and WASO were measured observationally by hospital staff in 15 minute increments. Multiple regression models tested average TST, NUMA, and WASO as predictors of parent-reported irritability, hyperactivity, and emotion dysregulation at discharge, controlling for parent-reports at admission. All analyses were further adjusted for study site, length of hospital stay, and use of medications for sleep, antidepressants/anxiolytics, antipsychotics, and stimulants. Exploratory analyses examined if relationships between sleep and clinical improvement varied by psychiatric co-morbidity.

Results:

Irritability, hyperactivity, and emotion dysregulation all significantly improved from admission to discharge (t-statistics were 13.60, 11.09, and 14.47, respectively, p-values <.001). Average TST was 9 hours and 24 minutes ± 63.3 minutes, average NUMA was 0.39 ± 0.37, and average WASO was 19.51 ± 20.39 minutes. Indices of sleep did not vary by co-morbid psychiatric diagnosis. Greater average WASO during hospital stay predicted higher hyperactivity at discharge, controlling for hyperactivity at admission and covariates (β = .161, p = .034). Greater average NUMA predicted greater emotion dysregulation at discharge controlling for emotion dysregulation at admission and covariates (β = .196, p = .014). There were no main effects of TST on clinical outcomes; however, for those with a co-morbid anxiety disorder, shorter TST predicted greater emotion dysregulation at discharge in fully adjusted models (β = .462, p = .003). No index of sleep predicted irritability at discharge.

Conclusions:

Results of the current study suggest that sleep may be an under-examined predictor of clinical improvement in children with ASD hospitalized for psychiatric treatment. Given that the inpatient environment is consistent with many sleep hygiene recommendations, underlying mechanisms, such as autonomic dysregulation, may account for the relationship between nocturnal arousals, hyperactivity, emotion dysregulation, and anxiety. Future studies using objective measures of sleep (e.g., actigraphy) are needed to further examine the interrelationships of sleep and externalizing symptoms.

174 **129.174** Social Communication and Repetitive Behaviours in Gender Dysphoric Children: Exploring the Specificity of Autistic Traits

J. H. Leef[1,2]*, J. A. Brian*[3]*, D. P. VanderLaan*[4]*, H. Wood*[5] *and K. J. Zucker*[6]*, (1)Autism Research Centre, Bloorview Research Institute, Toronto, ON, Canada, (2)Department of Applied Psychology and Human Development, University of Toronto & Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (4)Department of Psychology, University of Toronto at Mississauga, Mississauga, ON, Canada, (5)Toronto District School Board, Toronto, ON, Canada, (6)Department of Psychiatry, University of Toronto, Toronto, ON, Canada*

Background: Gender dysphoria (GD) is characterized by distress due to incongruence between assigned gender and experienced/expressed gender (APA, 2013). Evidence suggests a higher-than-expected co-occurrence of GD and autism spectrum disorder (ASD) in children, adolescents and adults (vanderMiesen, et al., 2015). The GD-ASD link has been explored in samples of children with GD (de Vries, et al., 2010; VanderLaan, et al., 2015) and in those with ASD (Strang, et al., 2014). However, studies of GD children have not explored whether ASD traits found in these samples are specific to GD, or whether these traits are also found in children referred for other psychiatric/psychological concerns.

Objectives: To explore whether traits of ASD are elevated in gender dysphoric children relative to children clinically referred for other concerns.

Methods: Data collected from two groups were analyzed. The GD group included 51 children (aged 4-12 years) referred to a specialized Gender Identity Service (males=38). The comparison (clinical control; CC) group included 39 age- and sex-matched children (males=27) referred to the same psychiatric hospital as the GD group for concerns *other* than GD or ASD (e.g., mood/anxiety).

The study analyzed parent reports on two ASD-specific measures—the Social Communication Questionnaire (SCQ) and the Social Responsiveness Scale (SRS).

Results: ANOVA (controlling for age) revealed a significant group effect for SCQ total score (*F*=7.97, *p*=.006, η_p^2=.084), with significantly higher scores in the GD (mean=6.71, SD=4.85) than the CC group (mean=4.72, *SD*=3.25). Based on the a priori hypothesis of an association between GD and perseverative/intense interests, we explored SCQ item #24 specifically. Chi^2 analysis revealed a significant association (X^2=5.73, p=.026), with 30.4% of the GD group endorsing this symptom (versus 8.6% of the CC group). ANOVA failed to find a group effect for SRS Total T-scores (p=.38). Further examination of SRS domains revealed a group by sex interaction for Social Cognition T-Score (F=4.89, p=.03, η_p^2=.045), and sex main effects for Social Awareness, Social Communication, Social Motivation, and Autistic Mannerisms (all p's ≤ .002). In all domains natal females' mean T-scores were above 60.

Conclusions: Preliminary findings corroborate our hypothesis that symptoms of ASD are more common in children with GD than those referred for other concerns, with a medium effect size (SCQ; Field, 2013). Furthermore, the symptom of perseverative/intense interests was endorsed more frequently (30.4%) for GD children than CC children (8.6%)—consistent with recent findings of intense/obsessional interests in GD children (Zucker, et al., 2017). Further exploration of similar items on the SCQ and SRS will be conducted. The failure to find significant group differences on the SRS Total Score may be due to low power, given our sample size. Natal females tended to have SRS T-scores in the Mild-to-Moderate range (T-score ≥

60), suggesting they have more severe social-communication deficits than natal males seeking psychiatric/psychological services. Perhaps this parallels the emerging shifts in the male:female ratios reported in both GD (Aiken, et al., 2015) and ASD literatures (Lai, et al., 2015). Further analyses will account for other demographic characteristics, referral questions and degree of gender nonconformity.

175 **129.175** Stability and Persistence of Emotional and Behavioural Problems in Children with ASD

S. Chandler[1]*, G. Baird*[2]*, T. Charman*[3] *and E. Simonoff*[1]*, (1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

High rates of co-occurring psychiatric disorders have been reported in older children, adolescents and adults with autism spectrum disorder (ASD). Recent studies have also shown high rates of emotional and behavioural problems (EBPs) in younger children with ASD. Early identification of comorbid problems is crucial in the management of ASD, especially given that the impact of many of these problems can often be reduced using evidence-based interventions. Psychiatric problems have been shown to persist in older children with ASD, but far less is known about the stability of EBPs in young children with ASD.

Objectives:

To assess the stability of IQ, ASD symptoms, and EBPs across approximately seven years, from early childhood to late childhood/adolescence in a community sample of children with ASD.

Methods:

All children born between 01/09/2000 and 01/09/2004, with a diagnosis of ASD, living in two London boroughs (n=447) were invited into the study. Parents were asked to complete the Developmental Behaviour Checklist (DBC) and the Social Communication Questionnaire (SCQ) at two time-points: when the children were aged 4- to 9-years-old (time 1); and again when the children were aged 11- to 15-years-old (time 2). IQ was assessed for all participating children at time 1, and for a subset at time 2. Paired t-tests were used to examine differences between scores at times 1 and 2. Children with persisting EBPs were defined as those who met the DBC clinical cut-off at times 1 and 2. Logistic regression was used to test whether any individual or background factors were associated with persisting EBPs. Individual factors examined were: IQ, autism severity (as measured by the SCQ) and EBPs (as measured by DBC total) at time 1; age; and sex. Background factors included: parental education and employment.

Results:

277 families participated at time 1 (child mean age = 6.8 years). Of these, 211 (76%) participated in the follow-up at time 2 (child mean age = 13.5 years). While there was no significant difference in IQ scores at time 1 and time 2 (p=.240), there was a significant decrease over time in both SCQ and DBC totals (p<.001 for both); the same was true for each of the DBC subscales (all p<. 05).

Despite an overall reduction in total scores, almost two thirds (62%) of children who reached the DBC cut-off at time 1 remained above cut-off at time 2. Persisting EBPs were associated with higher SCQ scores at time 1 (p=.032), but not with IQ or DBC totals at time 1, age, gender, or parent education or employment (all p>.15).

Conclusions:

Within this community sample of children with ASD, levels of ASD symptomatology and EBPs were less stable than IQ, and showed an overall reduction in parent-reported symptoms over time. However, for many of those with marked EBPs, these problems persisted over time. Higher autism severity at time 1 was associated with persisting EBPs. The study findings highlight the need for early identification of co-existing EBPs in children with ASD, in order to enable timely intervention.

176 **129.176** The Association between Additional Emotional and Behavioural Problems in Children with ASD and Their Parents' Stress and Mental Health Problems: A Systematic Review and Meta-Analysis.

I. Yorke[1]*, P. White*[1]*, A. Weston*[2]*, M. Rafla*[3]*, T. Charman*[4] *and E. Simonoff*[1]*, (1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)University of Bath, Bath, United Kingdom, (3)King's College London, London, United Kingdom, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Children with Autism Spectrum Disorder (ASD) and their parents are at heightened risk for mental health difficulties. According to research in the general population, parents' and children's psychological health are reciprocally related, with parent mental health problems (MHP) being well-established risk factors for psychopathology in their children. Investigating this relationship in families of children with ASD may have important implications for the development of therapeutic interventions. Existing findings are variable, which may be due to differences in sampling, measurement, and the variety of other child and parent factors that are included as covariates. Despite progressing research, most studies are based on data collected at single time-points from parents reporting on both themselves and their child.

Objectives: The current research aimed to systematically identify, organise and summarise the existing research on the relationship between additional emotional and behavioural problems (EBPs) in children with ASD, and parenting stress (PS) and MHP in their parents.

Methods: We conducted a systematic search to identify published studies analysing the relationship between additional EBPs in children with ASD and either PS or MHP in their parents. Zero-order correlation coefficients, quantifying the magnitude of the associations at single time-points, were entered into a series of meta-analyses. Multiple regression-based analyses involving other factors at both single and multiple time points were reviewed and summarised narratively.

Results: Seventy-one studies met criteria for inclusion in the review and 53 of these provided correlation coefficients. Twelve studies included an analysis of the relationships of interest across time. Meta-analyses showed significant pooled correlation coefficients of moderate magnitude for the associations of child total EBPs, externalising and internalising with both parent PS and MHP (pooled r=.25-.43; see Table 1, Figure 1). Low to moderate between-study heterogeneity was also found in each analysis, except the EBP-PS analysis which showed high heterogeneity (I^2=70.84%). Sample characteristics, e.g. child age, did not significantly explain heterogeneity in any analysis. However, differences in PS measurement properties were found to account for 19.22% of between-study differences in the EBP-PS analysis (p=.03). In a separate planned analysis using data from studies which included an alternative informant for the child EBPs, the relationship between this and parent MHP was reduced but remained significant (pooled r=.21; p<.02). Narrative review of single time-point studies showed mixed evidence for unique associations between the child and parent factors of interest, depending on other factors accounted for. Longitudinal studies showed consistent evidence of earlier parent PS and MHP predicting later child EBP. Evidence for the reverse was less consistent, though more apparent in better-powered studies.

Conclusions: The literature to date shows robust association between additional EBPs in children with ASD and the PS and MHP of their parents. Although reduced when child EBPs are assessed by an alternative rater, the association remains significant, suggesting that the relationship cannot be entirely accounted for by shared rater effects. The association also maintains once certain other factors are accounted for. There is some evidence for bidirectional association between child and parent mental health over time.

177 **129.177** The Role of Anxiety in Looking Patterns Among Children with ASD: Results from the ABC-CT Feasibility Study

E. Hamo[1], *A. Naples*[1], *B. Lewis*[1], *K. Chawarska*[1], *R. Bernier*[2], *S. Jeste*[3], *C. A. Nelson*[4], *G. Dawson*[5], *S. J. Webb*[2], *M. Murias*[6], *F. Shic*[7], *C. Sugar*[3] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)University of California, Los Angeles, Los Angeles, CA, (4)Boston Children's Hospital, Boston, MA, (5)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (7)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Background:
Background: Previous literature reports high comorbidity rates of anxiety disorders in individuals with autism spectrum disorder (ASD). Up to 39.6% of those with ASD have at least one co-morbid anxiety disorder. Therefore, it is important to understand whether anxiety impacts responses to social stimuli, and whether this effect is different in clinical populations. Overall, exploring these relationships can help understand the influence of anxiety on ASD symptoms to inform research and intervention.

Objectives: To examine the relationship between anxiety and attention to social stimuli among children with and without ASD.

Methods: Data was collected across five sites from 26 typically developing (TD) children and 23 children with ASD between ages 4-11 (M=7.22, SD=2.20; 71% male) and their caregivers. Binocular eye-tracking data was collected at 500Hz using a SR Eyelink 1000 Plus. Participants were presented with six trials, each consisting of five images (face, phone, bird, car, scrambled face; matched in color and luminosity) presented in an array such that each was equidistant from the center of the screen. Percent looking at specific images was calculated as the number of valid gaze samples in a pre-defined region around the image content divided by the total number of onscreen gaze samples. Caregivers were asked to complete the *Behavior Assessment for Children, Third Edition (BASC-3)* and *Childhood and Adolescent Symptom Inventory, 5th Edition* (*CASI-5*). T-tests were conducted to identify differences between groups. Correlations were used to determine associations between anxiety symptoms, as measured by *T*-scores from the *BASC-3* Anxiety subscale and *CASI-5* Social Anxiety subscale, and percent of time attending to social information during the eye-tracking task.

Results: Children with ASD spent significantly less time looking at faces (M=.17, SD=.02) than TD children (M=.24, SD=.02) [$t(45)$=2.53, p=.02)]. Anxiety scores were significantly higher in children with ASD (M=52, SD=2.72) than in the TD group (M=44.08, SD=1.39) [$t(46)$=-2.72, p=.01)]. Higher anxiety symptoms in children with ASD was positively correlated with percent of time looking at non-social objects (r_s=.426, p=.048). In particular, a higher anxiety score was significantly associated with more time spent looking at the technical objects (r_s=.477, p=.02) among children with ASD. Social anxiety was not significantly related to time looking at social or non-social images among children with ASD. No significant relationships between anxiety and looking patterns were found among TD children.

Conclusions: Results reveal a relationship between anxiety symptomology in children with ASD and preferential looking patterns toward non-social stimuli. Social anxiety was not associated with looking patterns, suggesting that the results are not attributed to specific anxiety toward social stimuli. Neither relationship was found in the TD group; however, clinically significant levels of anxiety were exclusionary for the TD group in the larger study. Overall, these findings suggest that anxiety may be a significant factor in existing ASD symptomology by contributing to the preferential looking patterns towards non-social information. In other words, children with ASD may be more likely to avoid looking at faces due to the anxiety-producing social stimuli.

178 **129.178** The Role of Medical (including Psychiatric) Evaluations in the Diagnosis of ASD:from Gold-Standard Instruments to Full Diagnosis

M. Parellada, *Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background: The diagnosis of ASD is based on observable behaviors. Best–estimate clinical diagnosis of ASD refers to a diagnosis of the clinical symptoms and development compatible with an ASD diagnosis with all available information including developmental history, assessment of ASD-behaviors, medical and school reports, with or without instruments developed for the assessment of parts of the diagnostic procedure (i.e. developmental history, ASD symptoms). Differential diagnosis of other psychiatric conditions that may better explain the observed behaviors should always be part of the diagnostic procedure.
Objectives: To present data from an "ASD Complex Diagnosis Program" where a full psychiatric evaluation is conducted in addition to a full ASD-related evaluation in cases in diagnostic doubt after a general Child Psychiatrist and/or Neuropaediatrician evaluation.

Methods: 180 patients consecutively attended in a Specialized consultative care (Tertiary Tier) Child Psychiatry Program for the assessment of children and adolescents with the suspicion of having an ASD diagnosis, underwent a full psychiatric and developmental evaluation. Final best-estimate diagnosis following DSM/ICD criteria was reached after i) evaluation of all life-time medical, educational and psychological reports ii) full psychiatric history with the patient and primary carer iii) full developmental history with the primary carer (roughly 50 % of the times with the ADI-R) iv) ADOS-2 evaluation v) psychopathological assessment including mental state vi) cognitive/language assessment if not available vii) family and teacher questionnaires for the assessment of ASD-behaviors, particularly in relation with peer-relationships vii) other questionnaires as appropriate viii) medical specialists consultation when indicated.

Results: main reasons for referral were: young children referred for a differential diagnosis with Specific Language Disorder, Intelligence

Developmental Disorder or emotional and/or behavioral disorders; children/adolescents with multiple previous diagnoses; adolescents for differential diagnosis with psychotic disorders or personality disorders. 85 % of the patients were male; 78 % were up to 9 years of age and 22 % were 10-18 years old. Roughly 50 % were elegible for module 3 of the ADOS-2 (complex language level and up to early adolescence). There was a deviation to the left in the distribution of IQ, with 51 % of the patients having a below average IQ (<70). 80 % of the full sample was given an ASD diagnosis. However, among children/adolescents 8-15 years of age only 58% were given a diagnosis of ASD; behavioural disorder (including severe ADHD), social communication disorder and specific language disorders followed in frequency. Among adolescents 16-18 years of age, 62 % were diagnosed with an ASD, followed by other psychiatric disorders (high-risk of psychosis, personality disorders) and specific language disorders.

Conclusions: a full psychiatric evaluation seems to be an important add-on for the proper diagnosis of children and adolescents with complex developmental/behavioral difficulties.

179 **129.179** Title: Do Motor Abilities Predict ADHD Symptoms in Preschoolers with FXS?

S. L. O'Connor[1], *E. A. Will*[2] *and J. E. Roberts*[2], *(1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Psychology, University of South Carolina, Columbia, SC*

Background: Attention Deficit/Hyperactivity Disorder (ADHD) is the most commonly diagnosed behavioral disorder in children with approximately 11% of the general population diagnosed with ADHD. Children with FXS and ASD experience higher rates of ADHD symptomatology, with rates in the literature ranging from 40-80%. Motor skills have been identified as a predictor of ADHD outcomes within the general population and have also been found to distinguish between clinical groups such as FXS and FXS+ASD. Thus, motor scores may be a viable predictor for ADHD in high risk populations such as FXS. Additionally, the presence of autism symptoms in FXS have been shown to moderate the severity and presence of ADHD in individuals with FXS. However, the relationship between autism symptoms and motor skills has not been investigated in ADHD and FXS.

Objectives: In the present study, we examined whether motor abilities, moderated by ADOS severity scores, were predictive of ADHD symptomatology in a group of preschoolers with FXS. We then examined whether fine motor and gross motor abilities, also moderated by ADOS severity scores, were predictive of ADHD symptomatology in preschoolers with FXS.

Methods: Participants included 36 preschool aged children with FXS. The Child Behavior Checklist 1½-5 ADHD-DSM subscale raw scores (CBCL) were used to assess the presence ADHD symptoms between 36-60 months of age. Both measures were collected at the same time. Broad motor abilities were measured by the Motor scale standard scores from the Vineland Adaptive Behavior Scale (VABS). Fine Motor and Gross Motor Scales raw scores were also used from the VABS.

Results: Results for the regression model testing broad motor skills predicting ADHD indicated that there were no significant associations between motor and ADHD, and that autism symptom severity did not moderate this association, though the overall model approached significance (p = .105; R^2 = .172). We followed up with two subsequent models to detect whether fine and gross motor skills individually predicted ADHD outcomes, however, no significant associations were found (p's > .05).

Conclusions: Study findings suggest that motor abilities may lead to developmental outcomes other than ADHD for preschoolers with FXS. Although neither fine motor nor gross motor was significantly associated with concurrent ADHD outcomes in preschool (i.e., 36 to 60 months), motor development in infancy may contribute to later ADHD outcomes for children with FXS. Future work should delineate early developmental pathways to ADHD and identify developmental outcomes related to early motor abilities in children with FXS.

180 **129.180** Vagal Tone As a Predictor of Separation Anxiety in Preschoolers at Elevated Risk for ASD

A. M. Brewe[1], *A. L. Hogan*[1], *C. E. Knott*[2] *and J. E. Roberts*[2], *(1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Psychology, University of South Carolina, Columbia, SC*

Background: Separation anxiety disorder (SAD) affects about 4% of typically-developing (TD) children. However, rates of SAD are twice as high for children with autism spectrum disorder (ASD). While traditional screening and diagnostic measures help define behavioral expressions of SAD, physiological indices may serve as valuable biomarkers given subtle signs and limited verbal skills that could preclude accurate recognition of early features. Vagal tone indexes parasympathetic/vagal regulation and atypical vagal tone has been tied to anxiety in TD children and adults. It is unclear if children with ASD have atypical vagal tone because their ASD symptoms interact with anxiety symptoms in a complex manner.

Objectives: The current study aims to characterize differences in vagal tone in groups at high risk for SAD, including children with fragile X syndrome (FXS) and younger siblings of children diagnosed with ASD (ASIBs), compared to TD peers. The study also aims to determine if ASD symptom severity correlates with vagal tone during a socially stressful task and if vagal tone predicts SAD in the high-risk groups.

Methods: Participants included TD males (CA=52.41 months; n=17), ASIBs (CA=60.12 months; n=19) and children with FXS (CA=60.53 months; n=21). Vagal tone was measured during a maternal separation task. Respiratory sinus arrhythmia (RSA), an index of vagal tone, was measured during baseline, maternal separation, and recovery periods. RSA in each period and RSA reactivity between periods was computed. The Spence Children's Anxiety Scale (Spence & Rapee, 1999) was used as a measure of parent-reported SAD. The Autism Diagnostic Observation Schedule – Second Edition (ADOS-2; Lord, Rutter, DiLavore, & Risi, 2001) was used to measure ASD symptom severity.

Results: One-way ANOVAs indicated that groups did not differ on Spence SAD subscale scores, $F(2,52)=0.303$, $p=.740$ or on baseline RSA, $F(2,56)=1.028$, $p=.364$. However, children with FXS exhibited lower RSA than ASIBs during the separation period $F(2,56)=3.823$, $p=.028$ and lower RSA than both ASIB and TD groups during the recovery periods, $F(2,56)=3.743$, $p=.030$. Regression analyses indicated ASD severity did not predict RSA in any groups; however, RSA reactivity from baseline to separation periods predicted SAD for ASIBs $R^2=.505$, $F(1,9)=9.188$, $p=.014$ and approached significance for the FXS group $R^2=.201$, $F(1,17)=4.288$, $p=.054$.

Conclusions: Regulation of vagal tone during stressful situations serves an adaptive function; therefore, the FXS group's lower vagal tone during separation and recovery provides evidence of physiological dysregulation. SAD has been shown to exacerbate impairments in children with ASD; therefore, analyzing how biological measurements of SAD correspond with behavioral features in high-risk groups is essential to understanding the expression of SAD in these groups. Severity of ASD does not appear to influence vagal tone, suggesting vagal tone in high-risk groups may be influenced by other factors. However, vagal reactivity did predict SAD symptoms in the ASIB group and marginally in the FXS group, indicating vagal tone may serve as a biomarker of SAD in at-risk populations.

181 **129.181** Why Is Quality of Life Reduced in Individuals with Autism Spectrum Conditions? Investigating the Impact of Core Symptoms and Psychiatric Comorbidities on Quality of Life in the EU-AIMS LEAP Cohort.

B. Oakley[1]*, J. Tillmann*[2]*, D. V. Crawley*[1]*, A. San Jose Caceres*[1]*, R. Holt*[3]*, T. Charman*[4]*, J. K. Buitelaar*[5]*, T. Banaschewski*[6]*, E. Simonoff*[7]*, D. G. Murphy*[8] *and E. Loth*[1]*, (1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)King's College London, London, United Kingdom of Great Britain and Northern Ireland, (3)University of Cambridge, Cambridge, United Kingdom, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (6)Child and Adolescent Psychiatry, Central Institute of Mental Health, Medical Faculty Mannheim, University of Heidelberg, Mannheim, Germany, (7)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (8)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Individuals with Autism Spectrum Conditions (ASCs) generally report lower quality of life (QoL) than the neurotypical population. There is often an implicit assumption that ASC per se (i.e. the defining core symptoms) is the central factor resulting in reduced QoL. However, the relative impact of psychiatric comorbidities (e.g. anxiety, depression, ADHD) vs. core ASC symptoms on different facets of QoL, at different stages of development, remains poorly understood, despite up to 71% of individuals with ASCs having one or more comorbidities.

Objectives: Thus, this study aimed to investigate the role of ASC core symptoms and psychiatric comorbidities in QoL across multiple domains, in a large and diverse sample of individuals with ASCs.

Methods: 445 individuals with ASCs and 302 individuals without ASC (with/without mild intellectual disabilities), aged 6-30 years, were recruited to EU-AIMS LEAP (Charman et al., 2017; Loth et al., 2017). ASC core symptoms were assessed using the Social Responsiveness Scale-2nd Edition (SRS-2) and Repetitive Behaviour Scale-Revised (RBS-R); co-occurring psychiatric symptoms were assessed using the Development and Well Being Assesesement. To measure QoL; 1) Across all participants, parent-report Columbia Impairment Scale (CIS) was administered; 2) In children (6-11 years), we also administered parent-report Child Health and Illness Profile (CHIP-CE), which indexes Satisfaction, Comfort, Resilience, Risk Avoidance & Achievement; 3) Participants 12-30 years completed self-report CIS and/or WHOQOL-BREF. The latter measure indexes Overall QoL, Physical Health, Psychological Health, Social Relationships & Environment. Within the ASC group we performed stepwise multiple regression for each domain of QoL as the dependent variable, and the following independent variables; demographics (age, IQ, sex, testing site), core symptomatology (SRS-2, RBS-R), and comorbid symptomatology (anxiety, depression, ADHD).

Results: In accordance with previous research, the ASC group scored significantly lower on QoL measures than Controls, with effect sizes from r=0.17-0.61. See Figure 1 for correlations.

CIS-Parent. Social-communication deficits accounted for 31.1% unique variance, with depression contributing a further 6.1%, and repetitive behaviours 1.8%.

CIS-Self. Social-communication deficits explained 29.1% variance, and anxiety explained a further 2.5%.

WHOQOL-BREF. Depression was the only variable significantly accounting for variance in; Overall QoL (29.1%), Physical Health (23.1%), and Social Relationships (47.2%). Social-communication deficits were the only symptom significantly explaining variance on Psychological (36.5%) and Environment (26.9%) domains.

CHIP-CE. For the Satisfaction domain, the best-fitting model included social-communication deficits (11.4% unique variance) and anxiety (5.1% unique variance). The same was true for the Comfort domain, however this time anxiety (20.1%) explained more variance than social-communication deficits (4.1%). Depression alone significantly accounted for 7.1% unique variance on the Resilience domain. Finally, the best-fitting model for Risk Avoidance included ADHD (17.5% unique variance) and sex (6.1%). The model for Achievement also featured ADHD (20.4% unique variance), as well as IQ (12.7%) and depression (5.8%).

Conclusions: These findings emphasise how QoL in ASCs is a multi-faceted construct, with diverse underpinnings, influenced by core and comorbid symptoms. Through better understanding the contributions of diverse symptoms on various domains of QoL, in different individuals with ASCs, we may identify how interventions can be targeted to improve QoL.

182 **129.182** The Effect of Nutrition and Exercise on Bone Density in Boys with Autism Spectrum Disorder

A. Neumeyer[1]*, N. Cano Sokoloff*[2]*, E. I. McDonnell*[3]*, E. Macklin*[2]*, T. M. Holmes*[4]*, J. L. Hubbard*[4]*, C. McDougle*[5] *and M. Misra*[6]*, (1)Lurie Center for Autism Massachusetts General Hospital, Lexington, MA, (2)Massachusetts General Hospital, Boston, MA, (3)Biostatistics Center, Massachusetts General Hospital, Boston, MA, (4)Translational & Clinical Research Center, Massachusetts General Hospital, Boston, MA, (5)Lurie Center for Autism,, Massachusetts General Hospital,, Lexington, MA, (6)Pediatrics, Massachusetts General Hospital and Harvard Medical School, Boston, MA*

Background:

Peak bone mass is an important determinant of future bone health. The childhood years are critical for development of bone mass, which depends upon many factors including genetics, nutrition, weight bearing activity, hormonal status, medication use and medical disease. Boys with autism spectrum disorder (ASD) have lower bone mineral density (BMD) than typically developing controls (TDC). Differences in nutrition and exercise may contribute to low BMD. Nutrition management of children with ASD is a challenge because children frequently have a restricted diet, either self-imposed and limited by taste or texture or imposed by parents to avoid potential allergens. Concurrent gastrointestinal diseases in children with ASD may affect absorption of nutrients. Children with ASD are also often less active physically and have a higher prevalence of hypotonia.

Objectives:

To examine macro- and micro-nutrient intake, serum levels of vitamin D and calcium, and self-reported physical activity in boys with ASD compared to TDC and the relationship of these variables with BMD**.**

Methods:

Participants included 49 prepubertal and pubertal boys (25 ASD, 24 TDC), ages 8-17 years, recruited from a clinic population (ASD) or community advertisements (ASD and TDC) matched for age. In this cross-sectional study, we assessed BMD of the lumbar spine, femoral neck, total hip and whole body less head using dual energy X-ray absorptiometry, and three-day diet/supplement and physical activity records. Fasting levels of 25(OH) vitamin D and calcium were obtained.

Results:

ASD participants were approximately 9 months younger than TDC participants on average. Age adjusted BMI z-scores were similar. Body mass index and serum vitamin D and calcium levels were similar. BMD Z-scores were 0.7 to 1.2 standard deviations lower in ASD than TDC at all locations. Fewer boys with ASD were categorized as “very physically active” (27% vs. 79%, p<0.001). Boys with ASD consumed significantly less calcium, iron, phosphorous, selenium, vitamins A, riboflavin, niacin, B6, B12 and dietary folate equivalents, with deficiencies ranging from 19 to 35%. Boys with ASD consumed 16% fewer calories, 37% less animal protein, and 20% less fat than TDC, with a larger percentage of calories obtained from carbohydrates. Higher animal protein, calcium and phosphorus intake was associated positively with bone density measures in boys with ASD. Our data confirm reports of micronutrient inadequacies in the diets (food alone) of boys with ASD and that vitamin supplementation does not correct several of these inadequacies.

Conclusions:

Boys with ASD were less active and had lower BMD Z-scores at the lumbar spine, femoral neck, total hip and whole body less head than TDC. Protein, calcium and phosphorus intake were lower in ASD than TDC and were associated positively with BMD. This suggests that encouraging diets higher in fortified dairy and animal protein as well as increased high-level exercise may improve bone health. It is important for practitioners to assess dietary intake of dairy and animal protein

183 **129.183** Heart Activity during Startle Paradym in Children with Fragile X Syndrome and Autism Spectrum Disorder Compared to Typically Developing Children

J. A. Ezell[1], *E. A. Will*[2], *S. McQuillin*[1] *and J. E. Roberts*[2], *(1)University of South Carolina, Columbia, SC, (2)Psychology, University of South Carolina, Columbia, SC*

Background: Fragile X syndrome (FXS) is a monogenetic disorder characterized by abnormal social behavior and intellectual disability. FXS is also the most frequent known heritable genetic cause of autism spectrum disorder (ASD), which makes it an ideal model for studying ASD. High rates of anxiety have been reported in both FXS and ASD with features of anxiety overlapping with ASD symptomatology in both clinical groups. Capturing anxiety in young children with FXS or ASD is challenging as verbal deficits can limit self-report and most measures are normed for older children or adults in these populations (Spence et al 2001). Behavioral and physiological measures of anxiety can provide important insight into early features of anxiety in children with FXS or ASD. Elevated heart rate and reduced modulation in response to threat can be indicative of anxiety (Whalen et al, 2017). Physiological reactivity to an auditory startle captures reflexive responses linked to underlying physiological mechanisms associated with anxiety. Given that children with FXS and ASD demonstrate dysregulated autonomic activity and related challenges modulating heart activity compared to typically developing (TD) children (Klusek et al, 2015; Roberts et al, 2012), heart activity in auditory startle response can provide insight into anxiety features in these high-risk groups.

Objectives: The purpose of this study is to characterize heart activity in response to an auditory startle in children with FXS and in children with ASD contrasted to low-risk controls. We predict that children with FXS or ASD will react with elevated heart activity to the auditory startle task compared to TD children.

Methods: Participants included 25 children with FXS, 21 TD children, and 11 children with idiopathic ASD (*n* =20 by INSAR) between the ages of 3-6 years old who are participating in an ongoing study. The auditory startle task takes place in the context of a silent children’s movie and is comprised of a three phases, 1). The pre-startle (30 seconds), 2) startle (1 second), and 3) post-startle (60 seconds).

Results: We examined patterns in heart activity during auditory startle response across FXS, ASD, and TD groups using a multi-level model, wherein 1s epochs were nested within children. The FXS and TD groups differed in startle response heart activity B=.50(.19), t=2.51, however, FXS and ASD groups did not B=.27(.19),t=1.39. Model results indicate that the FXS and ASD groups showed increased startle response heart rate, whereas the TD group showed a decrease (see figures).

Conclusions: These preliminary findings are consistent with previous research showing altered physiological reactivity in clinical samples with FXS and ASD compared to TD children. Results suggest that autonomic reactivity, indexed by heart rate, may represent a shared mechanistic vulnerability with anxiety in FXS and ASD. Elevated heart rate following startle response might be an early feature of anxiety in young children with FXS or ASD. Behavioral data are being coded during the startle experiment, and these data will be integrated with heart activity for presentation at the conference.

Poster Session
130 - Service Delivery/Systems of Care
5:30 PM - 7:00 PM - Hall Grote Zaal

184 **130.184** - Identifying Previous Service Experience and Needs Among Individuals with Autism Waiting for Services

L. Shea[1], *P. F. Turcotte*[2] *and S. Nonnemacher*[3], *(1)A.J. Drexel Autism Institute, Philadelphia, PA, (2)Drexel University, Philadelphia, PA, (3)Pennsylvania Bureau of Autism Services, Harrisburg, PA*

Background: Pennsylvania is home to two of the first programs for adults with autism in US, the Adult Autism Waiver and the Adult Community Autism Program, both administered by the Pennsylvania Bureau of Autism Services. In 2015, 1,648 individuals were waiting for services through these two programs. Understanding the service experiences and needs of individuals with autism waiting for services and their caregivers provides critical insight to help states plan for the services (and associated cost) individuals will need. Individuals waiting for services are also at risk of adverse outcomes such as hospitalization and police contact since they are less likely to be receiving behavioral supports that would help prevent these crises. To understand the needs of this group, the Pennsylvania Autism Needs Assessment was distributed to individuals with autism waiting for services and their caregivers.

Objectives: Demographic characteristics, service experiences, and service needs of individuals with autism waiting for services and their caregivers will be reported and compared to Autism Needs Assessment results from the rest of Pennsylvania who are not waiting for services.

Methods: The Pennsylvania Autism Needs Assessment was distributed to all individuals waiting for services for the Pennsylvania Bureau of Autism

Services programs over the age of 18 and their caregivers in 2015. Individuals and their caregivers could complete the Needs Assessment in paper copy or online. Paper copies were double data entered and data were analyzed using crosstabs for descriptive comparisons in SAS. Ongoing analyses to compare individuals waiting for services to those receiving services are underway.

Results: A total of 638 responses were gathered from individuals waiting for services and their caregivers. Most (410) responses were from caregivers and 228 individuals with autism over the age of 18 responded to the Needs Assessment for themselves. The majority of respondents (84%) were white. Most individuals indicated needing more support in social skills training (46%), supported employment (39%), and support groups (38%). One in five caregivers indicated a need for respite care. Additional analyses, including comparisons to responses to the Needs Assessment from statewide individuals not waiting for services are underway.

Conclusions: Limited available resources across states in the US for the foreseeable future indicate individuals with autism may wait for services especially during the transition into adulthood. Identifying the needs of this group helps to characterize the individuals who need services the most and provides valuable information to help states plan for their services and budget. With one-third of respondents indicating needing employment support services, and 24% indicating five or more co-occurring diagnoses, these results provide priorities for the services that can support individuals in obtaining and maintaining employment and seeking mental health support services. The low response rate from minority populations (< 20%) warrants a top priority for continued research, and more effort is needed to catalogue the needs of underserved and underrepresented populations.

185 **130.185** A Mixed Methods Approach to Understanding Community Providers' Implementation of an Evidence-Based, Parent-Mediated Intervention

__K. Casagrande__ and B. R. Ingersoll, Psychology, Michigan State University, East Lansing, MI

Background: Despite best practice recommendations for parent involvement in intervention for young children with ASD, parent-mediated interventions (PMIs) are highly under-utilized in community settings. A better understanding of factors that influence providers' implementation of PMIs is important for the development of successful training models. Research in other fields suggests a number of factors that influence implementation of evidence-based practices for young children, including provider self-efficacy, attitudes, and perceived barriers.
Objectives: The aim of the current study is to better understand factors that influence community providers' implementation of Project ImPACT, an evidence based PMI, using a mixed methods approach.

Methods: Ninety-two providers completed a follow-up 6 to 24 months after attending multi-day Project ImPACT workshops (response rate=24%). Providers reported whether or not they implemented Project ImPACT and rated their self-efficacy in using the program as a PMI. They completed questionnaires about attitudes towards and perceived barriers in their use of Project ImPACT. Finally, providers responded to open-ended questions about how they implemented the program, any modifications they had made, and characteristics of families for whom it was most and least helpful.

Results: Forty-four providers (48%) reported that they had implemented Project ImPACT as a PMI (group=5, individual=26, both=13). Of the 48 providers who did not implement Project ImPACT as a PMI, 31 reported implementing in other ways (direct intervention=17, used some components=8, telehealth=1). Implementers did not differ from non-implementers on demographic characteristics other than profession (χ^2=15.40, p=.017); SLPs were more likely to implement the intervention (p<.05), while social workers were less likely (p<.05).

Point-biserial correlations examined the relationship between implementation and provider self-efficacy, attitudes, and perceived barriers. Self-efficacy (r=.396, p<.001) and positive attitudes towards Project ImPACT (r=.271, p=.013) were positively correlated with implementation; perceived barriers (r=-.329, p=.004) were negatively correlated with implementation. Correlations also examined the relationship between individual barriers and implementation. Of the 18 potential barriers, 7 were significantly associated with program implementation (see Table 1).

An analysis of open-ended responses suggested that providers who implemented the program made a number of modifications, including alterations to intervention content (n=7), length of the program (n=24), and session format (n=4). Providers also reported making changes to core components, including collaborative goal setting (n=5) and homework (n=8). Two providers indicated they did not provide coaching. Providers thought the intervention was most helpful for parents with who were motivated (n=19), had adequate time to devote to the program (n=14), and have children with low attention and engagement (n=8); they indicated it was least helpful for parents with limited time (n=15), high stress (n=11), and other children (n=8).

Conclusions: Self-efficacy, barriers to program use, and provider perceptions of Project ImPACT were all significantly related to implementation as expected. There were also family characteristics, such as time, motivation, and stress, which influenced the successful use of the program. We can modify the development of EBPs and alter trainings to best support providers going forward by creating more intensive trainings, planning for common barriers to program use, and improving strategies for engaging and supporting parents.

186 **130.186** Accuracy of Community General Pediatrician Diagnosis of Autism Spectrum Disorder (ASD) Compared to Multi-Disciplinary Team Assessment

__L. Andoni__[1], J. A. Brian[2] and M. Penner[2], (1)University of Massachusetts, Boston, MA, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada

Background: The prevalence of ASD has increased dramatically in recent years, placing a strain on access to diagnostic assessment. Early diagnosis is of significant importance to obtaining early intervention and optimizing outcomes. Encouraging community-based clinicians, such as general pediatricians (GPs), to make the diagnosis may increase diagnostic capacity and decrease wait times. If pediatricians are to be used as a diagnostic resource for ASD, it is important to evaluate whether they provide accurate diagnostic assessments compared to a multi-disciplinary team (MDT) assessment.
Objectives: The objective of this study is to determine agreement in ASD diagnosis between GPs and a subspecialist MDT assessment.

Methods: This study follows a prospective, cross-sectional design. There are two target populations for recruitment: 1) GPs in Ontario (projected n = 20), and 2) their patients under 5.5 years referred for developmental concerns (n = 200 total; 10/pediatrician). Participants are randomized 1:1 to have their MDT visits scheduled either before or after the pediatrician visit. MDT and general pediatrician assessments are conducted blinded to each other's impressions. The MDT visits consist of clinical assessments by a developmental pediatrician and a psychologist. The MDT and GP independently record a forced decision on whether the child has ASD, and the GP indicates the actions they would have taken had the child not been enrolled in the study. The MDT team provides feedback on their assessment results to the family. Agreement between the two assessments is measured with a simple kappa statistic. Descriptive data around the breakdown of true and false positive and negative cases is provided.

Results: To date, 36 assessments have been completed (24 males, 12 females; mean age 40 months, range 17-63). Thirty of the children had an ASD diagnosis as determined by the MDT. GPs agreed with the MDT team on 66.7% of cases (24/36 cases), corresponding to a kappa of 0.2 (poor agreement). In 20 true positive cases, GPs indicated that they would have given the ASD diagnosis in 12 cases, referred to a specialist in 7 cases, and 'watched and waited' in 1 case. In 2 false positive cases, GPs indicated they would have referred to a specialist. In 4 true negative cases, the GPs indicated they would have given the non-ASD diagnosis in 3 cases, and referred to a specialist in 1 case. In 10 false negative cases, the GP would have incorrectly give a non-ASD diagnosis in 4 cases, 'watched and waited' in 2 cases, and referred to a specialist in 4 cases.

Conclusions: These results are preliminary but are illustrative of the importance of this work. GP participants are willing to diagnose ASD in their practices. The incidence of several false negative cases, some of which may have been missed diagnoses as the pediatricians would not have referred for further assessment, suggests that further GP education is needed on the varied clinical presentations of ASD. Further analysis with a larger sample size will permit identification of child features associated with 'accurate' ASD diagnostic determination by GPs.

187 **130.187** Allies and Adversaries: The Experience of Healthcare and Healthcare Relationships for Adults with 'High-Functioning' Autism Spectrum Disorder

M. Wright[1], *M. Medved*[2], *J. M. Montgomery*[3] *and K. Roger*[1], *(1)University of Manitoba, Winnipeg, MB, Canada, (2)American University of Paris, Paris, France, (3)Psychology, University of Manitoba, Winnipeg, MB, CANADA*

Background: 'High-Functioning' forms of Autism Spectrum Disorder (HFASD) are characterized by a lack of what has been called 'social competence,' in the context of on-track language development and intact cognitive abilities. The hallmark social difficulties of HFASD often impact interpersonal relationships, and many individuals with HFASD report feeling dismissed and fundamentally misunderstood as persons. Within healthcare, the Patient-Centred Care (PCC) framework – which promotes understanding the patient as a person and developing positive healthcare relationships - has received much attention in the literature and is widely accepted as beneficial to patients. Despite this focus, little is known about how adults with HFASD experience their healthcare or healthcare relationships. Many physicians report feeling ill-equipped to treat and interact with adult patients with HFASD, yet healthcare research has rarely consulted adults with HFASD, missing the opportunity to understand the unique perspectives of adults with HFASD to inform practice. Given that being understood and having positive relationships is known to contribute to better healthcare experiences and health outcomes, it is essential that we understand what adults with HFASD value and want in their healthcare and healthcare relationships to improve practice.

Objectives: The purpose of this study was to better understand how adults with HFASD experience their healthcare and healthcare relationships by asking them about their experiences directly and exclusively. More specifically, this study aimed to understand perceived strengths and challenges experienced by adults with HFASD, and identify both positive and negative aspects of healthcare and healthcare relationships from their unique perspective.

Methods: Twenty-eight North-American adults with HFASD who could navigate healthcare independently answered four online long-answer open-response questions about their experiences of their healthcare and healthcare providers. Responses were analysed using constant comparison analysis within the Grounded Theory framework. Participants were provided with preliminary findings and given the opportunity to comment, agree or disagree, or clarify their responses to ensure that the researcher had accurately captured their intended meaning.

Results: Participants identified several strengths (e.g., written communication and high intelligence) and challenges (e.g. in-person communication and feeling condescended towards) in navigating their healthcare. Overall, participants reported that their experiences in healthcare were determined by their healthcare relationships, irrespective of their own personal strengths and challenges. Positive experiences occurred with healthcare providers described as 'allies' who were caring, knowledgeable and empowering. At times, these 'allies' were perceived as lacking knowledge about HFASD, but still fostered an overall positive relationship and healthcare experience by conveying care and understanding of the patient. Negative experiences – which were more commonly reported - occurred with healthcare providers described as unknowledgeable and overpowering 'adversaries', and who dismissed patient's strengths.

Conclusions: For these adults with HFASD, positive and negative experiences of healthcare were largely determined by their experience of their healthcare relationships. Furthermore, healthcare providers who were perceived as knowledgeable and caring were described as forming positive healthcare relationships. This highlights the importance of increased awareness about HFASD - in terms of understanding both the disorder itself and the person with it - among healthcare providers.

188 **130.188** An Examination of Disparities in Patterns of Use of State-Funded Disability Services

S. R. Rieth[1,2], *L. Brookman-Frazee*[2,3], *K. S. Dickson*[2,4], *R. Plotkin*[5], *T. Cook-Clark*[5] *and C. M. Corsello*[6], *(1)San Diego State University, San Diego, CA, (2)Child and Adolescent Services Research Center, San Diego, CA, (3)Psychiatry, University of California, San Diego, San Diego, CA, (4)University of California, San Diego, La Jolla, CA, (5)San Diego Regional Center, San Diego, CA, (6)Psychiatry, UNC TEACCH Autism Program, Raleigh, NC*

Background: Access to effective, evidence-based services for youth with developmental disabilities in the community is limited, especially for ethnic minorities populations where significant disparities in identification, service entry and utilization are documented (Mandell et al., 2002, 2005, 2007). There are a growing number of large-scale, system-driven efforts to address service disparities but little is known about the specific patterns and influences of service usage disparities among minorities, which are key to informing efforts to address service disparities. In 2016, the State of California Department of Developmental Services launched a large-scale initiative to address disparities in care for Latino clients statewide. To best inform this effort, the San Diego Regional Center (SDRC) prioritized the identification and tracking of disparities in current service expenditures and authorizations by ethnicity and race.

Objectives: The aim of the current study is to examine patterns of service use and expenditures for individuals with developmental disabilities receiving state-funded disability services to identify service disparities by ethnicity and specific disability. Service use patterns from birth to adulthood were also examined to identify age groups in which such disparities emerge.

Methods: SDRC administrative claims data from fiscal years 2014-2015 were extracted. Purchase of service (POS) data for 27,343 SDRC clients were used to characterize service utilization patterns, including differences in service use by ethnicity as well as disability group from birth to adulthood. Specific disability categories include intellectual disability (ID), autism spectrum disorder (ASD), and comorbid medical issues.

Results: Analyses indicate significant differences in POS for Latino and Non-Latino/White clients ($F(3,27,332)=107.47$, $p<.01$), with smaller POS for Latino clients. Follow-up analyses aimed to understand patterns to these disparities revealed a significant 3-way interaction between ethnicity, age, and disability types. Post-hoc analyses revealed significant differences in POS between Non-Latino/White clients and Latino clients with ID that emerge between the ages of 14-18:11 and for clients with ASD that emerge between 16-18:11 years of age, with lower POS for Latino individuals. A similar pattern was observed for individuals with comorbid ASD and ID, ID and medical issues and ASD and medical issues beginning at ages 19-21:11. Further analyses examining these disparities by service type will be discussed.

Conclusions: These results provide relevant information for targeted disparity reduction efforts, including identification of strategies targeting these age ranges.

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130.189 An Overview of a Community-Based Treatment in Singapore for Children and Adolescents with Social Interaction and Communication Difficulties.

***Y. Heng*[1]** *and J. Wong[2], (1)National University Health System/ National University of Singapore, Singapore, Singapore, (2)Department of Psychological Medicine, National University Hospital of Singapore, Singapore, Singapore*

Background:

REACH (Response, Early intervention and Assessment in Community mental Health) is a community-based service in Singapore that provides mental health assessments and intervention of school-going children and adolescents (7-18 years old).

In Singapore, there is an estimated prevalence of 50, 000 individuals with Autism Spectrum Disorder (ASD), of which, 11, 500 are under the age of 19 years. With awareness, there has been a parallel increase in the number of individuals diagnosed with ASD, or identified to have social challenges since 2000 (Autism Resource Centre, 2017). These children can opt for education in a mainstream school where emphasis is placed more on academic learning. However, the children often require more intensive practice in social interaction and communication.

Objectives:

This poster aims to introduce REACH's intervention program for children and adolescents with ASD or social challenges, and explores its improvement outcomes based on pre and post parents' ratings.

Methods:

REACH's social skills lesson plans adopts Michelle Garcia's Social Thinking's strength-based treatment approach, focusing on building upon the key concepts of Central Coherence Theory (Happe and Frith, 2006), Theory of Mind (Flavell, 2004), and Executive Functioning (Hill, 2004).

Referrals to REACH are directed from health care professionals or school counsellors. Students underwent a compulsory screening session prior to commencement of social skills sessions. Parents completed a questionnaire during the screening process to identify key areas of social needs, namely, Self-Awareness and Self-Esteem, Non-Verbal Communication, Conversational Skills, Friendship Skills, and Assertiveness. For each skill, the students were rated on a scale of 1 to 3, where 1 was 'No Concern', 2 was 'Emerging Skill', and 3 was 'Needs Work'.

Based on the screening, students proceeded with either individual or group social skills sessions. Individual sessions were conducted in the respective schools of the participants, and an average of 8 hourly sessions was required to complete the individual sessions. Group sessions were scheduled at 1.5 hour for primary school-aged children, and 2 hours for secondary school students, for 5 weekly sessions. Upon completion of the therapy sessions, parents rated the students again to explore improvement outcome.

Results:

Since 2016, 3 primary school students and 11 secondary school students completed individual social skills session. 18 primary school students and 20 secondary students completed group social skills sessions. Preliminary findings showed overall improvements in the areas of Self-Awareness and Self-Esteem, Non-Verbal Communication, and Conversational Skills. (Actual results and analysis will be presented in the poster)

Conclusions:

REACH is the first community-based mental health team in Singapore that offers a tailored social skills therapy program for students with social challenges. Exploration of parents' ratings showed overall improvement in key areas of social skills. Future research could include teachers' ratings and students' self-ratings for more holistic evaluation of the program.

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130.190 Autism Alertness and Psychiatric Stigma in Dutch Physicians Screening in the Child General Population

***M. van 't Hof*[1,2]**, *I. A. van Berckelaer-Onnes[3], M. C. Neukerk[4], A. Daniels[5], H. W. Hoek[6,7,8] and W. A. Ester[2,9], (1)Sarr Expert Centre for Autism, Lucertis Child- & Adolecent Psychiatry, Rotterdam, Netherlands, (2)Parnassia Psychiatric Institute, The Hague, Netherlands, (3)Faculty of Social Sciences, Clinical Child and Adolescent Studies, Leiden University, Leiden, Netherlands, (4)Sarr Expert Centre for Autism, Lucertis Child and Adolescence Psychiatry, Rotterdam, Netherlands, (5)Simons Foundation, New York, NY, (6)Parnassia Academy, Parnassia Psychiatric Institute, Den Haag, Netherlands, (7)Department of Psychiatry, University of Groningen - University Medical Center Groningen, Groningen, Netherlands, (8)Department of Epidemiology, Columbia University - Mailman School of Public Health, New York, NY, (9)Sarr Expert Centre for Autism, Lucertis Child- & Adolecent Psychiatry, Rotterdam, Netherlands, Rotterdam, Netherlands*

Background: Stigmatizing beliefs and lacking mental health knowledge can delay the diagnostic process of autism by health professionals.
Objectives: The aim of the study is to evaluate the level of ASD alertness in Dutch physicians screening for autism in the child general population.

Methods: In a cohort of 93 Dutch Youth and Family Centre (YFC) physicians, we administered the Community Attitudes to Mental Illness (CAMI) questionnaire, an ASD knowledge test and demographic questionnaires.

Results: Results show that Dutch YFC physicians have a positive attitude towards persons with mental illness (CAMI 1-5 Likert scale, mean ranging from 2.18-2.22), sufficient general autism and low levels of specific autism knowledge (ASD knowledge test, scores 1(low)-10 (high): general: 7.1; specific 5.7). The level of psychiatric stigma was unrelated to the level of autism knowledge and other demographic variables.

Conclusions: Psychiatric stigma and autism knowledge are points of concern in physicians screening for autism in the general population. Research elucidating the relation between psychiatric stigma, ASD knowledge and the early detection of autism in health professionals is needed.

191 **130.191** Autism Spectrum Disorder and Challenging Behaviours Demonstrated in a Paediatric Hospital Environment

M. J. Mitchell[1], *K. Williams*[2] *and F. Newall*[3], *(1)Department of Paediatrics, The University of Melbourne; Royal Children's Hospital, Melbourne, Australia, (2)University of Melbourne and Royal Children's Hospital, Melbourne, Australia, (3)Royal Children's Hospital; The University of Melbourne, Melbourne, Australia*

Background: Children and young people (referred to as children) with autism spectrum disorder (ASD) often exhibit challenging behaviours which can be magnified in the hospital environment (Johnson, Bekhet, Robinson, & Rodriguez, 2014; Lecavalier, 2006). Challenging behaviours, whether self-directed or directed at parents/ caregivers or staff result in injury and distress for the child (Carroll et al., 2014).
The Code Grey/ Black procedures are two of a series of Emergency Response Codes used in Australian hospitals to provide guidance to staff, patients and their carers with regard to the provision of health care services. A Code Grey will be called "when an individual fails to respond to initial defusing mechanisms undertaken by staff" (Royal Children's Hospital, 2017).

Objectives: The objective of this study is to review data from an Australian tertiary paediatric hospital to understand the proportion of Code Grey/ Black activations that are for children with ASD and the accompanying circumstances.

Methods: The total number of Code Grey/Black activations from 1 July 2016- 30 June 2017 were identified through the Victorian Hospitals Incident Management System (VHIMS). Incidents caused by parents, carers or visitors were removed from the data set. Each remaining incident was reviewed to identify the context, response and outcomes. Patient medical records were reviewed for each incident to describe if the child had a diagnosis of ASD, Intellectual Disability (ID) or both. The Electronic Medical Record (EMR) was also reviewed to decide if the child had an identified behaviour of concern. Descriptive statistics were used to analyse the data.

Results: In one year 675 Code Grey/Black activations occurred with 622 (92%) of these initiated due to the behaviour of a hospitalised child. Aggressive incidents occurred in paediatric mental health units, paediatric wards, emergency department and outpatient clinics and were triggered by 165 patients. Twelve patients triggered more than ten incidents each and contributed to 309 (50%) of all Code Grey activations. Behaviours of concern were known in 85 of the 165 (50%) children who triggered code grey activations.

Children with ASD with or without ID triggered 223 (36%) code greys. Of these, 54 were triggered by children with ASD only and 169 by children with ASD and ID. One patient with ASD and ID accounted for 102 Code Grey activations in the 12 month period. Of all patients with ASD who triggered code greys, 85% had known behaviours of concern.

Conclusions: Children with ASD account for 36% of all clinical aggressive incidents at an Australian tertiary paediatric hospital. Challenging behaviours when exhibited in hospital and the resulting staff response, can cause distress or injury to the child and their family and influence future health care use. Understanding the profile of children who trigger Code Grey/ Black incidents will enable targeted clinical strategies and staff training approaches to be developed to reduce the triggers for stress, distress and aggression from patients with ASD & ID. This in turn may result in short and long term benefits for staff, children and their families.

192 **130.192** Beyond Sick and Well Visits: Pediatricians Knowledge and Beliefs about the Diagnosis of ASD

C. Montiel-Nava[1], *Z. Gonzalez*[2] *and J. A. Chacin*[3], *(1)Universidad Latina de Panama, Panama, Panama, (2)Universidad del Zulia, Maracaibo, Venezuela (Bolivarian Republic of), (3)Instituto de Genetica Medina, Universidad del Zulia, Maracaibo, Venezuela (Bolivarian Republic of)*

Background: Pediatricians play a central and crucial role in the evaluation and management of ASD. In average, they see a child for 11 well visits by age 36 months; which provides a venue for screening and surveillance of ASD. Even though, professional associations have been urging physicians to screen for ASD at 18 and 24 months; studies report mean ages of ASD diagnosis ranging from 38 to 120 months. Early identification is desirable because it is linked to better outcomes, and might improve the likelihood of referral to early intervention. Early diagnosis and timely referral have been related to the pediatricians' knowledge about ASD' symptoms. Latin American countries, in general, have limited access to diagnostic and treatment services; highlighting the pivotal role of pediatricians as diagnosticians of ASD. Studies on diagnostic practices of pediatricians and other physicians in Latin American countries are scarce, thus limiting information about health policies or capacity and training needs for these professionals.
Objectives: the primary goal of this study was to explore Venezuelan pediatricians knowledge and beliefs about the diagnosis of ASD.

Methods: Diagnostic criteria for autism spectrum disorders used by 75 Venezuelan pediatricians were examined using a 30 item- survey developed by Daley y Sigman (2002). The survey was translated into Spanish and back-translated to English, and later was validated by experts. The survey comprised three parts: 1.) pediatricians background and experiences with autism, 2.) a list of 18 characteristics or behaviors which included those required by the DSM-IV and some associated with other disorders, 3.) 2 open questions: "What other comments do you have about your experiences with autism in Venezuela?" and "What other behaviors or characteristics do you use in guiding your diagnosis?" (Daley & Sigman, 2002).

Results: The majority of the sample (92%) was working in urban health facilities. Participants had a range of professional and educational experiences; with a mean number of years of practice of 12.3 years (SD 6.2). Pediatricians in the sample reported a mean number of ASD cases during their career of 26.3 (SD 15.7). More than half of the Venezuelan pediatricians (54.7%, n=41) endorsed the necessary characteristics for ASD diagnosis. When asked about ASD etiology, 77.3% (n=58) exhibited average knowledge regarding the currently accepted ASD etiology (neurobiological and no caused by parents). In the comments section, common themes revolved around lack of awareness, underdiagnosis, and lack of enough trained professionals to handle ASD population in the country.

Conclusions: Venezuelan pediatricians consider the core features of autism as necessary for the diagnosis. They report seeing in their daily practice an increasing number of cases of ASD. These results provide a relevant analysis about knowledge, skills, and procedures that Venezuelan pediatricians used during the diagnosis process of children with ASD. Furthermore, it emphasizes Pediatricians' role as a partner of the parents of children with ASD to offer early diagnosis and referrals according to the current professional's guidelines.

193 **130.193** Broken Bridges: New School Transitions for Students with Autism Spectrum Disorder: A Review on Difficulties and

Strategies for Success

B. Bronstein[1], *H. J. Nuske*[2], *E. McGhee Hassrick*[3], *L. Hauptman*[4], *C. A. Aponte*[5], *L. Levato*[5], *A. C. Stahmer*[6], *D. S. Mandell*[2], *P. Mundy*[7], *C. Kasari*[4] *and T. Smith*[8], *(1)University of Pennsylvania, Philadelphia, PA, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (3)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (4)University of California, Los Angeles, Los Angeles, CA, (5)University of Rochester Medical Center, Rochester, NY, (6)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (7)University of California at Davis, Sacramento, CA, (8)University of Rochester, Rochester, NY*

Background: School transitions place enormous pressure on students to adapt quickly to new settings, which can strain their physical and mental health, and stress the family (Blair, 2002; Cairns and Harsh, 2014; Cauley and Jovanovich, 2006). Difficulties with social communication, peer relationships, resistance to change (Cuccaro et al., 2003) and intolerance of uncertainty (Boulter et al., 2014) may make new school transitions particularly difficult for students with autism spectrum disorder (ASD) and their parents. Therefore, usual transition procedures may not adequately address the needs of these students. Studies have hypothesized and measured different potential barriers to successful transition but few synthesize the transition needs of students with ASD or the benefits of specific supports.
Objectives: To review the literature on (1) transition difficulties faced by students with ASD, their families and school providers, (2) the strategies currently available to support them, and (3) inform future research about school transitions and the development of transition interventions for students with ASD, their families and school staff.

Methods: The review included 23 studies (10 primary school transition, 13 secondary school transition), with data from 394 students with ASD, 423 parents and 528 teachers, across 4 continents (North America, Europe, Africa, Australia). Authors assessed inclusion eligibility based on agreed upon criteria and reached high inter-rater reliability (Cronbach's α= .92). Coding was conducted in two stages (Boyatzis, 1998; Bradley et al., 2007). After establishing inter-rater agreement (>80%) with the lead coder on extracting transition difficulties and strategies of two articles, each article was independently coded by two coders and consensus coded in pairs. Second, themes and subthemes of transition difficulties and strategies were constructed through consensus using constant comparative method (Glaser and Strauss, 1967). For articles reporting on transition strategies (17 of 23), two authors independently rated level of evidence on a scale outlined in Harbour and Miller (2001), from 1++ (highest quality, (systematic reviews of RCTs) to 4 (expert opinion).

Results: Results confirmed that children with ASD, their families, and school staff experienced difficulties transitioning to kindergarten and secondary school. Main student difficulties were anxiety and increased social pressure; their parents felt overwhelmed with complex placement decisions and worried about the wellbeing of their children; and teachers strove to provide appropriate supports to their students with ASD, often with inadequate resources. Preliminary findings indicated that the most useful strategies involved clarifying the transition process for parents, helping the student adjust to the new school setting, fostering communication both between the sending and receiving schools and between school and home.

Conclusions: Current research highlights the concern that children with ASD, along with their parents and teachers, struggle with transitions and additional supports could be beneficial. However, intervention development has only recently begun. Strategies that clarify the transition process for parents, adjust the student to the new setting and foster communication among the sending and receiving schools and school and home may be particularly useful. There is a pressing need for community-based rigorously-tested interventions to test the effectiveness of different school transition strategies to ensure the success of students with ASD.

194 **130.194** Characterizing Disparities in Special Education Classroom Quality for Students with Autism

S. F. Vejnoska[1], *K. S. Dickson*[2], *S. R. Rieth*[2,3], *J. Suhrheinrich*[3] *and A. C. Stahmer*[4], *(1)University of California, Davis, Sacramento, CA, (2)Child and Adolescent Services Research Center, San Diego, CA, (3)San Diego State University, San Diego, CA, (4)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA*

Background: Schools provide the majority of services for children with ASD (Brookman-Frazee et al., 2009). Despite known special education disparities in identification and placement for minority and low-resource students with autism (Hibel et al., 2010; Travers et al., 2014), very few studies have looked at the quality of special education program that children receive. Some data suggest that students with autism from racial/ethnic minority and low-resource backgrounds may not be receiving high quality programs or recommended evidence-based practices due to teacher training constraints (McLeskey & Billingsley, 2008; Odom, Cox, & Brock, 2013). However, few studies have examined the impact of district and school level factors (e.g., racial/ethnic minority enrollment, percentage of students receiving free and reduced lunch) on special education classroom quality, which may affect implementation of effective practices. Additional research is needed to understand potential disparities in classroom quality in order to best direct resources and professional development efforts.
Objectives: To characterize differences in classroom quality for students with autism in a large urban sample based on school and district level factors (enrollment, % White, % Hispanic/Latino).

Methods: Data from a four-year study of 113 teachers from 17 school districts serving children under the educational classification of autism in public schools were examined. An expert assessor conducted an observational assessment of classroom quality (based on the Professional Development Assessment; Hume et al., 2009) in each student's classroom at intake to the larger study (Fall of the school year). The PDA includes 54 individual items across 7 domains. Student race/ethnicity and other demographics were collected via parents report upon intake. School and district level factors were collected from data from the California Department of Education, retrieved from Ed-Data.org in August 2017. Factors examined included school overall enrollment, district and school percent enrollment of White students, district and school percent enrollment of Hispanic/Latino students, percent of students at the school receiving free and reduced-price lunch, and school Title 1 status.

Results: Analyses indicate that both district and school level factors are significantly related to aspects of classroom quality. Specifically, a higher percentage of Non-Hispanic/Latino-White students at the district level (B=.01, *p*=.06), lower percentage of Hispanic/Latino students at both the district (B=-.01, *p*<.05) and school level (B=-.01, *p*=.06), and lower percentage of students receiving free or reduced lunch within the district (B=-.01, *p*<.05) were associated with higher quality ratings related to opportunities for peer interaction. Higher school enrollment was also associated with decreased use of strategies to promote peer relationships (*p*'s<.05). Additionally, a higher percentage of Non-Hispanic/Latino-White students at the district (B=.01, *p*=.085) and school (B=.01, *p*<.05) levels as well as a smaller proportion of schools classified as Title 1 (B=-.47, *p*=.08) were associated with higher quality ratings of teachers' instructional planning.

Conclusions: Disparities in the promotion of peer relationships and teachers' instructional planning exist in special education classrooms based on school and district level factors. Targeting these areas with professional development and additional resources may help address disparities in classroom quality.

195 **130.195** Child and Parental Correlates of Participation in Sports and Recreational Activities in School-Aged Children with Autism Spectrum Disorder

V. Lee[1]*, T. Bennett*[2]*, A. Zaidman-Zait*[3]*, E. Duku*[4]*, S. Georgiades*[4]*, P. Szatmari*[5]*, M. Elsabbagh*[6]*, P. Mirenda*[7]*, I. M. Smith*[8]*, W. J. Ungar*[9]*, T. Vaillancourt*[10]*, J. Volden*[11]*, C. Waddell*[12]*, L. Zwaigenbaum*[11] *and A. Thompson*[4]*, (1)McMaster Universtiy-Offord Centre, Hamilton, ON, Canada, (2)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (3)Tel-Aviv University, Tel-Aviv, Israel, (4)McMaster University, Hamilton, ON, Canada, (5)The Hospital for Sick Children, Toronto, ON, Canada, (6)McGill University, Montreal, PQ, Canada, (7)University of British Columbia, Vancouver, BC, Canada, (8)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (9)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (10)University of Ottawa, Ottawa, ON, Canada, (11)University of Alberta, Edmonton, AB, Canada, (12)Simon Fraser University, Vancouver, BC, Canada*

Background: Participation in sports and recreational programs (SRP) by children and adolescents is an essential component to healthy development; benefits for developmental outcomes (e.g. physical and mental health) have been well documented (Anderson et al, 2006). Yet the literature consistently indicates that children and youth with ASD are less likely than their same-aged peers to participate actively in community-based programs (Orsmond, Krauss, & Seltzer, 2004). While previous studies have noted individual, parental, contextual characteristics that may act as barriers and facilitators to participation, our understanding of factors related to longitudinal participation in these programs is limited.

Objectives: The primary objective of this study was to identify differences between child and parental characteristics of school-aged children with ASD whose parents reported consistent participation or no participation in organized SRP over a 4-year period between the ages of 7 and 12 years. A secondary objective was to examine whether these child and parental characteristics were correlated with participation over time.

Methods: Data came from the Pathways in ASD study, a large Canadian longitudinal prospective study of children with ASD. The sample was composed of 189 school-aged children with ASD at T_1 (mean age: 12.7 years, 83% male). Participation in organized community-based sports and recreational programs was indexed using the Community Programs and Services Assessment (CPSA) over a 4-year period (T_1-T_4, with T_1 as the first assessment between age 8-9 years and one assessment every 12 months for 3 consecutive years). ANOVAs were used to explore group differences based on consistent participation across the 4-year period and on variables of interest including child characteristics: T_1 autism severity scores (Autism Diagnostic Observation Scale; ADOS), T_2 and T_4 adaptive functioning (Vineland Adaptive Behavior Scale; VABS II); and T_1-T_4 externalizing and internalizing behaviour (Child Behavior Checklist; CBCL 6-18), and parent characteristics across T_1-T_4 including: estimated household income, parental stress (Parental Stress Index; PSI), and T_1-T_4 parental anxiety and depression self-reported symptoms (Symptoms Checklist-Revised; SCL-90-R).

Results: Of the sample, 21% of the families indicated consistent participation in SRPs over the 4 years and 23% of families indicated no participation. Groups did not differ significantly in gender, autism severity score, or internalizing behaviour. However, compared to children who consistently participated, those who did not participate had significantly lower adaptive functioning skills at T_2 and T_4 and more externalizing behaviours across T_1-T_4 ($p < 0.001$, for all). On parental characteristics, the group who participated consistently had significantly higher household income across time than those who did not participate at all ($p < 0.001$). Adaptive functioning, externalizing behaviour, and household income were significantly correlated with participation ($p < 0.01$).

Conclusions: Study findings show that school-aged children with ASD who regularly participate in SRPs have higher adaptive functioning, fewer externalizing behaviour problems, and higher parental income. These findings are consistent with previous literature indicating child and parental factors that limit or facilitate participation in SRPs. They also underline the importance of implementing and evaluating proactive, multifaceted strategies aimed at reducing child- and family-level barriers to inclusion in SRPs.

196 **130.196** Child Characteristics Associated with Educational Placement in Children with Autism Spectrum Disorders

J. Christiansen[1]*, S. Parlar*[2] *and L. Pedersen*[1]*, (1)Centre for Autism, Herlev, Denmark, (2)Nexus, Copenhagen, Denmark*

Background: With the Danish "Inclusion Law" of 2012 school type placement for Danish children with disabilities has been dictated by a quota: 96% of all children should be in regular classes. Prior to the introduction of the law the question of school type placement for children with disabilities was based on individual needs.

Objectives: To examine child characteristics associated with educational placement of Danish children with ASD, prior to 2012, where individual needs were considered.

Methods: Our sample consisted of 44 low functioning (IQ<70) and 95 high functioning (IQ≥70) children with ASD (all assessed at the same site between 1996-2012). 41/44 low functioning children were in special education. Child characteristics for the remaining 95 high functioning children were analyzed with multiple binary logistic regression to determine predictors of school placement. School placement was either regular classes (n=53; mean age 11.5) or special education (special school/class (n=35) or "other" (n=7))(n=42; mean age 11.4). For all 95 children we had information on: gender, IQ, ADOS, ADI-R, co-morbidity, somatic problems, medication and behavioral problems and for 74 children we had information on Vineland (regular classes n=39; special education: n=35). A variable only entered the logistic regression if it differed significantly (t-test or Chi-square test) between the two school type placements.

Results: The logistic model was at chance when predicting whether or not a child was in special education. Nevertheless, knowing that a child had poor reciprocal social interaction (high scores on ADI-R algorithm scale: "reciprocal social interaction") and the co-morbidity ADHD allowed the logistic model to predict, well above chance, that a child was not in regular class. With these two variables the overall percent correct predictions rose from 56% (percent correct prediction when guessing that all 95 children are in a regular class) to around 70%.

Conclusions: When individual needs are considered almost all low functioning children are in special education. Furthermore, for high functioning children, child characteristics such as ADHD and poor reciprocal social interaction are part of the factors that lead to special education.

197 **130.197** Community Based Autism Liaison & Treatment Project (CoBALT): Decreasing Wait Time and Increasing Access to Services

J. Bellando[1]*, E. Schulz*[2]*, J. J. Fussell*[3]*, D. Chang*[4]*, K. Pearson*[5]*, S. Jernigan*[3]*, J. Oswalt*[5]*, K. Oswalt*[5]*, T. Reid*[3]*, B. Whitaker*[3]*, R. Carey*[5]*, M. Lopez*[6]*, A. Goudie*[3]*,* *M. Campbell[3] and E. Corley[3], (1)University of Arkansas for Medical Sciences, Little Rock, AR, (2)Pediatrics, University of Akansas for Medical Sciences, Little Rock, AR, (3)Pediatrics, University of Arkansas for Medical Sciences, Little Rock, AR, (4)Biostatistics, University of Arkansas for Medical Sciences, Little Rock, AR, (5)James L. Dennis Developmental Center, Little Rock, AR, (6)Dennis Development Center, Little Rock, AR*

Background:

Families can face barriers in obtaining an evaluation for their child for suspected Autism Spectrum Disorder (ASD). If medical professionals are not comfortable in identifying developmental delays (DD) or ASD, they refer to the primary developmental center in the state, UAMS J. Dennis Developmental Center (DDC). This creates longer wait times for evaluations. Children from medically underserved populations often have additional difficulties in accessing services (i.e. transportation, financial constraints).

CoBALT is a capacity-building program that trains teams of physicians, speech pathologists, or behavioral health professionals to conduct Tier II screenings for possible DD/ASD diagnoses. Teams are located throughout the state of Arkansas in order to screen/diagnose and refer for appropriate treatment in their home community. Tier II screening closer to the child's home can may make it easier for families to begin the evaluation process in order to obtain needed services.

Objectives:

To determine 1) referral concerns from PCPs; 2) if the CoBALT model allows quicker access to screening; and 3) diagnostic outcomes of CoBALT screenings. For children who were additionally referred to the DDC, agreement in CoBALT and subspecialty team's diagnoses was assessed.

Methods:

CoBALT teams completed QI outcome data for a 12 months period on all children referred. For children also referred to the DDC by CoBALT teams, QI data was also completed by the DDC team to check for agreement of diagnoses rendered by the subspecialty team vs. CoBALT teams. Frequency data was calculated for all outcome measures.

Results:

In the one year period, 96 children were evaluated in CoBALT clinics (mean age = 3.2 years, 80% male). PCP primary presenting problems were Speech concerns (74%), ASD (43.8%), and DD (33.3%). Primary diagnoses given by CoBALT teams were DD (31.3 %), suspected ASD (20.8%), and Speech Delay (16.7%).

Families were seen within 65.3 days on average and drove approximately 14.3 miles to their local CoBALT clinic. This is compared to an average wait of 171 days for an ASD full team evaluation through the state primary diagnostic center and an average of 54.5 miles traveled by families for that evaluation.

Of the 96 CoBALT children, 37 (38%) were deemed in need of a comprehensive developmental evaluation. Currently, 21 of referred children have been evaluated at the state diagnostic center. The agreement between CoBALT and developmental center diagnoses are high (80%).

Conclusions:

The CoBALT model is promising for a rural, medically underserved state in achieving the mission of ASD screening and helping "whittle down the wait time" for access to services. However, more needs to be done to educate and train medical professionals. Additional educational supports are being created in the state of Arkansas for this purpose.

198 **130.198** Content Analysis of Psycho-Educational Intervention Goal for Young Children with Autism within the ICF-CY Framework.

*K. Strauss[1], A. Delle Fratte[2] and **L. Fava**[2], (1)Umbrella Autism, Rome, Italy, (2)Association for Treatment and Research in Autism Spectrum Disorders "UmbrellAutism", Rome, Italy*

Background:

Effort has been made to use the ICF taxonomy as a way to improve service delivery in health and education (WHO, 2001, 2007), in line with recent advances in research concerning neuro-developmental disabilities demonstrating the usefulness of a functional approach to ASD (Gillberg, 2010). The fact that children with Autism Spectrum Disorders manifest divers pattern of behaviors and level of performance. Such variability with in a broad spectrum challenges the decision-making process of individualized intervention goals, that should include the promotion of a broad range of children's life skills, that are developmentally appropriate and include information on the environmental support (Wilczynski et al., 2007). The ICF-CY based Matrix for Assessment of Activities and Participation (MAAP, Castro & Pinto, 2013) was designed to capture the nature and severity of the limitations of functioning in children with autism spectrum disorders, allows for a developmental norm-referenced rating of each specific skill performance and assesses environmental factors that are scene-setters for the occurrence of forms of participation. Thus, the instrument elicits teaching goals to be included in intervention curricula.

Objectives:

Mapping learning objectives of early intensive behavioral intervention onto the MAAP assessment tool within the ICF-CY framework, to document the extent individual functional domains documented in the assessment process are included in the individualized intervention goals and thus frame the child's current developmental status.

Methods:

This study analyzed the learning objectives of 24 psycho-educational intervention programs developed for pre-schoolers aged 2-6 years with autism, enrolled in early intensive behavioral intervention services in Italy. Individual functioning patterns and aspects of the environment relevant to the child's engagement in daily routines were identified utilizing the MAAP tool. The MAAP comprises 45 items corresponding each to a ICF-CY dimension that was regarded as essential for the assessment-intervention process of children with autism from birth to 6 years of age (ASD core set; Castro & Pinto, 2012, Pinto et al., 2013). Analysis of the overlap of functional dimensions from assessment to intervention goals were carried out through deductive content analysis. The process of analysis has followed a set of sequential steps using the ICF-CY linking rules (Cieza et al., 2005) on the identification of meaningful concepts. Coding was conducted by two independent researchers. Inter-rater reliability was calculated using Kappa Coefficients.

Results:

Results illustrate the majority of functional domains addressed in intervention goals mapped to the Activities and Participation component of the ICY-CY, representing the execution of tasks and forms of involvement in life situations. Nearly all functionality domains identified as essential for children with autism were included both in assessment data and in the intervention goals. Nevertheless, very few Environmental factors were addressed.

Conclusions:

The results suggests that interventions for young children with autism are focused essentially on children's skills and on directly observed performance. Missing consideration of environmental characteristics in which the child is embedded, underrate the multidimensional nature of child development, specifically in program promoting parent, peer and classroom inclusion.

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130.199 Disparities in Service Utilization Among Children with Autism Spectrum Disorder: A Review of the Literature

K. Smith[1]*, J. G. Gehricke*[2]*, S. Iadarola*[3]*, A. Wolfe*[4] *and K. Kuhlthau*[5]*, (1)Children's Hospital Los Angeles, Los Angeles, CA, (2)The Center for Autism & Neurodevelopmental Disorders, University of California, Irvine, Santa Ana, CA, (3)University of Rochester Medical Center, Rochester, NY, (4)Academic Pediatrics, Massachusetts General Hospital for Children, Boston, MA, (5)Massachusetts General Hospital, Boston, MA*

Background:

Previous research has demonstrated racial, ethnic, and socioeconomic disparities in autism spectrum disorder (ASD) diagnosis. However research related to disparities in service access and utilization in ASD is limited.

Objectives:

This literature review identified evidence related to the following key questions (KQ): 1) what are the disparities in service utilization among children with ASD by race/ethnicity and/or socioeconomic status, 2) are there differences in effectiveness of interventions for children with ASD by race/ethnicity and/or socioeconomic status and 3) are there differences in the quality of care provided to children with ASD by race/ethnicity and/or socioeconomic status?

Methods: On September 1, 2016, MEDLINE, PsycINFO, ERIC, and CINAHL databases were searched using a combination of MeSH terms and keywords related to ASD, disparities, treatment, and services; there was no limit to the date range. This search was supplemented by a review of relevant citations. The search identified 175 articles containing relevant keywords and addressing pediatric populations. At least two authors reviewed the titles and abstracts of all articles with full text of potentially relevant articles further reviewed. Authors abstracted articles that address at least one key question and met eligibility criteria.

Results:

Ten articles were identified, of which eight reported findings on service access and utilization (KQ1) with treatment disparities reported along several dimensions including access to care, referral frequency, number of service hours, and the proportion of unmet service needs. Groups with relatively low access to care include African American and Hispanic/Latino children, as well as children from low-income households. Findings from the papers reviewed indicate that these populations were shown to have higher odds of not having a primary care provider, are less likely to receive specialty and subspecialty care, and have less access to special education services as compared to their white, non-Hispanic, higher-resourced counterparts. None of the identified studies examined differences in intervention effectiveness (KQ2). Four studies addressed KQ3 by showing that parents of African American and Latino children reported worse quality of care (e.g. higher reports that doctor did not spend enough time with the family and not being sensitive to the family values), which may indirectly affect treatment effectiveness.

Conclusions:

This systematic review found evidence of disparities in service utilization and service quality among children with ASD by race/ethnicity and socioeconomic status. Evaluation of disparities in access as well as quality of care and effectiveness of intervention may further identify groups in need of outreach, care coordination and/or other interventions.

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130.200 Echo Autism Model for Training School Psychologists and Applied Behavior Analysts

K. O'Connor[1] *and J. Randolph*[2]*, (1)MU Thompson Center, Columbia, MO, (2)University of Missouri, Thompson Center for Autism and Neurodevelopmental Disorders, Columbia, MO*

Background:

Given the heterogeneity of individuals with autism and the complex assessment and programming needs for this population, professionals working with individuals with autism are required to continue their education in order to advance their craft and stay current on evidence-based practices. Yet, there is limited research on the methods, social validity and efficacy of continuing education (CE) opportunities provided to professionals.

Additionally, access to high quality CE opportunities are limited for professionals working in rural areas and regions with limited local expertise available. The Extension for Community Healthcare Outcomes (ECHO) model has been utilized and researched across multiple healthcare conditions as an effective tool for providing professional training using case based teaching and an online community of practice to areas with limited local expertise. (Arora, et al., 2011; Katzman, et al., 2014; Mazurek, 2017; Scott, et al., 2012).

This presentation will provide data from two cohorts of professionals participating in a 9-month ECHO program specifically designed as CE for their professional role: 1) A cohort of behavior analysts participated in ECHO Autism: Applied Behavior Analysis (ABA), 2) A cohort of school psychologists participated in ECHO Autism: School Psychology.

Objectives:

The objectives of this study were to examine the efficacy and acceptability of the ECHO model for School Psychologists and Behavior Analysts. Efficacy data was obtained through pre/post content assessments and pre/post reported use of and confidence with principles/interventions in their respective fields. Social validity data was collected on the acceptability of the ECHO model for CE.

Methods:

Participants included practicing school psychologists, educational diagnosticians and special education administrators (n=15) in ECHO School Psychology and practicing Board Certified Behavior Analysts (BCBAs) and assistants (BCaBAs; n=16) in ECHO ABA.

This study utilized a quasi-experimental design to evaluate the acceptability and efficacy of ECHO for CE. Through the ECHO framework, each of the cohorts participated in a one-hour, monthly online meeting for 9 months. The host panel of experts (in each respective field) facilitated a discussion based on a presented case and provided a content presentation on advanced professional principles.

Measures:

- Pre/post self-efficacy and confidence surveys: comprehensive survey regarding confidence and frequency of use principles/interventions in their respective field
- Pre/post content assessments for each session
- Social validity survey for each session
- Social validity survey upon completion of program with an emphasis on acceptability of CE opportunities

Results:

The data collection is ongoing and will be completed in early spring 2018. Participant pre/post outcomes on the content assessment and confidence/frequency survey will be analyzed. Analyses will also be conducted to examine the relationship between participant characteristics (e.g., years of experience, self-efficacy, attendance) in relation to intervention use and content assessment outcomes.

Conclusions:

The preliminary results of ECHO for CE for special education professionals. The results of this study may provide support for the use of case based learning and an online community of practice to advance professional knowledge. These results may inform the field to evaluate CE opportunities and refine how to determine the efficacy and social validity of professional development.

201 **130.201** Educating Students with Autism Spectrum Disorder in Mainstream Classes: Teacher Knowledge and Use of Empirically Supported Treatments.

R. P. Sulek[1]*, D. Trembath*[2]*, J. M. Paynter*[3] *and D. Keen*[4]*, (1)Griffith University, Australia, Gold Coast, Australia, (2)Menzies Health Institute, Griffith University, Australia, (3)School of Applied Psychology, Griffith University, Southport, Australia, (4)Autism Centre of Excellence, Griffith University, Mt Gravatt, Australia*

Background: Providing equal educational opportunities for children with autism spectrum disorder (ASD) goes beyond providing a place in mainstream classrooms. Children with ASD might experience delays in their development of critical skills that otherwise prepare children for school (e.g., ability to work independently, follow teacher directions). It is therefore crucial that teachers are both aware of these differences, and well equipped to support the development of these skills in the early years of school. Although several empirically supported treatments (ESTs) exist which can target these skills in children with ASD, there has been minimal investigation into the extent to which teachers are aware of, and use ESTs in mainstream settings. Additionally, factors such as the social validity of ESTs and sources of information teachers are accessing must be considered.

Objectives: The aim of our study was to investigate knowledge and use of these ESTs in Australian teachers of the foundation year (commonly referred to as kindergarten or ‘prep’). Additionally, we examined factors that contribute to the uptake of treatments in mainstream settings.

Methods: We used a mixed methods approach, with the research conducted over two phases. Participants in both phases were Australian foundation year teachers working with at least one child with ASD. In phase one, 155 participants completed an online survey which included measures of knowledge, use, and social validity of 20 ESTs and two non-ESTs outlined in Fleury, Thompson, and Wong (2015). Additionally, demographic information and sources of information commonly accessed by participants were collected. In phase two, 13 teachers were interviewed to gain a richer understanding of the factors that contribute to the uptake of ESTs in the classroom.

Results: Participants reported using all 20 treatments at least sometimes, with ESTs used more frequently than non-ESTs. Participant knowledge and perceived social validity of interventions was also significantly positively associated with use (*p’s* $< .001$). Participants interviewed identified several factors that influenced their decisions to use treatments, including the needs of the child, their knowledge and previous experience working with a child with ASD, their access to other professionals, and training received. Reliance on research evidence (i.e., accessing available literature) was found to be infrequently accessed across both phases of the study, with participants more commonly accessing within-school supports.

Conclusions: The strong association between social validity of ESTs and their use highlights the importance of developing, evaluating, and recommending to teachers treatments that are appropriate for use in mainstream settings, in order to close the research to practice gap that exists in autism and education. Taken together with the teacher-identified factors that influence decision making, the findings provide tangible avenues for further clinical-research efforts in collaboration with teachers to improve transition outcomes for children with ASD.

202 **130.202** Effects of Medicaid Waivers for Autism Spectrum Disorder on State Medicaid Expenditures

Z. Cidav[1]*, A. Dick*[2]*, G. Liu*[3]*, M. Sorbero*[4]*,* ***D. S. Mandell***[5]*, B. Stein*[4] *and D. Leslie*[6]*, (1)University of Pennsylvania, Philadelphia, PA, (2)The RAND Corporation, Boston, MA, (3)Penn State College of Medicine, Hershey, PA, (4)RAND, Pittsburgh, PA, (5)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (6)Penn State Milton S. Hershey Medical Center, Penn State College of Medicine, Hershey, PA*

Background: In the United States, Medicaid is the largest source of funding for healthcare services for individuals with autism spectrum disorder (ASD). Several states have passed Medicaid Home and Community-based Services (HCBS) waivers that expand eligibility criteria and available services for children with ASD. Previous research has shown considerable variation in these waivers, but little is known about their effects on Medicaid expenditures.

Objectives: To estimate the impact of state Medicaid waiver programs targeting children with ASD on state Medicaid expenditures, both for institutional and community-based care.

Methods: We use Medicaid claims data from 2001-2013 to estimate state-level expenditures. A fixed effects model will be used to estimate the effects of specific waiver characteristics on Medicaid expenditures among states and over time. We hypothesize that the waivers will result in substitution from institutional care to community-based care and associated cost savings for the states. The effects of waivers on expenditures for children with ASD will be compared with their effects on children without ASD as way to isolate the effects of waiver characteristics from

states' overall Medicaid generosity.

Results: Analyses are ongoing.

Conclusions: The results will identify waiver characteristics that are associated with cost containment and increased use of community care. These results will be the first step towards helping states develop efficient and effective waivers to support children with ASD and their families.

203 **130.203** Embodied Empowerment Design: Reframing the Problem through Co-Design

***J. van Dijk**, Twente University, Enschede, Netherlands*

Background: As health-care policy increasingly focuses on 'empowerment', assistive technologies are developed to help persons with Autism Spectrum Condition (ASC) in independent living. Most technologies quite straightforwardly provide 'solutions' to aid with daily tasks, or to train certain skills.

Objectives: Given the poor success-rates of assistive technologies in general, our co-design approach aims first to explore instead in more detail what the actual problems are, as seen from the lived, embodied and situated experiences of the people involved.

Methods: We work closely together with a small number of people on the spectrum, over a longer period of time. Through a series of design cycles involving contextual interview, role-play, collaborative brainstorming, prototyping, and evaluation of experience prototypes, we develop a designerly understanding of the details of their lifeworlds, along with a final product proposal. Reflecting on this process and the design outcome with stakeholders (people with ASC, family, care-professionals), we uncover implicit assumptions that may actually get in the way of designing truly empowering technologies, and we envision what alternative conceptualizations may look like.

Results: In this talk I present two cases. The first concerns a system of wireless lamp-bodies that provide situated hints to help structure the day. The second is a smartwatch allowing users to record their own relaxing messages to be played in response to situations of stress. Using these cases I develop the vision of Embodied Empowerment. This vision on empowering technologies critically reframes several conventional interpretations of assistive technology. First: our designs never directly address 'the disorder'. Straightforward attempts at 'solving problems caused by autism', I claim, are always potentially misguided. Instead, Embodied Empowerment calls for technology that enables people first and foremost to be and become most fully themselves. Second, our systems do not 'take over': they provide scaffolds with which people may regain control over their lives, recruiting their skills and available resources in the environment. Third, our technologies are not 'monitoring' or 'training' tools used by care-givers, nor are they replacing real people: instead they mediate in social relations with significant others, towards more empowered interactions. Fourth: while we use information technology, we do not use it to 'remind', 'instruct' or 'inform' the user about what to do. Rather, we design objects and spaces with interactive properties to catalyze and transform sensorimotor routines, such that the user can find (his own) information, by taking action. Finally, we envision not finished solutions, but open platforms. which can be tailored by people in use to their individual needs, interests and talents.

Conclusions: To conclude, we used a co-design research approach as a method to critically reframe some implicit assumptions in present-day assistive technology. The resulting vision of Embodied Empowerment opens up a large, unexplored design potential, promising new personally meaningful devices, to empower persons with ASD in living their everyday lives, on their own terms, in their own unique ways.

204 **130.204** Examining the Relationship between Educator Knowledge, Implementation Frequency, and Perceived Feasibility of Utility of Evidence-Based Practices Following a Training Paradigm of in-Person and Teleconferenced Training, Coaching, and Mentorship

***W. Loring**[1], C. McQueen[1], T. E. Foster[2], A. Dubin[2] and P. Juárez[1], (1)Vanderbilt University Medical Center, Nashville, TN, (2)Nemours/Alfred I. duPont Hospital for Children, Wilmington, DE*

Background: Federal legislation calls for educators serving students with autism spectrum disorder (ASD) to use evidence-based practices (EBPs). Educator feedback indicates that correctly identifying and implementing EBPs has become increasingly challenging, and the amount of pre-service information regarding EBP's and ASD varies greatly. Therefore, training in EBPs for educators is a pressing national need. In response, we partnered with our state's Department of Education in which collaborative planning of systems of professional development and program evaluation result in opportunities for students and educators to receive best-practice support and training. Through this, three-day workshops are provided in a fixed-model, experiential training paradigm designed for the unique support needs for staff educating students with ASD and provides in-person and teleconferenced training, coaching, and mentorship. During the year examined for this poster, 6 workshops were conducted in 3 versions for early childhood, elementary/middle, or high school educators. These workshops focus on the impact of ASD on learning and strategies to implement EBPs feasibly and successfully in optimizing learning.

Objectives: 1. To assist school districts statewide in moving towards more inclusive and evidence-based practices, 2. To develop nationally replicable models of high-quality educator professional development, 3. To advance policies and practices related to successfully building capacity and sustainability in educating students with ASD

Methods: Data collected evaluates: 1. Increased knowledge of targeted EBPs, 2. Implementation frequency and fidelity of targeted EBPs and 3. Perceived satisfaction, feasibility, and utility in optimizing student outcomes post-workshop. Knowledge and satisfaction data are collected immediately post-workshop. Reported implementation, feasibility, and utility are collected immediately post-workshop, during a classroom consultation 2 months post-workshop, and via survey 6 and 12 months post-workshop. Implementation fidelity is coded by consultants during the classroom consultation. The focus on this poster is examining the correlation between EBP knowledge and reported implementation, feasibility, and utility 2 months post-workshop.

Results: Across all workshop versions, there was a significant increase in EBP knowledge post-workshop. There was a significant correlation between EBP knowledge and reported implementation in one EBP in the High School version. There were no significant correlations between EBP knowledge and reported feasibility, utility, or implementation for any other EBPs across workshops. Reported implementation and perceived feasibility and utility were high 2 months post-workshop and implementation fidelity was moderate. There were significant correlations between feasibility and utility for all EBPs and between both feasibility and implementation and implementation and utility for 86% of targeted EBPs (see table).

Conclusions: This training paradigm results in increased EBP knowledge with moderate levels of implementation fidelity 2 months post-workshop.

EBP's were perceived as feasible to implement and useful in optimizing student outcomes. While minimal correlations were seen between EBP knowledge and implementation, feasibility, and utility, these 3 factors were highly correlated post-workshop, indicating that perceived feasibility and utility are directly related to the frequency of EBP implementation. These data are of great value in developing effective and efficient forms of professional development to support the critical need for educator training in the provision of EBP's in working with students with ASD.

205 **130.205** Experiences of Treatment and Support for Mental Health Problems, Self-Injury and Suicidality in Adults with Autism Spectrum Conditions.

L. Camm-Crosbie[1]*, S. A. Cassidy*[2]*, L. Bradley*[1] *and R. Shaw*[3]*, (1)Coventry University, Coventry, United Kingdom, (2)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (3)NHS Coventry and Warwickshire Partnership Trust, Warwickshire, United Kingdom*

Background: Recent research has shown that adults with Autism Spectrum Conditions (ASC) are at high risk of co-morbid psychiatric disorders, non-suicidal self-injury and suicidality. However, anecdotal evidence suggests that adults with ASC may have difficulty accessing appropriate support and treatment for these difficulties. This is particularly worrying considering that adults with ASC are significantly more likely to die by suicide than the general population.

Objectives: To explore experiences of support and treatment for mental health difficulties, self-injury and suicidality amongst adults with ASC.

Methods: An online survey exploring mental health, non-suicidal self-injury and suicidality was designed with the help of a steering group of eight adults diagnosed with ASC. Data from the section of the survey including qualitative questions on experiences of support and treatment for these difficulties are presented. Open ended questions explored experiences of trying to obtain, and receiving treatment and support for mental health problems, self-injury and/or suicidality.

Results: The ASC group comprised 200 adults (122 females, 77 males, 1 unreported) aged 18 to 67 (M = 38.9, SD = 11.5). Thematic analysis was used to analyse these qualitative data. An overarching theme was identified that tied together participants' diverse experiences: that individually tailored treatment and support was both beneficial and desirable. Participants described lack of available services for adults with ASC with mental health problems, lack of professionals understanding and knowledge of ASC, and the importance of effective adapted treatment and support for their wellbeing. For many, positive experiences of tailored treatment and support meant that suicide was no longer seen as part of their future.

Conclusions: Findings demonstrate an urgent need for professionals' to improve their awareness of ASC and adopt a more flexible approach, suited to individual needs. Participants' experiences clearly indicated that this is essential for improving their wellbeing, reducing mental health problems, self-harm and suicidality. Results will be used to inform mental health service provision for adults with ASC.

206 **130.206** Exploring the Relationship between Social Skills Knowledge and Reported Family Quality of Life through PEERS

J. Mueller[1] *and L. Dewey*[2]*, (1)Nemours/Alfred I duPont Hospital for Children, Wilmington, DE, (2)Nemours/AIDHC, Wilmington , DE*

Background: The Program for the Education and Enrichment of Relational Skills (PEERS), a social skills group program developed at UCLA (Laugeson and Frankel, 2010), teaches social skills to adolescents with ASD using simultaneous adolescent and parent groups. Research suggests that engagement in social skills groups for teens with ASD can not only improve peer relationships, but also their family's quality of life (Rankin et al., 2016; Laugeson et al., 2012; Haddad, 2013). Additionally, it is understood that parents highly value the acquisition of social skills in their teen with ASD (Rankin et al., 2016). Consequently, many of the factors impeding a high family quality of life for families with a child with ASD stem from social skills deficits (Lee, L., Harrington, R., Louie, B., and Newschaffer, C., 2008; Rao, R. & Beidel, D., 2009).

Objectives: This research project aims to better understand the impact of PEERS on family quality of life and social skills knowledge. Aim 1: Better understand possible reported change in family quality of life and social skills knowledge after participation in PEERS; Aim 2: Assess a possible relationship to between family quality of life and social skill knowledge.

Methods: The adolescent completed the Test of Adolescent Social Skills Knowledge (TASSK) and the parent completed the Family Quality of Life Scale (FQOL) pre and post completion of the PEERS group. Pre and post scores on the TASSK and the FQOL were assessed using repeated measures t-tests, and regression analysis was used to determine if changes in the TAASK scores were related to changes in FQOL scores

Results: Thirty families enrolled in PEERS across Delaware (age range of child: 7-17; M=13 years; Males=23, Females=7), and 14 families were considered to have completed PEERS (attended 10 or more sessions and completed both pre and post measures). No difference was reported regarding family quality of life (FQOL: $t(13)=-.737$, $p=.474$) following PEERS. However, there was a significant improvement in the scores on the TASSK after PEERS intervention (TASSK: $t(9)=-7.592$, $p=.000$). Nevertheless, there was no significant effect of social skills knowledge on family quality of life ($F(5, 1)=.148$, $p=.972$).

Conclusions: This study shows that adolescents gained social skills knowledge after completion of PEERS. However, increase in social skills knowledge did not seem to impact family quality of life. It is possible that other factors of social skills interactions might contribute to family quality of life, and future research is needed to understand the impact of social skills group interventions on families. This information can help guide future research in understanding the need for other social interventions and family focused treatment to improve quality of life for families with an adolescent with ASD.

207 **130.207** Exploring Unconscious Bias of Health Care Professionals Caring for Children with Autism

L. I. Florindez[1]*, D. H. Como*[1]*, J. Polido*[2]*, S. A. Cermak*[3] *and L. I. Duker (Stein)*[1]*, (1)Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)Children's Hospital, Los Angeles, Los Angeles, CA, (3)USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA*

Background:
Some patient populations experience marginalization in health care settings. Children with autism spectrum disorders (cASD) often experience challenges when receiving medical care due to their sensory sensitivities. Health care providers (HCPs) have direct contact with cASD and their families and rely on communication to build relationships and create rapport. Language used by HCPs can influence provider-patient encounters,

impact the stigma associated with being diagnosed with a disability, and change the way cASD experience health.

Objectives:

This paper will explore hidden assumptions held by some HCPs toward their patients with ASD, and how those beliefs are expressed in their language and actions.

Methods:

Two focus groups of 9 dental practitioners treating cASD were conducted to describe oral care related challenges experienced by cASD and identify strategies to address them. Each session lasted 2.5-3 hours and was transcribed verbatim. Thematic analysis was used to describe strategies to improve care, with codes developed inductively from the data and informed by sensitizing concepts from the literature. Having completed the analysis focused on strategies, it was clear that there were important aspects of the data that were not accounted for by the initial coding scheme. Additional codes driven by the data emerged related to the hidden biases of dentists when discussing children with ASD and their families.

Results:

Three themes were identified. The first, *Healthcare Microaggressions,* described instances when HCPs described their patients in a manner that communicated subtle negative opinions. This included implying that some parents could not be bothered to make appropriate oral care related decisions for their children. The second theme, *Marginalization,* denoted the use of exclusionary language, such as "those kids," which created a sense of otherness, specifically identifying children with ASD as different from "normal" patients. The last theme, *Preconceptions,* focused on HCP comments that illuminated subtle biases and opinions they had about their patients. Statements included their perception that some parents of children with ASD did not value their child's oral health enough to conduct routine oral care between visits, and assumptions about their patients' cultural backgrounds.

Conclusions:

Focus group findings provide insight into the implicit biases held by HCPs and how they manifest in their language and interactions with patients. The lives of cASD and their caregivers are affected by the stigma they experience in health care settings. In presenting examples of assumptions embedded in HCP language, we aim to raise awareness about the significance and consequences of biased communication in the patient-provider relationship and how to decrease stigma in marginalized populations. Further research is necessary to understand how these assumptions relate to quality of care.

208 **130.208** Feasibility and Potential Impact of the Building Alliances to Meet Autism Needs in Clinical Encounters (BALANCE) Program

S. L. Snow[1,2]*, J. M. Chorney*[3] *and I. M. Smith*[4]*, (1)Psychology and Neuroscience, Dalhousie University, Halifax, NS, Canada, (2)University of Manitoba, Winnipeg, MB, Canada, (3)Dalhousie University, Halifax, NS, Canada, (4)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA*

Background: Youth with autism spectrum disorder (ASD) have a high need for healthcare services but tend to have difficult experiences. Recommendations for improving care experiences emphasize family-centered approaches (FCC; partnering with families, assessing needs of each child, coordinating care, expressing empathy).Working collaboratively with HCPs and families, we developed an intervention (BALANCE: Building ALliances to meet Autism Needs in Clinical Encounters) to address barriers and improve the delivery of FCC for children with ASD. BALANCE consists of seven online modules for HCPs, and a toolkit of resources designed for the day surgery unit.

Objectives: This study explored the feasibility and potential impact of BALANCE.

Methods: BALANCE was implemented in the day surgery unit of a Canadian pediatric tertiary care hospital. All HCPs were shown the toolkit and invited to complete BALANCE. HCPs self-reported on barriers to and the delivery of FCC at baseline, post-intervention, and three-month follow-up. Linear mixed-effect models were used for analysis. HCPs also rated the feasibility of BALANCE and provided suggestions for improvement.

Results: Of the 106 interdisciplinary healthcare providers on the unit, 70 consented to participate. Of these, 62 started BALANCE, 53 completed all modules. HCPs reported significant reductions in barriers from baseline to post-intervention that were sustained at follow-up, and significant increases in delivery of FCC from baseline to follow-up. More than 95% of HCPs rated modules as usable, acceptable, and feasible. The most common theme regarding improvement was to equalize sound levels across modules.

Conclusions: The implementation of BALANCE was successful, indicating feasibility. BALANCE has the potential to address barriers to care and improve the delivery of FCC to children with ASD. Challenges with the delivery of FCC to children with ASD occur across healthcare contexts; BALANCE could be adapted for other care settings.

209 **130.209** Higher Levels of Autistic Traits Are Associated with Lower Wellbeing in Performing Arts Professionals and Students

E. Buckley[1]*, E. Pellicano*[2] *and A. Remington*[3]*, (1)UCL Centre for Research in Autism & Education, London, United Kingdom, (2)Macquarie University, Sydney, Australia, (3)UCL Centre for Research in Autism and Education, London, United Kingdom*

Background:

Researchers and clinicians have long held that imagination is limited in autism. Yet it is increasingly recognised that creativity might be an area of strength in autistic people (Best *et al.*, 2015). Although creative practice has not traditionally been thought of as an occupation in which autistic people would engage, anecdotal reports suggest that there might be a group of individuals with high levels of autistic traits pursuing careers in creative fields such as the performing arts. The performing arts is a varied profession, but usually artists are self-employed and need to possess skills including networking, administration, self-promotion, and time management – skills that are well known to be challenging for autistic people. Performing artists with high levels of autistic traits may therefore be experiencing difficulties in these areas and may benefit from support.

Objectives:

This study sought for the first time to identify the extent to which autistic people, or those with high levels of autistic traits, are pursuing careers in the performing arts, and to determine the nature of the relationship between individuals' autistic traits and their reported wellbeing, including perceived self-efficacy (during training and in the workplace), quality of life, mental health and perceived level of support required.

Methods:

To address these aims, we recruited a self-selecting, community-based sample of individuals working or studying in the performing arts, and invited them to complete an online survey. 1729 respondents took part: 1447 professionals and 282 students. The survey collected responses on participants' backgrounds, including diagnostic history as well as measures assessing their level of autistic traits (Subthreshold Autistic Traits Questionnaire (SATQ)), perceived self-efficacy (related either to their workplace or education, indexed by bespoke measures), quality of life (WHOQOL-BREF) and mental health (PHQ-8, GAD-7). There were also asked open-ended questions about support needed, received, or desired in their workplace or educational institution.

Results:

16 professionals (1%) and 8 students (3%) reported a clinical diagnosis of autism, and 50 professionals (3%) and 8 students (3%) scored more than 2 SD above the mean score on the SATQ. Correlational analyses between SATQ scores and scores on wellbeing measures demonstrated significant relationships for quality of life ($r=-0.34$, $p<0.001$), self-efficacy (workplace: $r=-0.41$, $p<0.001$; educational: $r=-0.44$, $p=<0.001$) and mental health (depression: $r=0.405$, $p<0.001$; anxiety: $r=0.360$, $p<0.001$): higher levels of autistic traits were associated with lower levels of quality of life, lower levels of self-efficacy and greater severity of mental health conditions. 631 (44%) professionals and 94 (33%) students reported a desire for more support, and autistic traits were significantly higher in participants who wanted support ($p<0.001$).

Conclusions:

Within the community of performing artists, there are a minority of individuals who are autistic or who have high levels of autistic traits. This study has demonstrated for the first time that these individuals may be especially vulnerable to lower wellbeing. More research is needed to understand how best to support these individuals.

210 **130.210** Identifying and Combating Intervention Misinformation in Autism

J. M. Paynter[1], *S. Luskin-Saxby*[2], *A. DeBlasio*[3], *G. Frost*[4], *K. Fordyce*[5], *C. Imms*[6], *D. Keen*[7], *S. Miller*[8], *D. Trembath*[9], *M. Tucker*[10] *and U. Ecker*[11], *(1)School of Applied Psychology, Griffith University, Southport, Australia, (2)Griffith University, Southport, Australia, (3)Anglicare SA ASELCC, Adelaide, Australia, (4)Anglicare SA Daphne St Autism Specific Early Learning and Care Centre, Prospect, Australia, (5)North West Tasmania Autism Specific Early Learning and Care Centre, St Giles Society, Burnie, Australia, (6)Australian Catholic University, Melbourne, Australia, (7)Autism Centre of Excellence, Griffith University, Mt Gravatt, Australia, (8)Autism Association of Western Australia, Perth, Australia, (9)Menzies Health Institute, Griffith University, Australia, (10)Queensland Autism Specific Early Learning and Care Centre, AEIOU Foundation, Nathan, Australia, (11)University of Western Australia, Perth, Australia*

Background: Autism has been described as a “fad magnet” (Metz et al., 2005) with an array of interventions of varying quality and safety available. Many of these are aggressively marketed using anecdotes, appeals to emotions, and celebrity endorsements. This occurs in the absence of empirical evidence, or even in the presence of refuting empirical evidence. Surveys of parents (Carlon et al., 2014) and professionals (Paynter et al., 2017) have shown that practices rejected by research continue to be used despite widely available reviews documenting effective (and ineffective) interventions (e.g., Wong et al., 2015). This may be due to the presence of misinformation regarding the evidence-base of interventions, which poses a potential challenge to providing the best possible support to individuals with autism and the wider community. For example, the harmful effects of misinformation are evident in declining vaccination rates linked to the myth that vaccines cause autism. Ironically, poorly designed refutations, or “debunkings” of such misinformation may further exacerbate the problem. For instance, attempts to debunk the vaccine-autism myth have led to a reduction in intention to vaccinate (Nyhan et al., 2014). However, the cognitive science literature provides guidelines for more effective strategies to debunk myths, and emerging research supports the efficacy of these techniques to addressing the vaccine-autism myth (e.g., using visuals; Dixon et al., 2015). To date, these guidelines have not been applied to autism interventions.

Objectives: We aimed to test the application of debunking principles (e.g., visualizing evidence, demonstrating consensus, see Lewandowski et al, 2012 review) to debunking autism intervention myths. We hypothesized that optimized materials using these principles would be more effective in changing knowledge and intentions to use and recommend ineffective strategies, than currently available materials that did not use these principles in their design.

Methods: In Phase 1, 71 early intervention staff completed questionnaires measuring knowledge and use of autism intervention strategies, attitudes towards evidence-based practice and towards researchers generally. In Phase 2, participants were randomly assigned to two groups for training: control (treatment as usual) and optimized debunking (specifically targeting three ineffective strategies to address misinformation about intervention effectiveness observed in Phase 1). In Phase 3, a follow-up assessment will be conducted in November 2017. Information regarding perceived evidence, use, and intended use, of strategies will be collected using measures adapted from Paynter et al (2017).

Results: Phase 1 results indicate the presence of misinformation regarding the evidence-base of both effective and ineffective interventions. Further, perception of an intervention as evidence-based was linked to greater reported use, irrespective of accuracy of this belief. The impact of optimized debunking compared to treatment as usual, follow-up outcomes, and predictors of response to the training will be presented.

Conclusions: Effective knowledge translation mechanisms are essential for improving access to evidence-based interventions for children with autism and for minimizing the risk of exposure to ineffective and potentially harmful interventions. Increasing the awareness of the evidence base of effective interventions along with debunking misinformation regarding ineffective interventions is vital to improve real-world implementation and sustained change in practice.

211 **130.211** Identifying Clinician Barriers to Quality Mental Health Treatment for Adults with Autism

S. R. Crabbe[1], *B. B. Maddox*[1] *and D. S. Mandell*[2], *(1)University of Pennsylvania, Philadelphia, PA, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: The number of adults diagnosed with autism is growing. More than half have a co-occurring psychiatric disorder, with anxiety and depression being the most common (Buck et al., 2014). In the general population, especially for those with public insurance, these disorders are typically treated at local community mental health centers (CMHCs). Many adults with autism would benefit from mental health treatment, but do not access these services, often because there are few clinicians trained to work with them. There is limited literature exploring this topic, and examining clinician perspectives on training needs would shed light on specific strategies to increase the quality services available to adults with autism. This study is the first to directly interview mental health clinicians on their experiences and needs in regards to treating adults with

autism.
Objectives: This community partnered study aims to identify the barriers clinicians in CMHCs face in providing quality services to adults with autism. These results will directly inform the development of a training program for CMHC clinicians.

Methods: To date, 28 clinicians (86% female, 76% white) from six CMHCs have completed a semi-structured interview. Participants were psychotherapists, case managers and intake coordinators. The interview contained questions about their knowledge of autism symptoms in adults, experience with and confidence in treating adults with autism, prior education and training related to adults with autism, and recommendations for topics that related training should address. All interviews were audio recorded and transcribed professionally for analysis. The analysis will be guided by grounded theory.

Results: Data collection and analyses are ongoing and will be completed by February 2018. While some clinicians noted that they had provided services to a handful of adults with autism, many did not have any experience treating this population. Most participants had no training or education in treating adults with autism and could only describe a few autism symptoms. Many clinicians were open to working with adults with autism, but lacked confidence to provide proper treatment due to inadequate knowledge about effective strategies for this population. For example, one clinician noted during her experience providing therapy to an adult with autism, "I was asking him the wrong questions or I was saying things in a way that I wasn't communicating or getting through to him. So it was challenging for me and…probably frustrating for the client."

Conclusions: Many CMHC clinicians do not have the confidence or skills to effectively address the needs of adults with autism. Clinicians could be better equipped to do so with the right training. From their perspective, priority training needs include a deeper understanding of core autism symptoms and how those affect the therapeutic relationship, along with direction on modifying treatment strategies for adults with autism. Clinicians would be interested in participating in an interactive training program, preferably with involvement from adults with autism, role-play exercises, discussion of actual cases, and ongoing consultation. Clinician training would increase their competence and confidence to provide needed services that will enhance the quality of life of adults with autism.

212 **130.212** Identifying Services That Provide Assistance to Individuals with Autism Spectrum Disorder in Brazil

J. Portolese[1]*, D. Bordini*[2]*, R. Lowenthal*[3]*, E. C. Zachi*[4] *and C. S. de Paula*[5]*, (1)Clinical Hospital, Sao Paulo, Brazil, (2)Departament of Psychiatry, Federal University of São Paulo, Sao Paulo, Brazil, (3)Santa Casa Hospital, Sao Paulo, Brazil, (4)Clinical Hospital, São Paulo, Brazil, (5)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil*

Background: In Brazil, the Unified Health SystemSUS should cover the majority of assistance services for individuals with Autism Spectrum Disorder-ASD, but there is no data on this field.
Objectives: To identify Brazilian institutions that provide assistance to individuals with ASD.

Methods: Information were collected through registries of the State Department of Health, Autistic Friends Associations-AMAs and searches on the internet. The institutions were contacted in order to gather information concerning target public and characteristics of the service.

Results: 650 institutions were identified, most of them concentrating in the Southeast and South regions of the country. Most of the institutions are the Association of Parents and Friends of Exceptional Children-APAEs, Centers for Child and Youth Psychosocial Care-CAPSIs and AMAs. There is a predominance of assistance to children and adolescents. Multiprofessional services were more frequent and intervention approaches include TEACCH, Psychoeducation and ABA.

Conclusions: The amount of institutions that assist individuals with ASD is insufficient and distributed irregularly in the country besides lacking to provide assistance to youngers and adults. The variability of the characteristics of the services reveals a lack of standardization regarding the procedures adopted. Knowledge of this information may help to promote the development of new evidence-based intervention proposals.

213 **130.213** Impact of Training Program to Treat Children with Autism in the Brazilian Public Health System

C. S. de Paula[1]*, L. C. Silva*[1]*, E. L. Ribeiro*[2] *and M. C. Teixeira*[1]*, (1)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (2)Secretaria Municipal de Saúde de São Paulo, Secretaria Municipal de Saúde de São Paulo, São Paulo, Brazil*

Background: Autism Spectrum Disorder (ASD) affects different areas of the global development of the individual, primarily socialization, behavior, sensory functions and language. Due to the complexity and variability of clinical settings, professionals working with children with ASD need to receive specialized training.
In Brazil, the Unified National Health System provides universal access to health services for the entire Brazilian population. According to the Brazilian public policy, some services are considered strategic for the identification and treatment of children/adolescents with ASD, mainly the Psychosocial Community Care Center for Children and Adolescents (CAPSi) which are day treatment facilities with multidisciplinary teams. However, recent research has indicated the lack of specialized training for the treatment of autism even in the CAPSI units.

Objectives: to develop, implement and to verify the impact of a training program aimed at professionals working with children with ASD in CAPSis, focused primarily on managing problems of behavior, communication and social interaction.

Methods: Design: quasi-experimental. Site: The public health system of the São Paulo city is organized in five regionals. This study was conducted in four out of five existing CAPSI in the northern regional of São Paulo city. Participants: 14 professionals nominated by the four CAPSis. Training program was composed of six stages (total of 16 hours divide in four meetings): (1) pre-intervention observation; (2) meetings with professionals to assess the topics/main needs to the training program; (3) development of materials for training and evaluation; (4) meetings for the implementation of training; (5) Final meeting for discussion of cases (6) distance supervision. Instruments to evaluate the training program: (1) Knowledge, Attitudes and Practices-KAP questionnaire; (2) Videos and questions; (3) Satisfaction Questionnaire.

Results: In general, this work fulfilled the objective of developing and implementing a feasible training program for CAPSI professionals. About the video evaluation, there were increases in the percentage of correct answers in 11 of the 13 videos used in the evaluation of the training. Regarding the three subscales of the KAP survey, there was an improvement in knowledge questions ($p = 0.003$) and attitudes ($p = 0.050$), but this difference was not confirmed in the practice category ($p = 0.186$). Furthermore, the study participants had a positive reaction to the training, since 100% of them evaluated the training program as excellent or good.

Conclusions: this brief and low-cost training program for the care of children with ASD was shown to be feasible with positive results, taking into account the challenges of the reality of the public health system. Two out of the 13 evaluative videos did not show an increase in the mean score after training and some hypothesis have been raised. Upcoming studies should review them, and make necessary changes for better evaluation.

214 **130.214** Improvements in Patient Access Result in Earlier Age of Diagnosis in a Clinical Setting

C. Hall[1]*, J. Hamel*[2] *and S. Miller*[2]*, (1)Emory University, Marcus Autism Center, Atlanta, GA, (2)Marcus Autism Center, Atlanta, GA*

Background: Recent CDC findings report a median age of autism diagnosis of 50 months (Christensen et al., 2016), though autism can be reliably diagnosed by 24 months. As one of the only specialty clinics in our state and one that serves a diverse and often economically disadvantaged population, children tend to receive a diagnosis even later, with a median age of diagnosis of 63 months in 2012. Many factors likely contribute to this later age of diagnosis including limited access to diagnostic services throughout the state as well as long wait times for appointments. In response to these concerns, several clinical initiatives were undertaken with the aim of improving patient access to diagnostic services.

Objectives: The purpose of this study was to determine whether initiatives to improve patient access and to reduce wait times were associated with clinically significant changes in age of diagnosis of ASD.

Methods: A patient access steering committee was formed in 2016 with the goal of reducing the waitlist and improving access to diagnostic assessments. Several procedural changes were made including requiring a PCP referral, clinical review of records prior to scheduling, and fast-tracking children younger than three into diagnostic appointments within two months of referral. Additionally, 26 clinicians participated together in an intensive diagnostic campaign to complete 170 assessments within 2 weeks. To determine whether these collective efforts resulted in lower age of diagnosis, records were reviewed for all children receiving diagnostic evaluations between November 2016 and June 2017. Information including child's age, diagnosis, race, ethnicity, and gender were included in the review.

Results: 861 children received diagnostic evaluations between November 2016 and June 2017, and 619 (72%) of these received a diagnosis of ASD. The demographic characteristics of the children with ASD were as follows: 38% African American, 45% White, 3% Asian, and 14% other. Twelve percent of the families served were non-English speaking and 70% had Medicaid as their primary insurance. Of those children diagnosed with ASD, 523 (84%) had never been identified as having ASD before. The median age of first time diagnosis was 42 months (SD = 28 months) as compared to the median age of 63 months (SD = 31 months) in 2012. One hundred seventy-five (33%) of the children were younger than 3 years old at time of first diagnosis. There were no differences in age of diagnosis based on gender, race or ethnicity.

Conclusions: A multi-faceted approach to improving access to diagnostic services resulted in 21-month difference in median age of autism diagnosis (3 years, 6 months old in 2017 as compared to 5 years, 3 months in 2012). This change highlights the importance of access and the impact it can make on early identification of ASD, particularly in diverse communities. Given that early intervention is associated with better long-term outcomes for children with ASD (Dawson et al., 2009; MacDonald et al., 2014), such clinical undertakings are a priority for the field and continued work is needed to identify more children at earlier ages.

215 **130.215** Increasing Access to Empirically-Validated Interventions for Autism Spectrum Disorder: Dissemination of PEERS into Community Mental Health Settings

L. Dewey*, Nemours/AIDHC, Wilmington , DE*

Background: Autism spectrum disorder (ASD) is a lifelong neurodevelopmental disorder marked by significant impairment in social communication and interaction and presence of restricted, repetitive patterns of behaviors and interests. A recent needs-assessment of families affected by ASD in the state of Delaware identified a critical need for social skills interventions among parents of children with ASD (Rhoton & Ekbladh, 2012; University of Delaware, 2013).

Objectives: This research project aims to build capacity for social skills interventions for ASD for adolescents in community mental health settings in Delaware, using The Program for the Education and Enrichment of Relational Skills (PEERS), a social skills group program developed at UCLA (Laugeson and Frankel, 2010). Aim 1: Build capacity for ASD interventions by providing formal education to community clinicians in PEERS; Aim 2: Assess family outcomes following participation in PEERS regarding social skill symptoms, parenting stress, and family quality of life.

Methods: Aim 1: A two-day education on PEERS was provided to community clinicians (n=15). Clinicians completed a survey developed by the researchers assessing their perception of implementing a social skills group intervention for families affected by ASD prior to the two-day education, after the two-day education, and following PEERS group completion. Aim 2: Five PEERS groups were held at three community mental health locations across the state of Delaware. Caregivers (n=14) completed 1) Social Responsiveness Scale, Second Edition (SRS-2) 2) Stress Index of Parents of Adolescents (SIPA) and 3) Beach Center Family Quality of Life Scale (FQOL).

Results: Clinicians reported increased confidence in their ability to deliver social skills intervention following two-day education on PEERS, as rated on a Likert Scale with 0 being no confidence and 5 being most confidence (pre: M=3.2, SD=1.3; post: M=4.1, SD=.9; $t(14)=-2.82$, $p=.014$). Furthermore, the clinicians who facilitated a PEERS group (n=9) reported a clinically significant increase in confidence ($t(8)=-2.309$, $p=.05$). Thirty families enrolled in PEERS across Delaware (age range of child: 7-17; M=13 years; Males=23, Females=7), and 14 families were considered to have completed PEERS (attended 10 or more sessions and completed both pre and post measures). No difference was reported regarding family quality of life (FQOL: $t(13)=-.737$, $p=.474$), social skills (SRS-2: $t(11)=-1.183$, $p=.261$), or parenting stress (SIPA: $t(11)=.549$, $p=.594$).

Conclusions: This study shows the feasibility of expanding social skills interventions for children and families affected by ASD into community mental health settings, as 15 clinicians received additional education regarding social skills interventions and five more group opportunities using the PEERS program were made available in the community. Although the PEERS program did not show changes in family quality of life, adolescent's social skills, or parenting stress, the study was limited by a small sample size of 14 families completing the intervention. Future research is needed to understand family characteristics and barriers that may impact completion of social skills programs in the community.

216 **130.216** Integrating Clinic-Based and Parent-Mediated Intervention for Autism in India

S. H. Dalwai*, Developmental Pediatrics, New Horizons Health and Research Foundation, Goregaon East,, India; Indian Academy of Pediatrics Mumbai, Mumbai, India*

Background: India contributes to most of the five million children with Autism Spectrum Disorder (ASD) in South Asia. However, studies have mainly reviewed solitary therapies or exclusive parent-mediated interventions. The clinical complexity of ASD demands a comprehensive approach. Few studies have evaluated clinical interventions aligned with intensive caregiver-engagement, partly due to the scarce treatment documentation and limited patient compliance for a sustained duration due to low insurance coverage.
Objectives: This study aims to describe the framework and outcomes of an interdisciplinary intervention program for children with ASD in Mumbai, India.

Methods: Founded in 2003, the aforesaid program headed by a developmental pediatrician includes an audiologist, psychologists, occupational and physical therapists, remedial educators, speech therapists and other visiting specialists (ophthalmologist, neurologist, orthopedic, psychiatrist, and nutritionist). Each child receives a trans-departmental evaluation and an interdisciplinary, goal-oriented, individualized and measurable program for a defined time-period (e.g. six months). Thereafter, the child is re-evaluated for the attainment of therapeutic goals. Individual sessions span 45 minutes with a 1:1 child-therapist ratio. On average, children receive 48-72 sessions of occupational therapy (2-3/week), 24-48 sessions of speech therapy (1-2/week) and 5-6 sessions of caregiver counseling. In addition to monthly counseling, a 'home-program' encourages caregivers to adhere to proven practices for mitigating routine behavioral concerns in ASD (adequate sleep, outdoor physical play, minimum gadget and animation exposure and home-cooked ASD-customized diet); and monthly group meetings help them to co-learn ways to interpret and respond to the child's needs. Retrospective quantitative (Stata-12) and qualitative sub-analyses at different time-points with varying sample sizes (due to the degree of patient compliance and documentation of outcomes) revealed key results.

Results: Out of 4265 children evaluated during 2009-2016, 625 were diagnosed with ASD (14.6%; mean chronological age [CA]:49 months) using the Diagnostic and Statistical Manual of Mental Disorders. Data reflect the public health burden of delayed care-seeking. Paired t-test analysis (n=19) of Receptive-Expressive Emergent Language Scale assessments revealed significant differences between mean receptive language age (RLA in months) at evaluation-1 (mean:20.7) and evaluation-2 (mean:30.6) [p=0.003,95% CI:3.6-16.1]; and mean expressive language age (ELA in months) at evaluation-1 (mean:16.1) and evaluation-2 (mean:24.9) [p=0.006,95% CI:2.6-14.9]. Difference in mean total scores on Childhood Autism Rating Scale (n=38) was 4.2 (p=0.0001,95%CI:3.2-5.1); and in mean social age on Vineland Social Maturity Scale was 0.8 years (p=0.0001,95%CI:0.6-1.1). Thus, the six-month intervention substantially impacted receptive and expressive communication and social behavior. The gap between CA and RLA (not ELA) at evaluation-1, inversely correlated with therapeutic outcomes. These results are supported by studies citing greater receptive language difficulties in ASD (viz. echolalia, scripted speech, and unusual prosody) compared to expressive language. Caregiver interviews (n=10) revealed that parents developed a greater acceptance of their child's condition under the guidance of an interdisciplinary team employing a goal-oriented treatment plan; adherence to the home-program and counseling that periodically addressed their concerns.

Conclusions:

The author organized a consortium for drafting national guidelines on the management of ASD in India, which were published in 2017. Prospective studies should evaluate such an integrated intervention model in India.

217 **130.217** Internet Misinformation on Autism Spectrum Disorders in Vietnam

C. V. Tran[1] *and B. Weiss*[2]*, (1)Vietnam National University, Hanoi, Viet Nam, (2)Vanderbilt University, Nashville, TN*

Background: The internet is increasingly being used as a source for information for virtually all topics, including Autism Spectrum Disorders (ASD). There is a vast amount of information available on the internet regarding ASD, but the accuracy of the information is unclear, particularly for developing countries. The possibility of misinformation provides a significant risk particularly for non-professionals, who lack the ability to evaluate the quality of the evidence found on the internet. The current article aims to explore the status of internet misinformation on ASD in Vietnam.
Objectives: This study had three main purposes. First, it evaluated the quality and accuracy of information regarding ASD on Vietnamese language websites. Second, it proposed solutions for managing and controlling the quality of information about ASD on Vietnamese language websites. Third, it provides a reference of for professionals, teachers and especially families of children with autism regarding the quality of information regarding ASD on Vietnamese websites.

Methods: Data was collected using on popular Vietnamese search engines such as Google (google.com.vn), Yahoo search (search.yahoo.com), Bing (www.bing.com), and a popular Vietnamese search engine namely Cốc Cốc (coccoc.com) using all variations of the word «autism» in Vietnamese and related disorders such as *tu ky, tu ki, tu be, roi loan phat trien lan toa, Asperger, Rett*. Five hundreds articles/posts in Vietnamese from various resources on the internet such as electronic journals, corporate web sites, personal blogs and forums were collected, coded for accuracy, type of information, etc. and analyzed by Atlas.Ti qualitative software.

Results: The amount of information posted about autism on the internet is quite large and frequently visited for many websites. Results showed that, in 500 posts, the majority of information was reasonably valid in regards to, for instance, the cause, diagnosis, treatment, prognosis, etc. However, websites with correct information were not the most frequently visited websites, and about 30% of the information was misleading or, even invalid, with statments made with no backing evidence such as the effects of parental care, watching TV, or sad music causing ASD. There is confusion between ASD and attention deficit hyperactivity disorder or speech delay, depression and other mental disorders. Currently, there are many interventions and treatment methods for children with ASD promoted on the internet. The most common methods are behavioral and psychological interventions but are not specifically and clearly defined. Some treatment methods without scientific evidence are still being published widely online, such as stem-cell therapy, hyperbaric oxygen therapy, acupuncture, meditation, and nutrition.

Conclusions: Wrong information, once it is accessed by parents, caretakers and teachers of children with ASD, may harm the children and their families in many ways. Not only wasting time using ineffective treatment methods, the treatment may make the children worsen. Incorrect understanding of the cause and prognosis of ASD may make parents guilty, having unreasonable expectations of their children, and result in iatrogenic effects (e.g., avoiding vaccinating children). This may cause significant negative consequences and require serious attention from researchers, clinicians and policy makers in Vietnam.

218 **130.218** Is Parent Mediated Telehealth Interventions for Children with ASD a Viable Option?

G. M. Kuravackel[1] *and L. A. Ruble*[2]*, (1)University of Louisville, Louisville, KY, (2)University of Kentucky, Lexington, KY*

Background:

Many parents of children with ASD find it difficult to access quality services, and greater challenges are often experienced by families in rural areas (Chen, et al., 2007). Rural settings are characterized by lessened availability of services per capita, and a lack of evidence-based practices for identifying and providing services for individuals with ASD (Rhoades et al., 2007) which can lead to comparatively worse educational and functional outcomes (Scarpa et al., 2013). One possible solution is the use of telehealth technology (Dudding, 2009; Turner, 2003) to address families' unmet needs for intervention (Hetizman-Powell, et al., 2014). Telehealth technology allows for specialized services, in real time, over a geographical distance and permits interactive and individualized learning (Baggett et al., 2009). Parent training programs have also been found to be cost effective and ecologically valid way to increase access to evidence based intervention (Wainer et al., 2015).

Objectives:

The current literature review examined the reach, efficacy and feasibility of parent mediated telehealth interventions for children with ASD. More specifically this review answers questions of intervention effectiveness, parent satisfaction, fidelity of implementation, acceptability of telehealth mediated interventions, and dropout rates. Differences between self-directed (parent learns and implements interventions independent of a therapist)versus therapist supported approaches and existing barriers in telehealth-mediated interventions are also identified.

Methods:

Computer based database searches of peer-reviewed articles were used to identify studies that met inclusion criteria. Studies were included if they (a) utilized self-directed or therapist-assisted telehealth technology to treatment and assessed outcomes, (b) described an intervention that was delivered by a parent or caregiver, (c) report original data, (d) examined and discussed parent satisfaction and implementation fidelity, and (e) were published in English.

Results:

The review of literature produced ten studies that examined parent-mediated telehealth interventions that also examined parent satisfaction and fidelity of implementation. Five of the ten studies were part of two larger studies so original data could only be obtained from two of the five resulting in seven independent studies. All studies showed improvement in outcomes with the parent-mediated interventions. Effect sizes when available from data ranged from 0.35 to 2.41. Fidelity of implementation whether therapist or parent rated ranged from 72 to 97%. Parent satisfaction and acceptance ranged from 72 to 98.7%. Attrition ranged from 0 to 14.2%. Lower satisfaction and higher attrition occurred when the intervention was self-directed versus therapist assisted.

Conclusions:

All seven studies report greater access and reach with parent-mediated telehealth technology without compromising the fidelity and quality of the intervention. Parents also reported satisfaction and acceptance of telehealth approaches specifically with regard to access and availability of intervention in their community or home. On the other hand almost all studies were supported by research grants and families were provided with technology (when not available) and intervention at no cost. Service reimbursement could vary depending on state and location. Technological problems arising from internet speed or other malfunctions also posed occasional problems in access, despite these problems, satisfaction and fidelity were rated high.

219 **130.219** Longitudinal Trends in the Early Work Experiences of Youth with Autism in the U.S.

A. Roux[1], *P. Shattuck*[2], *J. Rast*[2] *and K. Anderson*[3], *(1)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (2)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (3)Life Course Outcomes Research Program, Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

Background: Paid work experiences during high school are strongly associated with positive post-secondary employment outcomes for young adults with intellectual and developmental disabilities. In one study, only 11% of special education students with autism (with significant functional deficits) had paid work experience during high school, compared to 31% of students with intellectual disability (ID). Yet few studies have focused on early work experiences of students with autism and whether prevalence of early work is improving over time.

Objectives: Describe the paid work experiences of special education students with autism during high school, and determine how the prevalence of early work has changed across time relative to students with other types of disabilities.

Methods: We used secondary data from two related studies: the National Longitudinal Transition Study-2 (NLTS2) and the National Longitudinal Transition Study-2012 (NLTS2012). Both studies were designed to yield nationally representative estimates of the characteristics and experiences of youth who received special education services. Wave 2 of the NLTS2 (2002-2003) surveyed 600 students with autism ages 15-19 years who were in 9th grade or higher, and NLTS2012 (2012) surveyed 500. Both surveys asked students whether they did any work for and/or a school-sponsored job for pay within the past 12 months. Parents answered survey questions if youth were unable to respond. We report proportions and 95% confidence intervals for key variables. We tested for significant changes in early work experiences between cohorts.

Results: The 2012 cohort of adolescents in the special education autism category was less diverse (79% White), less impaired and had higher functional skills then the earlier cohort of students with autism. Approximately 34% of the recent autism cohort were reportedly unable to carry on a conversation, or had "a lot of trouble" with conversation compared to 54% of the previous cohort. Nearly 60% of recent autism cohort were able to get to places outside the home "pretty well" or "very well", compared to 46% of the earlier cohort. However, the autism group was generally more impaired than students with ID, emotional disturbance, other health impairments, and those who did not have disabilities that impacted their education.

Students with autism had the lowest rate of paid work experiences (27%) during high school compared to students with ID (35%), emotional disturbance (47%), other health impairments (48%), and those who did not receive special education or accommodations (56%). Rates of early work experiences were not significantly different for students with autism between the two cohorts, compared to a significant decrease in early work for those with ID, emotional disturbance, or other health impairments.

Conclusions: Although exposure to early paid work is a key policy target in the US and internationally, rates of early work experiences for high school students with autism have not improved across the last decade. Students with autism had the lowest employment rate across disability comparison groups in this study. Providing early work experiences, and the supports to make them successful, are critically important because of their strong association with post-secondary employment.

220 **130.220** Measuring Perioperative Distress in Children with Autism Spectrum Disorder

E. S. Cameron[1]*, J. M. Chorney*[2]*, I. M. Smith*[3] *and S. L. Snow*[4]*, (1)IWK Health Centre, Halifax, NS, Canada, (2)Dalhousie University, Halifax, NS, Canada, (3)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (4)Psychology and Neuroscience, Dalhousie University, Halifax, NS, Canada*

Background: The surgical experience can be distressing for children. Between 40% and 50% of typically developing children experience distress during the induction of anesthesia. The characteristics of children with ASD may make them especially vulnerable to the demands of surgery. Deviation from routine (e.g., lengthy wait times, unfamiliar environments), hyper- or hypo-reactivity to sensory stimulation, and limitations in verbal and non-verbal communication may all result in heightened levels of distress for these children. Whereas the behavioural manifestations of distress and the frequency of perioperative distress has been well characterized in typically developing children, similar systematic descriptions have not been made in children with autism spectrum disorder (ASD). This study aimed to describe the behavioural manifestation of perioperative distress and the frequency of perioperative distress in children with ASD.

Objectives: The specific aims of this paper are to: 1) describe the frequency of parent-reported child distress across the perioperative course for a sample of children with autism, and 2) describe the behaviours parents use to judge children's level of distress.

Methods: Participants in this study were 55 parents and their children with ASD undergoing outpatient surgery with general anesthesia. Parents completed the Autism Perioperative Stoplight Distress Scale—a novel, theory-driven measure—to assess their children's distress at four time points (in the preoperative holding area, when the child was taken to the operating room, at induction, and in recovery) two to eight days after their child's surgery. This measure asked parents to rank their child's distress from 'green' ("good to go"), to 'yellow' ("a little bit on edge"), to 'orange' ("increasingly distressed or aroused") to 'red' ("experienced full-on distress") and to describe the behaviours they witnessed at each of the four time points.

Results: Results indicated that 89.1% percent of children with ASD experienced perioperative distress, with 38.2% of children experiencing extreme distress at one or more time points. Children experienced the most distress at the induction of anesthesia (84.6%, n = 13), and in the recovery unit (78.2%, n = 55). Parent reported behaviours were coded into 20 categories. The most common distress behaviours reported by parents included: fearful, distressed vocalizations, resistant, and uncomfortable.

Conclusions: Nearly 90% of children with ASD experienced perioperative distress, with a large portion of children experiencing extreme distress. Parents reported several novel behaviours that have not been included in assessment scales for typically developing children (e.g., repetitive behaviours, self-injurious behaviours, repetitive questioning). Many behaviours were reported across all four levels of distress, suggesting that parental input or individualization will be needed to interpret behavioural observations if they are to be used in future studies. This study provides a unique contribution to the fields of autism and anesthesiology in that it is the first to empirically describe the unique set of behaviours that children with ASD may display perioperatively and outlines the large frequency of children experiencing perioperative distress.

221 **130.221** Needs and Priorities of Providers Serving Children and Youth with Autism Spectrum Disorders in Rural Areas

S. Vanegas[1]*, Y. Xu*[2]*, S. Magaña*[3,4] *and T. Heller*[2]*, (1)School of Social Work, Texas State University, San Marcos, TX, (2)Disability and Human Development, University of Illinois at Chicago, Chicago, IL, (3)Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX, (4)University of Texas at Austin, Austin, TX*

Background: Research on Autism Spectrum Disorders (ASD) has found significant disparities in access to services and outcomes in rural communities. Screening instruments used to identify children with ASD are less valid and reliable when used among low-income and ethnic minority families in rural areas (Scarpa et al., 2013). Rates of diagnosis are also much lower in rural areas when compared to urban areas (Dickerson et al., 2016), and when children from rural areas are diagnosed, they are typically diagnosed much later than children from urban areas (Kalkbrenner et al., 2011). These disparities have been associated with a lack of primary and specialty care providers (Mandell et al., 2010). With more information about the needs, barriers, and priorities of providers in rural areas, we can increase the professional capacity to address the specific needs of children with ASD and their families within rural communities.

Objectives: The objective of the current study is to identify the unmet needs and priorities providers face in rural areas.

Methods: We focused on two rural counties in Illinois (USA). These counties were identified as rural by the Office of Rural Health Policy (2016) and were comprised of predominantly low-income households, with over 55% of children enrolled in school, considered eligible to receive free or reduced lunch. Educators, service providers, and other professionals who provided services to children/youth with ASD under 22 years of age were eligible to participate. Providers were recruited from schools, clinics, and community organizations. Two experienced investigators led the focus group discussions and followed a script on topics and prompts. The topics included sources of information, services provided/barriers to providing services, transition/future planning, impact of ASD on families and unwanted outcomes. The focus groups included a total of 8 participants and each lasted approximately 90 minutes. The focus groups were audio-recorded and transcribed to identify common themes.

Results: The focus group participants were special education teachers (*n* = 2), case managers/resource specialists (*n* = 2), early childhood administrators (*n* = 2), and speech-language pathologists (*n* = 2). All participants were currently active in their professions, providing direct services and supports to children with ASD and their families. The most prominent themes across both focus groups included limited opportunities for interprofessional collaborations and consultation as a barrier in providing consistent recommendations to families, and insufficient support for staff salaries and professional development on ASD. Themes within each topic (sources of information, service provision and barriers to providing services, transition/future planning, impact of ASD on families, and unwanted outcomes) will be presented along with recommendations to address high priority needs.

Conclusions: Little is known about the experiences of ASD service providers in rural areas. As many disparities in access to and receipt of services have been identified for children with ASD and their families in these areas, it is critical to identify ways to adequately address these disparities. By identifying the critical needs and priorities service providers experience in rural areas in the United States, greater efforts can be made to ameliorate these disparities.

222 **130.222** Online but Live and Interactive Social Skills Intervention

T. P. Gabrielsen*, Counseling & Special Education, Brigham Young University, Provo, UT*

Background:

Addressing core social communication deficits of autism is a universally recommended intervention, but group social skills interventions have not been universally available, particularly in rural or otherwise underserved areas. With increasing availability of Internet service, delivery of telehealth and online services for autism is also increasing. Using an electronic format for social skills instruction has been available in static (learning module) formats, but has not yet been studied in a live, interactive format using a manualized curriculum for in-person group intervention.

Objectives:

This study developed feasible methods for adapting an evidence-based, in-person curriculum to an online, live, interactive format. Once developed, online and in-person delivery of the curriculum were compared in terms of ease, generalization effects, participation rates, and spontaneous conversation generated during sessions.

Methods:

Participants included some typical peers and adolescents (n=17, with n=35 projected), ages 12-16, with existing or pending autism diagnoses. Some parents (n=4) had immigrated to the USA, meaning participants lived in bilingual homes. Inclusionary criteria were language and cognitive abilities consistent with <3 years delay in academics and ability to function independently in group environments. Autism symptoms were verified by Autism Diagnostic Observation Schedule (ADOS-2), Social Communication Questionnaire, and Social Responsiveness Scales (SRS-2). Cognitive and verbal abilities were verified using standardized IQ measures. In-person participants required weekly transportation to the university. Online participants required Internet access and computers with videocameras and microphones. Settings were a large private university (in-person group and generalization probes for both groups) and online (HIPAA-compliant Zoom platform). Protocols for navigating the online environment and rules specific to that environment were developed and distributed. A tech demo teleconference visit was held with families prior to starting online sessions. Curriculum in both delivery models (in-person and online) was the PEERS® Treatment Manual (Laugeson & Frankel, 2010), delivered for 14 weeks, then in-person participants attended 3 generalization probes in age-appropriate activity settings (e.g., going to a museum, out for fast food, and bowling) on campus. Online participants met together on campus on two occasions for generalization probe activities. Parent sessions were held simultaneously for in-person groups, successively for online groups. Measures of effectiveness included direct observation of social engagement during group sessions, pre- and post-intervention parent social skills questionnaires (SRS-2 and Autism Social Skills Profile), and direct observation of social engagement during generalization probes.

Results:

Participants were able to effectively access the online or in-person sessions with only occasional disruption. All elements of the PEERS® curriculum were adapted for online participation, including some games (e.g., Jeopardy!, Battleship, Pictionary, etc.) and token systems for participation were rewarded in both environments. Social engagement in both groups increased over time, with the online group showing increased participation in breakout rooms versus the larger group. Generalization probes showed spontaneous conversation rates maintained in activities outside of group sessions, consistent with parent report of increased conversation skills.

Conclusions:

Online delivery of a manualized social skills intervention may not be ideal, but can be effective for families who cannot otherwise access groups because of geographical isolation or other barriers.

223 **130.223** Parents of Preschool Children Newly Diagnosed with Autism Spectrum Disorder: The Effectiveness of a Self-Directed on-Line Parent Training and Support Program on Parent and Child Outcomes

***A. T. Robson**, Applied Health Sciences, University of Manitoba, Winnipeg, MB, Canada*

Background: In community funded systems there is often a critical gap in service from diagnosis to the start of formalized autism treatment services. During this stressful gap in service, parents could be supported with an affordable, easily accessible, on-line training and support program.

Objectives: The primary purpose of this study was to address the gap in service between diagnosis and access to formal services, by developing and evaluating the effectiveness of a self-directed on-line ASD training and support program. The secondary purpose was to assess how parent stress interacts with participation in training, as well as parent and child outcomes.

Methods: A set of six multi-media on-line modules were developed based on the existing literature, with content specific to: Understanding ASD; Dealing with the diagnosis; Accessing community services; and Parent implemented, naturalistic, early intervention practices. An on-line support forum for parents in the treatment group was also included. The present study used a randomized, masked, waitlist control design, comparing an intervention treatment group to a waitlist control group. A prospective consecutive sample of participants was recruited from the local children's hospital (n = 10; child mean age 50 months). Parents were initially assessed using the Parenting Stress Index –Short Form, an ASD knowledge measure, and an early intervention treatment fidelity measure. Child outcome measures included observational measures of child engagement and expressive communication. After initial assessment, half the parents were given access to the on-line learning modules (treatment group). Four months later, all parents and children were re-assessed and then the parents in the waitlist control group received access to the on-line learning modules. Data was analysed to determine: i) if children in the treatment group had significant gains in engagement and expressive communication when compared to the waitlist control group; ii) if parents in the treatment group had significant increases in ASD knowledge and early intervention skills compared to the waitlist control group; and iii) if there was an interaction effect between parent stress and parent gains.

Results: Preliminary results (n=10) indicate children in the treatment group increased joint engagement (71% to 85%) and expressive communication scores (33% to 47%), while children in the waitlist control group stayed relatively the same (65% to 61% and 37% to 43% respectively). Parents in the treatment group had increased ASD knowledge scores (64% to 83%) and early intervention skills (82% to 96%) while parents in the waitlist control group stayed relatively the same (64% to 70% and 90% to 89% respectively), while parent stress scores decreased in the treatment group (78% to 69%) and increased in the waitlist control group (85% to 92%). An interaction effect between stress and parent knowledge and early intervention skills was not evident.

Conclusions: Preliminary results indicate that parents are able to gain ASD knowledge and early intervention skills from on-line multi-media autism learning modules and that participation in the learning modules and the on-line parent support forum helps to reduce parent stress.

Parent gains also had a positive effect on their child's engagement and expressive communication.

224 **130.224** Passport to Life: Investigating the Need for Life Skills Training Among High Functioning Young People with Autism and Their Parents"

S. Chantziara[1]*, J. Krska*[1]*, P. McGill*[2] *and A. Bratt*[1]*, (1)Medway School of Pharmacy, Universities of Kent and Greenwich, Chatham, United Kingdom, (2)Tizard Centre, University of Kent, Canterbury, United Kingdom*

Background:

In the area of autism interventions further research is needed to identify effective strategies to promote independence (Hendricks & Wehman, 2009). It is recommended that life skills should be addressed before adulthood and school could be an ideal place to target those skills and set individualised goals during transition planning (Duncan and Bishop, 2015). Furthermore there is a need to establish which outcomes are most meaningful for individuals and their families and they should be consulted in the development of future interventions and supports (Ratto and Mesibov, 2015).

Objectives:

This was a qualitative study with the aim to investigate: **a)** Views and needs in relation to adulthood transition as expressed by young people with Autism Spectrum Disorders (ASDs) and their parents **b)** Their experiences of previously accessed training and support with an emphasis on school provision **c)** What type(s) of future life skills support they may consider beneficial and would wish to access.

Methods:

Data were collected through 20 semi-structured interviews with ten young people in the age groups 11-17 years and ten mothers. Data were analysed using Thematic Analysis

Results:

Three overreaching themes were identified: Building the Foundations for the Future (*Sub theme 1a: Focusing on strengths and interests and encouraging participation in new activities; Sub theme 1b: Trying to identify available support but faced with confusion and lack of clarity*); Theme 2: Caught in between: Negotiating two parallel but different realities (*Sub theme 2a: Experiencing the common challenges of adolescence; Sub theme 2b: Facing additional challenges related to autism; Sub theme 2c: Young people with ASDs and their families share common aspirations with their neuroypical peers while recognising that achieving those is not going to be straightforward*); Theme 3: The need for personalisation of the support (*Sub theme 3a: Mixed acceptability and efficiency of previously accessed support; Sub theme 3b*: Shifting the *focus to the individual-The requirement for mentoring and ASD specific support; Sub theme 3c: Prioritising the Young Person*). Participants expressed the desire for personalised support and mentoring was considered to best meet this requirement. Mothers wanted the focus of interventions to shift on the young people and did not want to get involved in the training designed for their children. Perceived inability from schools and services to recognise and manage individual needs was the main cause for dissatisfaction among participants and only few of them described receiving ongoing support around life skills from their school. Furthermore, mothers were not always aware of what support is available and how to access it.

Conclusions:

The study highlights possible issues in the current provision of support for young people with ASDs and offers new insights into the existing literature of autism interventions, particularly regarding the types of support and levels of parental involvement that parents and young people consider desirable.

225 **130.225** Perspectives of Non-Urban General Pediatricians on Diagnosing Autism Spectrum Disorders

J. Das[1]*, L. Hartman*[2]*, G. King*[2]*, N. Jones-Stokreef*[3]*, C. Moore Hepburn*[4] *and* ***M. Penner***[1,5]*, (1)Developmental Pediatrics, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Developmental Pediatrics, Orillia Soldiers Memorial Hospital, Orillia, ON, Canada, (4)Department of Paediatrics, The Hospital for Sick Children, Toronto, ON, Canada, (5)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: Long wait times for autism spectrum disorder (ASD) diagnosis contribute to delayed access to ASD interventions, which are most effective at young ages. General pediatricians (GPs) represent a potential resource for increasing diagnostic capacity and decreasing wait times for ASD diagnostic assessments. Previous work has described urban GPs' opinions about their role in ASD diagnosis; however, no current research has solicited perspectives of non-urban GPs, whose practice realities may differ significantly.

Objectives: The objective of this project was to explore the perspectives of GPs practicing in smaller Ontario communities regarding their diagnostic processes and their role in ASD diagnostic assessment.

Methods: We performed a qualitative study using thematic analysis of GP's experiences with cases of suspected ASD. GPs from three small/medium-sized Ontario communities (population range: 14,000-64,000) were recruited to provide variation in perspectives. Semi-structured interviews were conducted, transcribed, and coded. A preliminary theoretical framework was developed and sent to participants with a request for feedback (member checking). Feedback did not necessitate any significant changes to the framework.

Results: 14 GPs participated in interviews (7 from Community A, 4 from Community B, 3 from Community C). All participants considered ASD diagnosis to be in the GP's scope of practice and many considered it part of their service to their community. Many sought out and self-funded additional ASD training as necessitated by their practices. Our framework identified three stages in the diagnosis of ASD: pre-assessment (gathering information prior to the first clinic visit), diagnosis, and service access. All of these stages are influenced by ecological factors including the individual patient/family, individual physician factors, factors reflecting the GP's community group practice (i.e., how the group has decided its members will approach cases of suspected ASD), and factors concerning the broader system of ASD care.

Conclusions: GPs practicing in small and medium-sized Ontario communities routinely diagnose ASD and see this as part of their scope of practice. Compared to their urban counterparts, they emphasized a stronger sense of responsibility to their colleagues and to their communities. Strategies aimed at increasing diagnostic capacity should target group practices, increase availability of ASD specific training programs, and improve efficiency of clinic visits through pre-clinic information gathering. Further research regarding accuracy of GP assessments as well as patient perspectives is required.

226 **130.226** Prevalence and Correlates of Employment and Postsecondary Education in Transition-Age Youth with Autism in Vocational Rehabilitation

J. Rast[1]*, A. Roux*[2]*, K. Anderson*[3] *and P. Shattuck*[1]*, (1)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)A.J. Drexel Autism Institute, Drexel University, Philadelphia, PA, (3)Life Course Outcomes Research Program, Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

Background: Transition-age youth with autism (TAYA) experience poor postsecondary outcomes across a range of indicators related to employment and related services. Vocational Rehabilitation (VR) is a source of public assistance for youth who seek employment, and youth with autism are a growing segment of VR service users. Postsecondary education (PSE) facilitates skills building that can lead to employment and better wages. Recent federal legislation seeks to improve PSE opportunities and employment outcomes of youth with disabilities. We know little about how the employment and PSE outcomes of TAYA vary from those of other youth with disabilities who used VR services, or if the correlates of successful outcomes differ by group.

Objectives: We will describe the characteristics of TAYA who use VR services compared to transition-age youth (TAY) with other intellectual or developmental disabilities (IDD). We will analyze the correlates of employment and advancement of PSE after VR exit for TAYA in comparison toTAY with IDD.

Methods: This study used RSA-911 FFY 2015 data for TAYA (age 14-24). In comparison, we looked at TAY with intellectual disability, cerebral palsy, or traumatic brain injury, who did not have autism as a cause of their job impairment. The two outcomes of interest were exit from VR with employment and advancement of PSE. Previous studies have shown that VR outcomes vary by state for TAY with IDD. Therefore we considered state of service provision to accurately model the clustered nature of this data using generalized estimating equations (GEE) to estimate population average values of the correlates of the outcomes of interest.

Results: TAYA more often left VR with employment (59% of TAYA versus 51% of TAY with IDD) or advancement in PSE (13% versus 7.4%).

Overall, the correlates of exit from VR with employment were similar across groups: older age; having family or friends as the primary source of support; and receipt of most services were associated with increased odds of employment. Spending a higher than average number of days in VR services was associated with lower odds of employment.

The strongest correlate of advancement of PSE was receipt of PSE training services. Job readiness training and on-the-job supports were negatively associated with advancement of PSE in both groups, as was older age and public insurance. Having a “most significant disability” was associated with lower odds of advancement in PSE in TAYA, but not in TAY with IDD. Spending longer in VR services was positively associated with advancement of PSE.

Conclusions: While the main purpose of VR is to provide services and supports to achieve employment, support for advancement of PSE is a critical step on the pathway to employment. The correlates of successful employment differ from the correlates of advancement of PSE, indicating the importance of matching services to goals. Expectations for employment and educational advancement should be made clear in the Individualized Plan for Employment at the initiation of the VR process. Future study should examine state variation in receipt of PSE in relation to employment outcomes.

227 **130.227** Priorities for Treatment and Services Established By the Combating Autism Act: Costs and Outcomes

P. Doehring*, ASD Roadmap, Chadds Ford, PA*

Background: The 2006 Combating Autism Act or CAA is the most ambitious national research strategy focused on ASD to date. In response to growing concerns about the prevalence and impact of ASD, the InterAgency Autism Coordinating Committee or IACC was created via CAA to establish research priorities to allocate federal research funding. Between 2008 and 2013, IACC helped to direct more than $1 billion from the US National Institutes of Health or NIH alone. Researchers and advocates have begun to question IACC’s emphasis on basic health science relative to interventions, and the extent to which this emphasis has translated into improved outcomes for the population of people with ASD. To date, only a handful of independent researchers have sought to systematically reconsider IACC’s priorities and potential impact.

Objectives: To establish how much of the research (and resulting publications) funded by the NIH between 2008 and 2013 to address issues related to treatment or services for people with ASD resulted in testable interventions or services, especially those used in home- or community-based settings or targeting underserved populations.

Methods: Using the Autism Research Database, we assembled all NIH-funded research grants between 2008 and 2013 that addressed questions 4 (Treatments and Interventions) and 5 (Services). We have also begun to assemble all publications linked to these projects using existing federal databases supplemented by Pubmed/Psychinfo searches as needed. We have begun to conduct title, abstract, and full-text reviews as needed to identify the subset of these research projects and publications that either tested a specific and immediately applicable treatment, or that identified or sought to overcome specific barriers to treatment implementation (e.g., training, access to services, etc.). Within this subset, we are categorizing articles according to population, treatment focus, treatment setting, and treatment implementation.

Results: About 20% of the NIH’s ASD research funding between 2008 and 2013 was directed to Treatments or Services, significantly falling short of targeted funding allocations in many cases. Preliminary analyses reveal that less than two-thirds of these projects, and the publications which resulted, tested a specific treatment or considered specific barriers to implementation: other projects instead examined animal models or factors theoretically contributing to improved intervention or services. Many of the grants and publications that were focused on testable treatments were not home- or community-based, instead relying either on specialized settings, professionals, or levels of support. A small proportion of total research funding and publications addressing testable treatments or services focused on traditionally underserved populations. Very few grants and publications looked beyond specific treatments towards implementation barriers at the local, regional, or national level.

Conclusions: A small proportion of the research funded by the NIH between 2008 and 2013, and the publications which resulted, actually tested a specific treatment or service. The paucity of research on treatments that are community-based, or that address persistent barriers faced by underserved populations, limits the likely impact of the knowledge gained on the lives of people struggling with ASD right now. Implications for future research and policy are discussed.

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130.228 Put It to the Test: Do Standardized Testing Practices Hurt Students with Autism?

M. Seidman[1]*, J. T. Russo*[1] *and D. S. Mandell*[2]*, (1)University of Pennsylvania, Philadelphia, PA, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: The state of Pennsylvania mandates that all students between third and eighth grade, regardless of cognitive ability, take standardized achievement tests. These tests are administered in school during a 3-week period. State testing guidelines strongly encourage schools to assign teachers as proctors who are not the teachers of the students taking the test. As a result, autism support teachers often are asked to proctor the tests for classrooms that are not their own, effectively removing them from their autism support classrooms for most of several days or weeks in the spring. This practice disrupts the teachers' daily instructional routines and implementation of evidence based practices. With just a month and a half of school remaining when the standardized testing period ends, teachers may be less likely to resume routine EBP implementation. No research to date has investigated the effect that standardized test proctoring has on autism support teachers' use of EBPs and thus student cognitive and language ability.

Objectives: to estimate the impact of standardized testing practices on (1) autism support teachers' implementation of evidence based practices for children with autism and (2) student cognitive/language ability in a large school district in Pennsylvania.

Methods: The sample includes 69 kindergarten-through-second-grade autism support teachers and 143 students in a large school district in Pennsylvania; 19 teachers were pulled from their classrooms to proctor state exams. All teachers received coaching in five EBPs for children with autism: discrete trial training, pivotal response training, data collection, positive reinforcement, and visual schedules. Data on teachers' accuracy of EBP implementation was collected 3-4 times over a 7 month period through direct observation. Data on teachers' frequency of EBP implementation was collected 6-9 times over a 9 month period through teacher self-report. Students cognitive and language abilities were measured at baseline and exit using the DAS-II and the Bracken Basics Concepts Scale (Receptive and Expressive). A difference-in-differences design will be used to estimate the extent to which teachers' administration of the standardized testing to students with and without cognitive disabilities is associated with teachers' use of EBPs and their accuracy of EBP implementation for their students with autism. The effect of this disruption on student outcomes will be measured using linear regression with random effects for classroom.

Results: Data collection is complete and analyses are underway.

Conclusions: Over the last fifteen years, opponents of federal testing requirements have cited various harmful effects on public schools: teachers are forced to teach to the test, pressure on underperforming schools, teacher evaluations based on test results, pressure on school leaders and states to improve results, takes time away from teacher instruction. Results of this study will lead to a better understanding of the way in which school-wide standardized testing practices influence autism support teacher's use of evidence based practices. Findings indicating a decrease in teacher EBP use or poorer accuracy of EBP implementation would have significant policy implications on the practices associated with standardized testing administration.

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130.229 Reducing Emergency Room Admissions for Individuals with ASD and Severe Behavior

M. D. Powers[1]*, M. J. Palmieri*[2] *and A. Laprime*[3]*, (1)The Center for Children with Special Needs, Glastonbury, CT, (2)Center for Children with Special Needs, Glastonbury, CT, (3)CCSN, Glastonbury, CT*

Background:

Individuals with Autism Spectrum Disorders are often remanded to the Emergency Departments (EDs) of local hospitals following episodes of severe aggression, self-injury, or property destruction. Unfortunately, community hospital EDs are often ill-equipped to stabilize these patients, resulting in excessive stays in the ED or premature release back to the home setting where repeat referrals to the ED are more likely. It is well-documented that children with ASD are 9 times as likely to visit the ED than children without ASD, that they are at greater risk for psychiatrist hospitalization than children with other disorders, and that aggressive and self-injurious behaviors combined with lack of appropriate community services increases the risk of hospitalization.

Objectives:

The BRISC project investigated the development and implementation of a subacute program providing a comprehensive and coordinated system of care, designed for children with ASD admitted to the ED. Key components included rapid deployment of functional analytic behavioral assessment and positive behavior supports for the child upon admission, discharge planning from the date of admission linking parents to effective community and educational resources, intensive parent training, and training parents to work with their child to generalize positive and adaptive replacement skills while maintaining the reduction of significant problem behavior upon returning home.

Methods:

Eight children (7M, 1F) and their families currently admitted to emergency departments at local hospitals for severe aggression, self-injury, or property destruction between the ages 5-13 years old with ASD participated in this program. Each had a history of high intensity and high frequency severe problem behavior, co-morbid psychiatric diagnosis or significant trauma history, repeated hospitalizations or emergency room visits, multiple school placements, complex family histories and different levels of community provider involvement. Comprehensive assessments were conducted to determine behavior function(s) and guide the development of function-based treatment plans. Treatment protocols emphasized acquisition of functional replacement skills, coping skills, and maintenance of zero or low rates of challenging behavior. Program staff, parents and community providers were trained on these plans to fidelity in the program, on home visits, and upon discharge.

Results: Compared to baseline assessments, results indicate a significant reduction in problem behavior in program and at home, high rates of acquisition of functional replacement skills, high rates of skill acquisition among staff and family caregivers upon discharge, and improvements on parent-reported quality of life and use of positive parenting strategies following discharge (see Table). Most importantly, of all children admitted to the program 2 experienced an ED re-admission within the 6 months after discharge but were quickly stabilized.

Conclusions: While hospitalization and ED visits are sometimes warranted, their overuse may also represent a failure to provide appropriate community-based care. As such, the need for intervention strategies that divert from ED and hospital admissions is evident. Results are discussed in terms of the importance of a coordinated system of care for these high-risk children, the importance of intensive and function-based assessment and treatment planning, and the critical impact of treatment fidelity in parent training.

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130.230 School Psychologists' Confidence in Conducting ASD Assessments

L. J. Dilly[1,2] *and S. Richardson*[2,3]*, (1)Marcus Autism Center, Children's Healthcare of Atlanta, Atlanta, GA, (2)Emory University School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Atlanta, GA*

Background: With Autism Spectrum Disorder (ASD) in the U.S. reaching prevalence rates of 1 in 68, and an average age of diagnosis well beyond the entry age for special needs preschool (CDC 2010), public schools are increasingly tasked with assessing these students (Christensen et al., 2016; Pettygrove et al., 2013). Furthering the demand on school psychologists, ASD identification rates vary across racial and ethnic groups, with average ages of diagnosis in the school age years in disadvantaged communities (Christensen et al., 2016; Daniels & Mandell, 2014). In addition, girls with ASD may be missed in assessment due to variations in their presentation (Dean et al., 2014; Dworzynski, Ronald, Bolton, & Happe, 2012).
Objectives: To examine school psychologists' confidence in assessing children with ASD. Specifically, school psychologists' confidence in assessing various childhood disabilities, including ASD, learning disabilities (LD), and emotional and behavioral disorders (EBD) was compared. Follow-up analyses evaluated confidence in ASD evaluations across gender and bilingual children.

Methods: A team of clinicians and researchers created a survey with Likert-scale (1-5) questions assessing ASD assessment procedures in the school setting. The survey was emailed to 557 valid email addresses. After two reminder emails, a total of 333 surveys were completed. The response rate was 59%. IDEA Section 618 data records indicate that in 2013 there were 720 school psychologists, indicating the respondents represent approximately 46% of school psychologists in state of Georgia.

Results: A repeated measures ANOVA indicated variations in school psychologists' confidence across ASD assessments (M=4.05; SD: .720), LD assessments (M=4.61; SD: .516), and EBD assessments (M=4.33; SD: .647) were significant (Greenhouse-Geisser correction F(1.748, 499) = 96.58; p<0.001). Effect sizes between ASD and LD assessment confidence were large (r = .617) and moderate for ASD as compared to EBD assessment confidence (r = .34). School psychologists were significantly less confident in assessing ASD than LD or EBD. Paired t-tests revealed significant differences in confidence assessing ASD in boys (M=4.07; SD=.693) versus girls (M=3.99; SD=.729) (t (286)= 4.23; p = 0.001; d= .112). School psychologists' confidence in assessing ASD overall (M = 4.05; SD = .72) versus assessing ASD in bilingual children (M= 2.54; SD=1.08) was also significantly different (t (286) = 24.16; p <0.001; *d* = 1.65).

Conclusions: While school psychologists are often called upon to conduct assessments of ASD in the schools, they are much less confident in assessing ASD versus learning disabilities and emotional/behavioral disorders. In particular, school psychologists are reticent about their ability to assess bilingual children for ASD. This likely contributes to the later age of diagnosis and lower prevalence rates of nonwhite, Hispanic children (Locke et al., 2017). School psychologists also indicated lower confidence assessing girls for ASD, although this effect size was relatively small. As research indicates that most school psychologists did not receive specific pre-service training in conducting ASD evaluations, the need for increased pre-service and continuing education for school psychologists is apparent (Aiello, Ruble, & Esler, 2017; Combes, Chang, Austin, & Hayes, 2016).

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130.231 Stakeholder Validation of the Family Navigator Manual

B. Rappaport[1]*, T. Savion-Lemieux*[2]*, A. Yusuf*[3]*, R. Tesfaye*[1] *and M. Elsabbagh*[4]*, (1)Neuroscience, McGill University, Montreal, QC, Canada, (2)Research Institute-McGill University Health Centre, Montreal, QC, Canada, (3)Psychiatry, McGill University, Montreal, QC, Canada, (4)McGill University, Montreal, PQ, Canada*

Background: Parents of children with Autism Spectrum Disorder (ASD) experience significant barriers in the access and coordination of care. Families describe their experience with care systems as a "confusing maze", in contrast with local and international policies that clearly stipulate the importance of tailored, continuous, and coordinated services across the lifespan. The Family Navigator model (FN), which we developed, responds to these unmet needs by supporting caregiver empowerment and care continuity during different transition periods, beginning at the post-diagnostic period. Thus far, we have developed the FN based on best available evidence on: Navigation efficacy in other health conditions, research about the experience of families in routine services, and an in-depth review of care policy. Taken together, we have incorporated the evidence into a manual we developed to define the FN, including role and functions of the family navigator.
Objectives: The current qualitative study took a participatory approach engaging stakeholders (community professionals who are involved in care coordination or navigation) to validate the FN manual. Prior to beginning a randomized controlled trial of the FN, we sought to validate the model to ensure that the navigator's role and functions coincided with community stakeholders' views of navigation in autism care and services. Both community professionals who take on the role of a navigator, regardless of their professional title, and decision makers involved in navigation, were invited to participate in the stakeholder validation. We developed a workgroup activity where experienced facilitators guided small group discussions about active ingredients of navigation, following a series of pre-specified open-ended questions.

Methods: 49 individuals participated in the stakeholder validation. Included were different professionals, (e.g. social workers, clinicians, and educational consultants) with an average of 10 years of experience working with families with ASD, from a variety of sectors (i.e., health and social services, education, and community organizations). Fives groups of 8-10 participants answered and discussed open-ended questions posed by the facilitator. Group discussion were audio-recorded on iPads, and later transcribed by a research assistant. Using NViVo.10, and with a grounded theory approach, the data was coded into emerging themes related to active ingredients of navigation. After the initial coding of the transcripts, themes were extracted and grouped into broader categories.

Results: Overall, emerging themes from the stakeholder validation suggested that presently, within care services, the professionals responsible for coordination of care for families (i.e., navigation): acts as a go-to person; has an active partnership with the family; is knowledgeable about ASD and the pathways for accessing associated services; facilitates communications and information exchange across different services; and coaches families to be their "own navigator."

Conclusions: The themes derived from the stakeholder validation helped refine the role and functions of the Family Navigator within the FN manual. The next phase will consist of formally evaluating the FN model in a randomized control trial, while also continuing to engage stakeholders in order to ensure consideration of contextual aspects to implementation of the model within local care services and that knowledge generated leads to impact in the community.

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130.232 State-Level Autism Policies and Their Impact on Families' Access to Early Intensive Behavioral Interventions

A. Chu[1]*, S. broder-Fingert*[2]*, K. Long*[3] *and E. Feinberg*[1]*, (1)Boston University School of Public Health, Boston, MA, (2)Pediatrics, Boston University,* *Boston, MA, (3)Boston University, Boston, MA*

Background: There is increasing evidence of the effectiveness of early intensive behavioral interventions (EIBI) to impact core autism symptoms. However, few young children have access to or engage in the recommended 20 hours of intervention. State-level policies affect access to EIBI by informing guidelines on who can provide an autism diagnosis, shaping workforce development policies for specialty service providers, and impacting insurance coverage and reimbursement for services. Yet, few studies have examined policy-responsive barriers to such services, instead focusing primarily on individual or systems-level barriers. Project EARLY is a multi-site comparative effectiveness trial of a strategy to improve early identification and linkage to services among ethnically diverse, low-income families of children at risk for autism. The trial takes place in Massachusetts, Connecticut, and Pennsylvania, and provides an opportunity to study state-specific policies and practices that may impact families' engagement with and access to EIBI.

Objectives: To identify the potential state-level policy levers that can address disparities in access to and engagement in EIBIs for children with autism.

Methods: We conducted semi-structured qualitative interviews with stakeholders in Massachusetts (n=8), Connecticut (n=1), and Pennsylvania (n=2), that included policy experts, service coordinators, and Part C Early Intervention directors. Interview questions were guided by the Consolidated Framework for Implementation Research (CFIR). Interviews were audio-recorded, transcribed, and double-coded. They were analyzed via thematic and content analyses and mapped on to CFIR domains. Data collection for Pennsylvania and Connecticut is ongoing. We project a total of 15 interviews at the end of this study. We will utilize triangulation and member-checking to assess new policy-levers identified in upcoming stakeholder interviews to assess their generalizability and applicability to different state policy environments.

Results: Preliminary results from Massachusetts stakeholder interviews identified several policy-sensitive barriers that low income, ethnically diverse families experiencing when accessing EIBIs: 1) a shortage of certified providers who can provide behavioral interventions; 2) delays in obtaining diagnostic assessments, a prerequisite to obtaining EIBI in Massachusetts; and 3) cultural and linguistic barriers among EIBI providers. Massachusetts stakeholders expressed interest in understanding state policies and regulations that a) support the provision of more integrated early childhood services – e.g. Pennsylvania, which integrates Part C and B services for children birth through age 5 and b) decrease barriers to diagnostic assessment - e.g. Connecticut, which offers diagnostic assessment through Part C programs. These findings map onto the CFIR domains of engaging, tension for change, and external policy and incentives.

Conclusions: Preliminary findings identified potential policy levers to address disparities in access to and engagement in EIBI. Findings from Massachusetts will inform areas of further exploration with Connecticut and Pennsylvania stakeholders regarding state policies regulating certification of providers, provision of diagnostic services, and workforce development. As demand and funding for EIBI expands, states are faced with the challenge of meeting the increased service needs. Using an implementation science framework – CFIR - as a scaffolding to understand the role of state-level policies to increase access and provision of EIBI will support dissemination of findings to state policy makers and advocates.

233 **130.233** Stick or Switch? Factors That Influence Educational Placement over Time for Children with Autism.

P. White[1], *S. Chandler*[1], *I. Yorke*[1], *V. Carter Leno*[1], *T. Charman*[2] *and E. Simonoff*[1], *(1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

A number of factors may influence education provision decisions for parents of children with autism, including advice from professionals, placement availability, primary school experience of inclusion and socio-economic status. The majority of studies exploring parental choice have taken a qualitative approach. Early child-, parent- and neighbourhood factors have not been systematically explored as predictors of educational support transition.

Objectives:

To use a longitudinal, community-based sample of children with autism, who were initially in mainstream primary schools, to investigate which factors predict later transition to specialist education, and investigate if later parent-rated school satisfaction significantly differs between the two groups (mainstream vs. specialist education).

Methods:

This observational study included 274 children with autism from two London boroughs, first seen at 4-9 years (Wave 1) and followed up 7 years later (age 11-15 years, Wave 2) when attending secondary school. Only children in mainstream school at Wave 1 were included in this analysis (n=157; 132 males, 25 females). Wave 1 measures included as predictors of secondary school placement were child IQ, child sex, parent-reported autism severity (Social Communication Questionnaire [SCQ]), parent and teacher-reported emotional/behavioural problems (Developmental Behaviour Checklist [DBC]), parental self-report of mental health (K10), parental education, ethnicity and neighbourhood deprivation. Secondary school placement was classified as mainstream (with/without support) or specialist provision. At Wave 2, parents completed the Engagement and Confidence Scale of the Wider Outcome Survey of Parents (WOSP-ECS; Humphrey et al., 2011). As IQ was an important predictor of placement, the association between each predictor variable and later school status was tested using logistic regression adjusted for IQ. Factors showing an association at p <0.1 were retained in the multivariate prediction model. The two parent-reported behaviour measures (SCQ and DBC) were highly correlated so an *a priori* decision was made to retain the parent-reported SCQ and the teacher-reported DBC in the fully adjusted model.

Results:

As expected, lower IQ predicted later school transition to a specialist setting. In addition, with IQ as a covariate, higher parent-reported SCQ, parent and teacher-reported DBC and white ethnicity also predicted specialist placement transition. However, only IQ remained significant in the full multivariate model, likely due in part to collinearity of the DBC and SCQ with IQ. Parents of children who had transferred to a specialist setting reported greater confidence with the school (WOSP-ECS M= 18.6, SD= 4.9) than those remaining in mainstream (WOSP-ECS M=16.4, SD= 5.3) (p=.02).

Conclusions:

In addition to IQ, results suggest that autism severity, emotional/behaviour problems and ethnicity may be important factors to consider regarding school placement for individuals with autism. These factors were fully significant in the simpler analyses and marginally significant in the multivariate analysis. In the current sample, it was difficult to disentangle ethnicity from locality and choice of education provision differences between the two boroughs. In the UK, there is still pressure for educational inclusion. The finding that parents of children who had transferred to specialist provision had more confidence in the school's ability to support their child should be communicated to education policy makers.

234 **130.234** Teacher Attitudes That Affect Implementation of Evidence-Based Practices in Self-Contained Autism Support Classrooms in Public Schools

J. Locke[1]*, M. Xie*[2]*, M. Seidman*[2]*, C. Spaulding*[2,3] *and D. S. Mandell*[4]*, (1)Speech & Hearing Sciences, University of Washington, Seattle, WA, (2)University of Pennsylvania, Philadelphia, PA, (3)Stony Brook University, Stony Brook, NY, (4)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: The significant lifelong impairments associated with autism spectrum disorder (ASD), combined with the growing number of children diagnosed with ASD, have created urgency in improving school-based quality of care. Few empirically supported interventions have been effectively implemented in schools, the primary setting in which children with ASD receive services. EBPs for children with autism are intensive and require substantial training to achieve successful implementation. Several studies indicate that with training, teachers and classroom staff can implement autism EBPs; however, there are varying levels of EBP use and implementation fidelity, the degree to which an EBP is used as designed (Proctor et al., 2011; Suhrheinrich et al., 2013; Pellecchia et al., 2015; Mandell et al., 2013). Effective implementation ensures that EBPs go from being merely a good idea to actually being put into practice in organizations. A critical factor in effective implementation is the context in which implementation takes places. The field of implementation science has a variety of perspectives and advancements related to implementation, especially at the individual level, which have not been fully considered by autism researchers.

Objectives: The purpose of this study was to examine the individual factors associated with the implementation of EBPs (i.e., discrete trial training, pivotal response training, and visual schedules) for children with ASD in self-contained classrooms in public elementary schools.

Methods: Participants included 67 autism support teachers from 44 public elementary schools. Participants completed ratings of attitudes of EBPs using the Evidence-Based Practices Attitudes Scale, a 15-item psychometrically sound measure that assesses four general attitudes toward adoption of EBPs: appeal, requirements, openness, and divergence (Aarons, 2004). Teachers and classroom staff completed self-report ratings of the frequency with which they deliver each of the EBPs as a proxy for implementation fidelity (e.g. dose).

Results: We computed means and standard deviations to examine attitudes about EBPs and fidelity of each EBP. Despite the nested structure of the data (classrooms nested within schools), multilevel models (MLMs) were not conducted, as there was one teacher per self-contained classroom, which did not allow for clusters needed for MLMs. Instead, regression analyses were used. In the unadjusted models, separate linear regressions were used to test for associations between attitudes about EBPs and fidelity of each EBP. In separate adjusted models, we entered all variables of interest as independent variables with a bivariate association significant at p <.2 and fidelity of each EBP as the dependent variable. Attitudes about EBPs were significantly associated with teachers' use of discrete trial training (p=.01) and visual schedules (p=.04) but not pivotal response training.

Conclusions: The results of this study provide an in-depth understanding of individual-level factors that influence the implementation of EBPs for children with ASD in public schools. These data suggest that individual attitudes about EBPs may be important to consider when evaluating successful implementation of some autism EBPs in elementary schools. Positive attitudes about EBP use may lead to increased use when EBPs are highly structured (discrete trial training and visual schedules) as opposed to naturalistic (pivotal response training).

235 **130.235** Teleplay: A NOVEL Approach to Combat the EARLY Identification Disparity in a RURAL Community

A. B. Barber[1]*, L. G. Yerby*[2]*, J. Boothe*[3]*, D. Albertson*[4]*, C. J. Oslin*[5] *and B. Hargis*[1]*, (1)Communicative Disorders, University of Alabama, Tuscaloosa, AL, (2)Department of Community Medicine and Population Health, University of Alabama, Tuscaloosa, AL, (3)Family Medicine, University of Alabama, Tuscaloosa, AL, (4)Library and Information Studies, University at Buffalo, The State University of New York, Buffalo, NY, (5)University of Alabama, Tuscaloosa, AL*

Background:

Recent research suggests that Telehealth can be useful to accurately identify ASD (Reese et al., 2012; Smith et al., 2017), thereby demonstrating its potential for improving early identification in rural and underserved areas where accessibility to ASD diagnostic and intervention services are limited (Mandell et al., 2005, Stahmer, 2007). Although technology accessibility, limited insurance coverage, funding, and lack of in-person connections present barriers to Telehealth (Antezana et al., 2017, Machalicek et al., 2016), better utilization of technology for information sharing could provide physicians working in rural areas comparable access and online support to expedite the screening, intervention, and referral process.

Objectives:

To pilot Teleplay, an interactive Telehealth platform, in a rural physician's office in order to assess implementation feasibility, the impact on early ASD identification, and the impact on rural medical staff ASD knowledge relative to signs and management. The ultimate objective is to improve early identification in rural communities by integrating ASD specialists into the medical home via Teleplay and by increasing rural physicians' knowledge of ASD signs using their own patient's annotated video samples.

Methods:

Teleplay was developed with National Libraries of Medicine project development funds as an interactive tool to connect rural medical teams with university based ASD experts for communication about children who are at risk for ASD. Teleplay is implemented as follows. 1. When children fail the M-CHAT at 18- or 24-month well child visits, caregivers are invited to complete the Structured Play Assessment (SPA; Ungerer & Sigman, 1981) in the physician's office with their child; 2. The SPA is video recorded by a nurse and securely uploaded via Teleplay to a university-based ASD Clinic; 3. The ASD team observes the video, scores the CARS-2 (Schopler et al., 2010), which is embedded into the Teleplay interface, and time stamps and annotates red flags; 4. The ASD team then sends the annotated time clips with the overall description of any ASD symptoms, and general referral recommendations (i.e. early intervention, speech, full autism evaluation) back to the physician via Teleplay; and 5. The physician uses the videos to communicate feedback to caregivers. Using a logic model (Rubio et al., 2010), the feasibility of implementing Teleplay will be assessed. Finally, the physicians and staff will complete pre-and post ASD quizzes to assess the impact of Teleplay on knowledge of ASD symptoms and management.

Results:

The Teleplay pilot study is active and will conclude in early spring. ASD knowledge was assessed prior to Teleplay implementation. Physicians, residents, and nurses completed a 10-question quiz adapted from the CDC Autism Case Training for developmental-behavioral pediatrics and averaged 73.7% accuracy. The quiz will be re-administered post Teleplay implementation. According to initial assessment using the logic model, collecting and uploading the SPA, scoring and time stamping children's videos, and returning videos to physicians is feasible. Challenges and perceptions will also be assessed and discussed.

Conclusions:

Teleplay is a novel platform that offers a promising solution to the accessibility disparity experienced by children with ASD and their families living in underserved communities.

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130.236 The Feasibility of an Adaptive Telehealth Program for Delivering Parent Mediated Intervention for Autism Spectrum Disorder

A. Wainer[1], *C. Leonczyk*[2] *and Z. Arnold*[1], *(1)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (2)AARTS Center, Rush University Medical Center, Chicago, IL*

Background: There is strong empirical and theoretical support for parent involvement in interventions for autism spectrum disorder (ASD), with rapid growth in the development and evaluation of manualized parent-mediated early interventions (PMI). Despite purported benefits of PMI, such programs are highly under-utilized in community settings, due in large part to a lack of trained professionals, lengthy waitlists, child care, transportation, and reimbursement issues. These barriers compel examination of alternative service delivery methods, such as telehealth, to increase access to care.

Benefits of telehealth include greater provider and patient coverage and opportunities for standardized yet individualized learning. Indeed, telehealth is well-suited to deliver adaptive PMI (e.g., stepped-care models) as varying levels of intensity and support can be automatically provided as needed. Adaptive telehealth can deliver instruction to parents in a self-directed format or with the addition of remote "coaching." Thus, we have developed a telehealth program to provide PMI in a stepped-care format in an effort to increase dissemination and optimize delivery of early intervention for young children with ASD.

Objectives: We developed a stepped-care telehealth program, Me Too Online, to deliver PMI in an evidence-based imitation intervention called reciprocal imitation training (RIT). The goal of the current pilot randomized control trial (RCT) was to demonstrate feasibility of the stepped-care model, and evaluate the initial impact of the program on parent behavior and experiences, and child social communication.

Methods: This 15-week pilot RCT compared Me Too Online to a waitlist control in 20 young children with ASD and their parents (18 to 49 months). Families in Me Too Online used a self-directed website for five weeks and then responder status was evaluated based on parent fidelity and self-efficacy. Non-responding parents received remote coaching sessions over the next five weeks. Those in the control condition received usual care and were given the chance to participate in Me Too Online after 15 weeks. Parent report and standardized assessments were administered at baseline and at 15 weeks.

Results: Results of ANCOVA indicated children in Me Too Online demonstrated greater increases in parent report of social communication ($p<.05$, $d = 1.27$) on the Social Communication Checklist. Specifically, significant increases were observed in ratings of social engagement ($p< .05$, $d = 1.39$) and imitation ($p< .05$, $d = 1.49$). Results of ANCOVA also indicated significantly greater increases in parenting self-efficacy for Me Too Online relative to control ($p < .05$, Cohen's $d = 1.4$). Parents in Me Too Online showed improvements in fidelity concurrent with participation in the program; roughly seventy percent of parents required additional coaching after use of the website alone. Parents rated Me Too Online content and delivery method as highly acceptable, useful, and effective.

Conclusions: This study provides initial data supporting the feasibility and effectiveness of a stepped-care PMI telehealth program for young children with ASD. An important next step will be to evaluate the extent to which such a program can improve reach and reduce costs associated with early intervention for ASD on a larger scale.

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130.237 The Impact of Online Computer Games on Mental Health of Children with Autism or Hearing Loss.

O. Alawajee[1], *J. Delafield-Butt*[2] *and C. Costa*[3], *(1)University of Strathclyde, Glasgow, United Kingdom of Great Britain and Northern Ireland, (2)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom, (3)University of Strathclyde, Glasgow, United Kingdom*

Background: Children with Autism Spectrum Disorder (ASD) or Deaf and Hard of Hearing (DHH) have relationship challenges and difficulties and/or mental health difficulties due to functional disturbance affecting social interaction, learning, and communication.

Objectives: This study examined the role of online computer games to facilitate learning relationships skills and to help improve mental health concerns of children with ASD and DHH. This study approached the role of these games as potential beneficial educational or psychological interventions that might improve social relations, social skills development, and mental health and well-being. Minecraft and its autism-specific modification, Autcraft, were chosen as the focus of this study due to their popularity, accessibility, and the co-operative, rather than competitive, gameplay characteristics.

Methods: This investigation recruited parents of children and children in the United Kingdom (UK) and the Kingdom of Saudi Arabia (KSA). It employed mixed methods data collection. It consisted of two parts: an exploratory questionnaire (n= 195) and a small selection of case studies (n=3), which consisted of post-surveys, observations, and interviews. Subjects for the questionnaire were parents of primary school children aged 8 and over from three groups: children with autism (n= 115), deaf and hard of hearing children (n=10), and children without a disability (n=41).

Results: Minecraft is a popular game among children with ASD and DHH conditions, especially in the UK sample. Positive associations were observed between children's Minecraft gameplay and the quality of those children's friendships and peer relationships, as well as home life skills. Adverse associations were observed between mental health difficulties and the ability to develop good relationships with others through Minecraft play.

Conclusions: Playful, creative interaction with others, such as peers, teachers and other experts is helpful in making learning socially meaningful. Minecraft appears helpful in giving players new freedoms to explore, to experiment, to fail or succeed, and to progress toward desired and self-created imaginative goals. Positive associations within the questionnaire data with Minecraft use suggest this sandbox, open world game might serve as an assistive or supportive tools that can facilitate social creativity and play to impact positively with psychological benefit. Concerns for possible adverse effects will be discussed, as well as current limits of research integrity. Altogether, these data suggest possible positive benefits for Minecraft gameplay for children with ASD and DHH that may be considered for incorporation into educational pedagogy or psychological support.

238 **130.238** The Impact of Participatory Design on the Wellbeing of Individuals with Autism

M. Magnee*, HAN University of Applied Sciences, Nijmegen, Netherlands*

Background: Participatory design (PD) methods have been used to facilitate individuals with autism contributing to the design of assistive technologies. Through appropriate structuring of the PD sessions, the likelihood of developing feasible and accessible technologies that are relevant to users' life worlds is increased. However, challenges remain regarding the integration of these design protocols in regular health care practice and regarding the value of PD in relation to how outcomes of projects are evaluated. Singular measuring instruments do not prove to be decisive, given the complex embedding of assistive technologies in the social life of its users and the multidimensional character of wellbeing.
Objectives: To provide an integral and multidimensional understanding of what constitutes a successful outcome of participatory designed assistive technologies, by means of an evaluation suite in which newly developed technologies are co-evaluated for and with individuals with autism and their caregivers.

Methods: Four separate assistive technologies were evaluated with a group (N=28) of young adult individuals with autism. These include: I) a mobile application called 'TasKing', that helps with fulfilling everyday chores, II) the M-Power tablet that helps people with face-to-face conversations, III) the OOC stress pillow that helps with stress relief by means of a tactile heartbeat inside the pillow, IV) the Tinybot, a robotized planning assistant. Drawing on concepts from the Capability Approach (Nussbaum, 2011; Sen, 1999), realistic evaluation (Pawson & Tilley, 1997) and Actor-Network Theory (Latour, 2005) we designed an evaluation suite consisting of a narrative interview, an actor-network map, quality of life questionnaires, practitioner log entries and user-experience/ usability checklists. These data were aggregated during several 'community of practice' meetings.

Results: Results will be presented from the evaluation of the four co-designed assistive technologies. The separate components of the evaluation suite provide us with a combined collection of subjective and objective effects on the wellbeing of the participants involved and the implications of participatory design processes on day-to-day care. Data from narrative interviews clarify subjective feelings of wellbeing, actor-network maps visualize the embedding of the technologies in the participants' life, quality of life questionnaires provide for quantitative data on quality of life domains (Schalock, 2000), practitioner log entries are deployed for mapping the actual use of the interventions following the CIMO-logic (Context, Intervention, generative Mechanism, Outcome), and usability checklists are used to gauge common usability aspects of the intervention.

Conclusions: This study will contribute to the understanding of what constitutes a successful outcome of participatory designed assistive technologies by emphasizing on the multidimensional aspect of human wellbeing as well as on the implementation of these design and evaluation protocols in everyday care.

239 **130.239** The Relationship between Socioeconomic Status and Use of Interventions in Families of Children with Autism Spectrum Disorder: Results from the ABC-CT Feasibility Study

A. Sridhar[1]*, S. Faja*[2]*, C. A. Nelson*[2]*, S. J. Webb*[3] *and J. McPartland*[4]*, (1)Michigan State University, East Lansing, MI, (2)Boston Children's Hospital, Boston, MA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Prior research indicates significantly reduced utilization of autism-related services in families with lower socioeconomic status (SES). Specifically, research shows that families with lower SES receive fewer hours of autism-related services, and a smaller variety in the types of services they receive. The Autism Biomarkers Consortium for Clinical Trials (ABC-CT) is a multi-site project that aims to investigate biomarkers associated with autism spectrum disorder including their sensitivity to community-based intervention. It provides an opportunity to investigate the relations between SES, total hours of services received, and types of interventions used (evidence-based or complementary and alternative medicine), from data collected at five sites across the United States.
Objectives: To examine the relations between SES and total number of hours of interventions received and to examine patterns between SES and type of interventions received.

Methods: Twenty-five children with ASD and twenty-six typically developing children (M= 8.04 years old, SD= 2.2, range 4-11) participated in the feasibility phase of the ABC-CT project. Two participants did not provide complete data and were not included in analyses. Parents completed a series of questionnaires that included a demographics form and intervention and medication history. Demographics data collected included the participant's race, race of both biological parents, education level of both biological parents, and annual household income. In addition, parents completed an intervention and medication history log on the participant's use of medication (type of medicine and daily dose), the types of intervention received (e.g. speech and language therapy, equine therapy) and the total number of hours of intervention received in the previous six weeks.

Results: Poisson regressions examined the relations between socioeconomic status (measured by parental education level and household income), child age, and hours of intervention received (with significance < .05). Specifically, total hours of intervention received, total hours of evidence-based practices (EBPs) and total hours of complementary and alternative medicine (CAMs) were examined. Annual household income was significantly related to total number of hours of interventions received and total number of hours of CAM received. Maternal education level was significantly related to total hours of EBPs received, but unrelated to total hours of intervention received or total hours of CAM received. Paternal education level and participant's age were significantly related to total hours of interventions received, total hours of EBP received, and total hours of CAM received. Examination of SES by intervention type via Pearson's Chi-squared showed no differences related to SES level in the proportion of families who accessed EBPs, CAMs, or medication. Finally, no site-related differences were found for use of EBPs, CAMs, or medication.

Conclusions: These results indicate relations between parental education level, income, age, and total hours of intervention received by children with autism. Results indicate these effects were due to differences at higher levels of annual household income and parental education. Although these preliminary findings suggest relations between socioeconomic status and the amount of intervention received by children with autism across the U.S., in order to further explore these relations, they should be replicated in a larger sample.

240 **130.240** Theory of Planned Behavior Variables As Predictors of Community Providers' Intent to Implement a Parent-Mediated Intervention for Children with ASD.

D. Straiton *and B. R. Ingersoll, Psychology, Michigan State University, East Lansing, MI*

Background: Parent-mediated interventions are an effective method for improving outcomes for children with ASD (e.g. Ingersoll, Wainer, Berger, Pickard, & Bonter, 2016; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010), yet they are underutilized in community settings where the majority of children receive their services (Lord et al., 2005; Stahmer & Aarons, 2009). The theory of planned behavior (TPB) posits that an individual's beliefs/attitudes, perceptions of norms, and perceived behavioral control predict their intent to perform a behavior (Ajzen, 1985). A strong research base has demonstrated that TPB is an effective model for understanding and changing health-related behaviors (e.g. Albarracin, Johnson, Fisbein, & Muellerleile, 2001; Godin & Kok, 1996) but TPB has thus far not been examined in reference to community providers' intentions to implement parent-mediated intervention for families of children with ASD.
Objectives: This study examined the extent to which TPB could predict community providers' intent to implement an evidence-based, parent-mediated social communication intervention for children with ASD.

Methods: Providers (n = 72) participated in a workshop for Project ImPACT and provided demographic variables (gender, age, racial/ethnic minority status, graduate degree, years of ASD experience, degree to which their caseload matched Project ImPACT's target population) as well as variables derived from TPB (attitudes towards parent-mediated interventions, agency norms regarding parent-mediated interventions, self-efficacy regarding parent coaching skills).

Results: Demographic variables associated with intent to use the intervention included the degree to which providers' caseloads matched Project ImPACT's targeted population and whether the provider had a graduate degree (r = .268, p =.031 and r = .360, p = .003, respectively). Providers' attitudes toward parent-mediated interventions and ratings of perceived behavioral control (i.e. perceived coaching skill level) were associated with intent to implement (r = .330, p = .004 and r = .247, p = .035, respectively), consistent with research on TPB regarding intentions to change health-related behaviors (Ajzen, 2007). Contrary to hypothesis, perceived agency norms were not associated with intentions, r = .002, p = .987. Multiple regression of demographic and TPB variables demonstrated that holding a graduate degree (β = .317, p = .006), having positive attitudes towards parent-mediated interventions (β = .251, p = .026), and having high ratings of self-efficacy regarding parent coaching skills (β = .242, p = .031) were each unique predictors of intention to implement Project ImPACT and together explained ~27% of variance.

Conclusions: Results demonstrate support for the application of TPB to providers' intentions to implement parent-mediated ASD interventions in community settings. TPB provides a theoretical foundation for understanding providers' intentions to implement parent-mediated interventions, which in turn can be used to develop intention interventions to increase implementation of these evidence-based practices. Future research will examine the efficacy of an intervention to influence providers' perceived behavioral control and attitudes towards parent-mediated intervention in an effort to increase provider implementation of parent-mediated interventions for families of traditionally underserved children with ASD served in community mental health settings.

241 **130.241** Using Technology to Support Early Identification of Autism Spectrum Disorder in Vietnam

H. Hoang*, H. S. Vu and G. Le, Center for Creative Initiatives in Health and Population, Hanoi, Viet Nam*

Background:
Early identification and intervention for children with Autism Spectrum Disorder (ASD) in low-middle income countries and in Vietnam in particularly is still a big challenge. Only some pediatric hospitals in big cities in Vietnam provide assessment and diagnosis services for children (VAN, 2012; Mang luoi tu ky Viet Nam, 2016). Young infants and children experience no routine health and development screening, and there is a lack of screening and other assessment tools translated into Vietnamese readily available for use (Ha et al., 2017; Cong et al., 2015). Meanwhile, information available on child development and ASD are not consistent or reliable, and can be confusing for parents leading to considerable misunderstandings and delayed reactions.

Telecommunication Vietnam has been rising rapidly and smartphone become very popular. The increasing use of technology provides the possibility of implementing screening for developmental delay and autism via online platforms. This paper presents our pilot project of developing a365.vn – a web-based platform to support early identification of ASD by both health professionals and parents/caregivers of young children.
Objectives:

- To describe the models and results from the online screening tools on A365 by two groups of users: healthcare professionals during regular child check-ups and parents/caregivers.
- To discuss the advantages and challenges for users, lessons learned and implications for applying technology to support autism screening and diagnosis.

Methods:
Quantitative data are collected from the back-end system, including registered users' demographics and behaviors and tests results, as well as from Google Analytics which provides further information about all visitors to the website. We also used qualitative data from group discussion and in-per-son and phone interviews with users.
Results:
As of June 2017, there were 5536 developmental and autism screening tests completed on the website by users from 59/63 provinces in Vietnam. Screening conducted by health professionals during health check-ups or at home by parents both have advantages and limitations. The

prevalence of children at-risk of developmental delay and autism identified by parents/caregivers was higher than by health professionals. This might imply that the majority of parent users of A365 already had some concerns about their child's development, and as a result become interested in using the tools provided by a365.vn. In contrast, integration of screening into regular health check-ups allows screening at wider scale. Our pilot project also shows that training in autism and using screening tools empowers and increases the health professionals' confidence level.

Conclusions: For both models, significant efforts for communications is required, both by traditional, mass media means such as posters, radios, etc,... to more technology-based, viral means such as social media and online forums. Collaboration with stakeholders, leaders and influencers at various levels, such as community leaders/authority, facebook influencers, etc. are also needed for the screening service to reach more parents. Last but not least, both models points to the need for follow-up services to confirm the diagnosis of at-risk children as well as further support for early intervention.

242 **130.242** Using the Dynamic Sustainability Framework to Adapt Family Navigation for Children with Autism Spectrum Disorder: Results from a Quasi-Experimental Trial

S. broder-Fingert[1]*, A. Chu*[2] *and E. Feinberg*[2]*, (1)Pediatrics, Boston University, Boston, MA, (2)Boston University School of Public Health, Boston, MA*

Background: Family Navigation (FN) is an evidence-based case management approach to helping families overcome systems and person-level barriers to care. Our previous pilot work in a population of low-income, minority children demonstrates the feasibility, acceptability, and suggests effectiveness of FN to enhance access to services for children with autism spectrum disorders (ASD).

Objectives: In the current study, we describe: 1) how we adapted FN to improve implementation; and 2) compare the implementation of this adapted version of FN to a previous trial of FN for children with ASD.

Methods: We used the Dynamic Sustainability Framework (DSF) and data from our previous pilot of FN to inform adaptations. First, we worked with an advisory group of clinicians and researchers to make specific adaptations – the goal of which was improved implementation. Then, we recruited 40 parents of children with positive ASD screens and randomly allocated them to receive an adapted form of FN or usual care. Using a quasi-experimental design, we compared implementation outcomes (utilization, feasibility, and acceptability) between the recruited population and a population of 40 parent-child dyads who participated in a previous pilot of a non-adapted version of FN. Finally, we measured the clinical outcome - time to diagnostic resolution - using survival analysis.

Results: Adaptations were made in all three domains of the DSF: Intervention (e.g. addition of motivational interviewing training), Practice Setting (e.g. change in recruitment location), and Ecological System (e.g. changes in appointment scheduling). Compared to the un-adapted version of FN, families referred to the study were more likely to have an initial visit with the FN (97.7% versus 81.4%, $p<0.001$), and had more interactions (phone, text, in-person) with their FN (mean of 7 interactions v. 22, $p<0.001$). Parents rated the relationship with their navigator (on the satisfaction with navigation questionnaire) similarly between groups (mean score 3.80 v. 3.82, $p=0.8$). For our clinical outcome, FN improved diagnostic resolution for children at risk of ASD at similar rates in the original and adapted FN model (95% versus 90%, $p=0.15$).

Conclusions: Using the DSF to adapt FN improved implementation without altering satisfaction with or effectiveness of the intervention. These data support an adaptive approach to future implementation of FN in new settings.

Oral Session -
Invited, Keynote Speakers, Awards
136 - Welcome Address & Sponsor Update
8:45 AM - 9:00 AM - Grote Zaal

8:45 Welcome Address & Sponsor Update.

Oral Session -
Invited, Keynote Speakers, Awards
137 - Keynote Address - Rosalind W. Picard, Sc.D, FIEEE
9:00 AM - 10:00 AM - Grote Zaal

Rosalind W. Picard is founder and director of the Affective Computing Research Group at the MIT Media Laboratory, faculty chair of MIT's Mind+Hand+Heart initiative, co-founder of Affectiva, providing emotion AI technology to help measure and communicate emotion, and co-founder and Chief Scientist of Empatica, improving lives with clinical-quality wearable sensors and analytics. Picard is the author of over two hundred and fifty peer-reviewed scientific articles. She is known internationally for authoring the book, Affective Computing, which is credited for launching the field by that name. She holds a Bachelors in Electrical Engineering from the Georgia Institute of Technology and Masters and Doctorate degrees in Electrical Engineering and Computer Science from MIT. Picard is an active inventor with over a dozen patents: her group's inventions have been twice named to "top ten" lists, including the New York Times Magazine's Best Ideas of 2006 for their Social Cue Reader used in autism, and 2011's Popular Science Top Ten Inventions for a Mirror that Monitors Vital Signs. Picard's lab at MIT creates new technologies to better understand, predict, and regulate emotion in service of better human health and well being.

9:00 How Emotion Technology Can Improve Science and the Future of Autism

R. W. Picard*, MIT, Cambridge, MA*

Computers, robots, and wearable technologies are gaining the ability to sense, recognize, and respond intelligently to human emotion. This talk will highlight several important findings made with these recent advances, including surprises about the "true smile of happiness," and how a wearable built to measure autonomic stress in autism led to unusual electrodermal signals on the wrist that reveal new insights into deep brain activity, with implications for anxiety, epilepsy, sleep-memory consolidation, mood disorders, pain measurement, and more. How might these technologies transform the way we do research in autism? How might we use these findings to enable more comfortable social-emotional communication and future improved health experiences for people on the spectrum?

Panel Session
Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
138 - 'Sensory First' Approaches to Dissect Physiological Heterogeneity in ASD.
10:30 AM - 12:30 PM - Grote Zaal

Panel Chair: Hilgo Bruining, *Brain Centre Rudolf Magnus, Amsterdam, Netherlands*

Discussant: Patrick Bolton, *Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

A prevailing theory is that imbalances of excitatory and inhibitory (E/I) signals in the brain underlie information processing defects in ASD. This theory relates to the observation that many individuals with autism experience seizures and display ongoing 'sharp spike' activity during wake stage and even more frequently in sleeps. E/I balance is regarded critical for the shaping of sensory processing networks during early postnatal stages as well as to maintain sensory functions through supporting roles such as network synchronization, noise filtering and sensory binding. Surprisingly, it has taken until the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) to formally acknowledge sensory difficulties as a core diagnostic feature of ASD and mechanistic understanding of sensory processing alterations in ASD is limited. In this panel, we present studies of two large ongoing sensory driven translational ASD research projects in the Netherlands, the Sensory Processing Program in Utrecht/Amsterdam and the BECAUSE project in Amsterdam. We will present novel neurophysiology approaches and techniques to elucidate associations between E/I balance and sensory processing components that may support rational treatment decisions in ASD with and without epilepsy comorbidity.

10:30 **138.001** Sensory-First Dissection of ASD with and without Epilepsy Using Combined Analysis of Auditory Event Related Potentials.

__C. Vlaskamp__[1], B. Oranje[1], D. M. van Andel[2], J. J. Sprengers[2], S. Durston[3] and H. Bruining[4], (1)Department of Psychiatry, Brain Center Rudolf Magnus, NICHE Lab, University Medical Center Utrecht, Utrecht, Netherlands, (2)Brain Center Rudolf Magnus, Department of Psychiatry, UMC Utrecht, Utrecht, Netherlands, (3)Department of Psychiatry, Brain Center Rudolf Magnus, University Medical Center Utrecht, Utrecht, Netherlands, (4)Brain Centre Rudolf Magnus, Amsterdam, Netherlands

Background:
Sensory processing is increasingly regarded as a critical cornerstone for understanding ASD. So far, mechanistic understanding of sensory processing alterations in ASD is limited. A leading theory is that these alterations are closely related to an imbalance of excitation and inhibition. This theory is supported by the frequent occurrence of seizures or epileptiform changes in patients with ASD. It is yet unknown how this comorbidity affects sensory processing and sensory behavioral reactivity. As part of the Sensory Processing Program in Utrecht, we tested how sensory processing of auditory stimuli might predict behavioral outcome in ASD with and without epilepsy comorbidity.

Objectives:
The objective of this study was to investigate the relationship between neurophysiological measures of sensory processing and sensory behavioral reactivity, such as irritability, and assess the influence of comorbid epilepsy.

Methods:
90 children with ASD (with and without comorbid epilepsy) and 30 typically developing (TD) children aged 7-12 were assessed with an extensive neurophysiological battery. Using EEG, measured mismatch negativity (MMN), an automatic orienting reflex occurring after deviation of stimuli in the environment without requiring conscious perception. On a more conscious level, we measured selective attention (SA) which demands the focus on stimuli while ignoring irrelevant information in the environment, captured in the P3b component. In addition, multiple behavioral parental questionnaires (ABC, SP-NL and SRS) were included in the analyses.

Results:
Children with ASD (with and without epilepsy) showed less selective attention, as indicated by lower P3b amplitude to attended auditory stimuli. Autonomous discrimination as measured with MMN was not significantly different between ASD and TD children on the ASD group level, but a discrepancy between ASD with and without epilepsy was found: children with ASD and comorbid epilepsy showed increased MMN compared to TD, whereas children with ASD without seizures showed decreased MMN. Furthermore, reduced selective attention was associated with increased irritability and sensory hyper-reactivity. Finally, concurrent problems in MMN and SA had additive effects on behavioral outcome as indicated by increased irritability.

Conclusions:
This sensory-first approach raises new possibilities for rational diagnostics and treatment on a neurophysiological basis. Results show that crucial sensory contrasts may be lost when ASD is analyzed without stratification. Epilepsy comorbidity has a profound impact on sensory processing as indicated by the MMN, suggesting the presence of opposing neural phenotypes within the autism spectrum. In addition, the integration of multiple sensory processing (ERP) components into the diagnostic equation might further disentangle the variability in clinical manifestations.

10:55 **138.002** EEG-Driven Stratification of Autism Spectrum Disorder with and without Epilepsy

__H. Bruining__[1], S. Simpraga[2], E. Juarez[2], J. J. Sprengers[3], S. S. Poil[2], H. Mansvelder[2] and K. Linkenkaer-Hansen[4], (1)Brain Centre Rudolf Magnus, Amsterdam, Netherlands, (2)CNCR, VU Medical Center, Amsterdam, Amsterdam, Netherlands, (3)Brain Center Rudolf Magnus, Department of Psychiatry, UMC Utrecht, Utrecht, Netherlands, (4)Department of Integrative Neurophysiology, CNCR, VU University Amsterdam, Amsterdam, Netherlands

Background:

Clinical heterogeneity makes understanding of autism spectrum disorder (ASD) challenging and complicates development of successful treatment. Neurophysiologically, excitatory-inhibitory (E/I) imbalance and disturbed neuronal oscillations have been proposed as central mechanisms behind ASD.

Objectives:

We aimed to use EEG biomarkers to assess neural disturbances and make ASD triage more precise than is currently feasible using current behavioral and sensory scales. We further investigated whether ASD children with (ASD-EPI) or without epilepsy (ASD) can be stratified using integrative indices derived from comprehensive EEG biomarker mapping and machine-learning.

Methods:

90 ASD and 30 typically developing (TD) children (age 7-12 years, IQ>70) were measured with 64- channel EEG in an eyes-closed resting-state condition. All EEG recordings were visually scored for (epileptiform) abnormalities. We quantified the EEG oscillations using spectral and temporal methods in the standard frequency bands and averaged values across channels within three large regions of interest. We also characterized long-range temporal correlations of ongoing oscillations as a proxy of E/I balance using detrended fluctuation analysis (DFA). Integration of biomarkers was done in the Neurophysiological Biomarker Toolbox (http://www.nbtwiki.net/), employing data-mining algorithms to combine information from multiple biomarkers into a single index.

Results:

We found a high number of EEG abnormalities within the ASD groups. ASD patients had high delta relative power and strong autocorrelations in widespread brain regions: both ASD and ASD-EPI subjects showed elevated long-range temporal correlations compared with TD, suggesting that the E/I balance is indeed disturbed in ASD (Poil et al., 2012). The machine-learning techniques resulted in integrated EEG-biomarker indices that discriminated the two ASD groups from TD with high accuracy, and predicted the EEG abnormality scores. The EEG index that optimally discriminated ASD and TD children showed high correlation with total IQ, Sensory Profile scores and Social Responsiveness Scale. The index discriminating ASD-EPI from ASD correlated highly with Autism Behaviour Checklist-Irritability subscale.

Conclusions:

Our findings suggest that these EEG markers can be used to stratify ASD patients, which might contribute to the development of a decision support system for diagnostic and prognostic use in the clinical assessment of children with various manifestations of ASD.

11:20 **138.003** Sensorimotor Gating Variability in ASD with and without Epilepsy Comorbidity May Indicate a Sensory Treatment Target.

J. J. Sprengers[1], *E. Juarez*[2], *D. M. van Andel*[1], *C. Vlaskamp*[3], *K. Linkenkaer-Hansen*[4], *H. Bruining*[5] *and B. Oranje*[3], *(1)Brain Center Rudolf Magnus, Department of Psychiatry, UMC Utrecht, Utrecht, Netherlands, (2)CNCR, VU Medical Center, Amsterdam, Amsterdam, Netherlands, (3)Department of Psychiatry, Brain Center Rudolf Magnus, NICHE Lab, University Medical Center Utrecht, Utrecht, Netherlands, (4)Department of Integrative Neurophysiology, CNCR, VU University Amsterdam, Amsterdam, Netherlands, (5)Brain Centre Rudolf Magnus, Amsterdam, Netherlands*

Background:

An increasing role for sensory dysfunctions is indicated in the pathogenesis of Autism Spectrum Disorder (ASD). The nature and severity of these dysfunctions in ASD may indicate specific subtypes and treatment targets. Event related potential (ERP) EEG paradigms in relation to clinical manifestations of ASD offer a framework to characterize and dissect sensory dysfunctions. Sensorimotor gating is an unconscious early sensory processing mechanism and found abnormal earlier in children with epilepsy. As proof of principle, we tested whether sensory gating deficits are influenced by focal EEG abnormalities and epilepsy comorbidities in ASD.

Objectives:

To test the association between sensorimotor gating abnormalities and epilepsy comorbidity in children with ASD.

Methods:

90 children aged 7-12 with an IQ above 70 and atypical sensory behavior (60 diagnosed with autism spectrum disorder (ASD), 30 diagnosed with epilepsy and ASD comorbidity) and 30 typically developing children aged were investigated. Sensory behavioral abnormalities (SP-NL, ABC-I, ADOS and SRS), quantitative and qualitative EEG parameters (p50, resting state and focal abnormality grading) were assessed. Comparative statistical analyses were used to test whether abnormal p50 suppression coincided with epilepsy diagnosis or focal abnormality grades and associated with different behavioural outcomes.

Results:

Sensory gating abnormalities were more frequent amongst children diagnosed with epilepsy and in children who showed focal EEG abnormalities. Presence of p50 abnormalities or epilepsy comorbidity seemed not to associated with autism severity or sensory abnormalities.

Conclusions:

Sensory gating abnormalities seem to be more frequent in ASD patients with epilepsy comorbidity. This association may elude to common mechanisms between ASD and epilepsy syndromes as has been hypothesized previously. Future studies may attempt to correct sensory gating deficits in ASD with antiepileptic treatment, especially when epielptiform abnormalities are noted in the EEG of children with ASD.

11:45 **138.004** The Because Project: Impaired Sensory Processing in ASD: From Clinical Profiles to Synaptic Mechanisms

M. Verhage, *CNCR, VU Medical Center, Amsterdam, Amsterdam, Netherlands*

Background:

The neurobiological mechanisms underlying ASD are still poorly understood. Recently, sensory sensitivities, such as extreme sensitivity to light, sound, or touch, were added to the ASD diagnostic criteria (DSM5) as negative and prevalent symptoms. A new network theory explains the sensory sensitivity problems in ASD by a disturbed excitation/inhibition (E/I) balance in synaptic networks in the brain.The current project aims to test this theory using behavioral, neuropsychological, neurophysiological and cellular analyses of sensory processing deficits in ASD.

Objectives:

In this presentation, I will highlight the progress of BECAUSE: From Behavior to Cell in AUtism SEnsory processing, a Dutch national project to test this theory using behavioral, neuropsychological, neurophysiological and synaptic analyses of sensory processing deficits in ASD.

Methods:

BECAUSE has exploited our Netherlands Autism Register to pre-select extreme cases of high and low sensory sensitivity among ASD participants (currently 683) and control subjects and examine the relationship between sensory sensitivity and other clinical characteristics and daily functioning skills. Eighty pre-selected participants have been assessing further, using customized sensory processing tasks and EEG, which we have previously optimized to analyze sensory sensitivity and E/I balance. We have previously optimied small, standardized neuronal networks in vitro, made of human neurons derived from induced pluripotent stem cells (iPSCs) and to record differences in synaptic and network properties. The sensory sensitivity and E/I balance tests is used to generate these standardized in vitro networks of the most extreme cases. Finally, it has been proposed that the (unknown) neurobiological mechanisms underlying sensory processing deficits are similar to those underlying higher order social function deficits (Baum et al., 2015). Therefore, we are testing whether the outcomes of our neuropsychological and neurophysiological tests are predictive for the reported higher order function deficits.

Results:

This presentation will be the first presentation of the BECAUSE screenings data. In addition, the completed pilot studies on EEG-analysis of excitation/inhibition balance and synapse physiology in patient-derived neurons will be discussed.

Conclusions:

BECAUSE brings together unique expertise to bridge across behavioral, neuropsychological, neurophysiological and cellular research domains of ASD, focusing on a symptom that is recently recognized as a central mechanism, also in relation to other indicators of ASD, but for which integrated studies across research domains are still lacking. Whereas higher order social functions are difficult to measure quantitatively, sensory processing can be easily quantified in a manner that is less biased for age, gender, or cultural background. BECAUSE is expected to lead to a more objective, unbiased and homogeneous ASD subtyping which is again expected to improve ASD diagnosis and facilitate cellular studies with neurons derived from ASD participants. Such iPSC-derived neuronal models, in contrast to current (monogenic) animal- or cell-models, present the full polygenic complexity of ASD. Together, BECAUSE provides a unique opportunity to bring together information from these different research domains, enhance our understanding of the complexity of ASD, and provide intervention targets to alleviate the burden of ASD.

Panel Session
Early Development (< 48 months)
139 - Brainview: Developing New Approaches to EARLY Detection of Autism Traits
10:30 AM - 12:30 PM - Willem Burger Zaal

Panel Chair: Grainne M. McAlonan, *Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom*

Discussant: Jan Buitelaar, *Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands*

Neurodevelopmental disorders such as autism spectrum disorders (ASD) likely arise well before a clinical diagnosis is made. Longitudinal studies in infants with and without familial risk for ASD provide the opportunity to identify biomarkers that predate later ASD symptoms. Here we report how Early Stage Researchers are collaborating to use novel multi-modal methods within such cohorts to reveal typical and atypical mechanisms of early development. The first presenter will start at birth, examining maturation of synchronous fMRI activity in the social brain network in neonates at-risk of ASD. In the second presentation, we look at responses to social stimuli in 8-month-old infants who later develop ASD and explain how this data can be used to predict later diagnostic outcome in classifier models. The third presenter will then report on the association between functional EEG connectivity in at-risk infants at 14-months and restricted and repetitive behaviours in ASD. Finally, the last talk will examine 2-4 year-old toddlers recently diagnosed with ASD and explore the association between autonomic arousal (heart rate and heart rate variability) and cognitive and social skills. Together, with the discussant, we will examine how these findings may have clinical meaning, both for early diagnosis and targeting novel treatments.

10:30 **139.001** Altered Maturation of Spontaneous Synchronous Neural Activity in the Social Brain of New-Born Infants with Risk Factors for ASD

J. Ciarrusta[1], *R. Dimitrova*[2], *J. Ó Muircheartaigh*[3], *D. Batalle*[1], *D. Edwards*[4], *E. Hughes*[2], *T. Arichi*[5], *D. G. Murphy*[6] *and G. M. McAlonan*[7], *(1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Centre for the Developing Brain, Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neurosciences, King's College London, London, United Kingdom, (4)Imaging Sciences & Biomedical Engineering, King's College London, London, United Kingdom, (5)Imaging Science & Biomedical Engineering, King's College London, London, United Kingdom, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom*

Background:

Specific brain regions (such as the cingulate and fusiform gyri) play a key role in social cognitive processing. Although several studies have reported altered functional connectivity within these regions in individuals with ASD, it is unknown when such atypicalities emerge. Converging evidence from animal models of ASD indicates that genetic or environmental risk factors for ASD disrupt the maturation of ‘spontaneous synchronous’ brain activity in functional networks in early postnatal life. However, no-one has examined whether synchronous activity in social brain regions (e. g. fusiform gyrus and posterior cingulate) is altered in the first few weeks of life in human infants at-risk of ASD.

Objectives:

Here, we used Regional Homogeneity (ReHo) to quantify synchronous neural activity at ‘rest’ (fMRI) in neonates with (R+) and without (R-) an established risk factor for ASD (such as a sibling with a diagnosis). We hypothesized that there would be a group difference in synchronous activity and how it changes with age in the social brain.

Methods:

High temporal resolution fMRI during natural sleep was acquired in a Philips 3T Scanner from 24 R+ and 19 R- neonates within the first 4 weeks of life [R+ median age 42.85 weeks post-menstrual age (PMA); R- median age 42.71 weeks PMA]. Data pre-processing was implemented in FSL (www.fmrib.ox.ac.uk/fsl), with non-linear spatial normalization into an age-appropriate template space (http://brain-development.org/brain-atlases/multi-structural-neonatal-brain-atlas/). The pre-selected social regions-of-interest were based on the social brain atlas (https://neurovault.org/collections/2462/) and comprised the superior temporal gyrus, the fusiform gyrus, the posterior and the anterior cingulate and the insula, defined using the same neonatal atlas that was used as a template. Voxel-wise regional homogeneity (ReHo) values were extracted using AFNI 3dReHo for 27 nearest neighbors per voxel. Unpaired t-tests with permutation testing were used to compare the interaction between age and regional homogeneity maps in the regions of interest between groups with false discovery rate (FDR) correction for multiple comparisons.

Results:

We found a main effect of group; R+ neonates had significantly higher ReHo in all regions except the fusiform and the right insula. In addition, ReHo increased with age in the R- group, but decreased with age in the R+ group in every region-of-interest apart from the fusiform. This was most prominent in the bilateral posterior cingulate and left insula cortices where the ReHo-age interaction was significant (see figure 1).

Conclusions:

Our data indicates that atypical maturation of networks which support social behaviour happens from birth in infants at risk of ASD.

10:55 **139.002** Neural Sensitivity to Social Stimuli at 8 Months Predicts Social Behaviour at Two Years and ASD-Outcome at Three Years.

*G. Bussu[1], **A. Gui**[2], C. Tye[3], E. J. Jones[4], T. Gliga[2], M. Elsabbagh[5], T. Charman[6], M. H. Johnson[7], K. Johnsen[8], J. K. Buitelaar[9] and &. The BASIS Team[2], (1)Donders Institute for Brain, Cognition and Behaviour, Radboudumc, Nijmegen, Netherlands, (2)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (3)Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (5)McGill University, Montreal, PQ, Canada, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (8)Mentis Cura, Reykjavík, Iceland, (9)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands*

Background: Autism Spectrum Disorder (ASD) is typically diagnosed at age two or three, and is characterised by difficulties in social communication and interaction. Atypical neural responses to social stimuli have been associated with difficulties in socialisation in toddlerhood (Webb et al. 2011; Dawson et al., 2012). Early evidence suggests that such brain-related changes emerge earlier than clinical manifestations, raising the possibility of early identification (Elsabbagh et al., 2012; Jones et al., 2016). In order to have clinical potential, such effects must be replicated and extended to individual-level prediction.

Objectives: We first tested whether differences in neural correlates of attention engagement to social stimuli at 8 months are associated with atypical social behaviour at two years and autism outcome at three years (study 1). Additionally, we investigated whether a specific subset of brain responses to the same stimuli can predict individual ASD outcome (study 2).

Methods: EEG activity was recorded from 67 low-risk (LR) infants and 145 high-risk (HR) siblings while looking at faces with direct and averted gaze and visual noise (Figure 1). Clinical outcome of HR infants was established at 36 months (typical development [HR-TD; n=77]; atypical development [HR-Aty; n=37]; ASD [HR-ASD; n=31]). The Vineland Adaptive Behavior Score (VABS) questionnaire was used to assess social behaviour at 24 months.

Analysis 1 examined whether groups showed differences in mean amplitude of the Nc (attention-related) component when looking at face versus noise. In study 2, a Support Vector Machine (SVM) classifier discriminated HR-ASD from other siblings using ERP features selected by a genetic algorithm.

Results: Analysis 1: LR and HR groups showed significantly different Nc responses to the face-noise contrast (p=.04), with HR showing a significantly less negative early Nc component when looking at faces vs noise (p<.000). HR-ASD infants showed a larger difference in mean amplitude of the early Nc over the right frontal region with respect to the other groups (t(340)=-2.09, p=0.037). The amplitude difference in the face-noise contrast in infancy significantly predicted VABS socialization scores at two years (beta=-0.55, p=.007, Figure 2). Analysis 2: classification of HR-ASD at 8 months was possible with 80.4% Area Under the Curve (AUC; 95% confidence interval, CI [72.4, 87.6]). The most relevant features included differences in P4 (latency) and P1 for the gaze shift contrast; and P1 (amplitude), N290 (latency), and P4 for the face-noise contrast. Finally, responses to faces and the face-noise contrast showed high predictive power for ASD (80.7% AUC; 95% CI [72.5, 88.0]).

Conclusions: Differences in neural responses to faces vs. noise at 8 months can predict socialisation skills at 2 years, and individual ASD outcome at 3 years. Early disruptions to social attention engagement can be critical to later development of ASD traits such as social interaction difficulties, and have important clinical implications for early risk assessment and targeted intervention.

11:20 **139.003** Early Functional EEG Connectivity in Infants at Risk for Autism Associates with Later Circumscribed Interests; A Replication Study

***R. Haartsen**[1], E. J. Jones[2], E. V. Orekhova[3], T. Charman[4], M. H. Johnson[5] and &. the BASIS Team[6], (1)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)MEG-Center, Moscow University of Psychology and Education, Moscow, Russian Federation, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (6)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom*

Background:

Previous studies have suggested functional EEG connectivity as potential biomarker of Autism Spectrum Disorders (ASD). However, findings are mixed and replication is essential for application in the clinical field and understanding of underlying mechanisms. Our previous study found functional EEG hyper-connectivity in 14-month-old infants who developed ASD at a later age compared to those who did not met ASD criteria. The amount of hyper-connectivity in selected fronto-central connections was related to later severity of restricted and repetitive behaviours (RRBs) in infants who later developed ASD, whereas no associations were found with later communication difficulties.

Objectives:

The current study had three objectives: 1) replicate the findings of hyper-connectivity in infants who later develop ASD, 2) replicate the association between early hyper-connectivity and later RRBs, and 3) further investigate the latter association by looking at subtypes of RRBs.

Methods:

Functional EEG connectivity was measured with the debiased weighted phase lag index for the alpha range (7-8 Hz) from EEG recordings while 14-month-old infants watched videos. Clinical outcome and symptom severity at 36 months of age were assessed via parental interview with the Autism Diagnostic Interview – Revised (ADI-R). The final sample included infants with low familial risk ($N_{LR} = 20$), and with high familial risk who showed typical development ($N_{HR\text{-}TD} = 47$), atypical development ($N_{HR\text{-}Atyp} = 21$), or met ASD criteria ($N_{HR\text{-}ASD} = 13$) at 36 months. Global (average) connectivity values in the HR-ASD group were compared to the LR, HR-TD and HR-Atyp group separately. Spearman's correlations were used to investigate associations between connectivity and the Repetitive Behaviour and Social and Communication scales of the ADI-R.

For correlational analyses for the subtypes of restricted and repetitive behaviours, datasets for infants with high familial risk from the previous and current study were combined. We focused on three subtypes of RRBs: repetitive motor behaviours ($N_{HR} = 103$), insistence on sameness ($N_{HR} = 102$), and circumscribed interests ($N_{HR} = 90$) measured with the ADI-R.

Results:

Global EEG connectivity in the HR-ASD group showed no significant differences compared to the LR, HR-TD, or HR-Atyp group. In the HR-ASD group, functional connectivity across selected fronto-central connections was associated with RRBs (Figure 1). No significant associations were observed with social and communication difficulties in the HR-ASD or HR group.

Further analyses in the combined datasets showed that functional EEG connectivity in the HR group was significantly associated with circumscribed interests, whereas correlations with repetitive motor behaviours and insistence on sameness did not reach significance.

Conclusions:

First, we did not replicate the finding of hyper-connectivity in the HR-ASD group compared to the other groups. The heterogeneity in ASD might underlie our failure to replicate categorical outcome findings.

Second, we did replicate the previously observed association between functional EEG connectivity and dimensional traits in HR-ASD infants. This is the first replication of an infant neural predictor of later variation in dimensional traits.

Lastly, the associations with functional connectivity were strongest for circumscribed interests. It is possible that atypical connectivity in the cortico-basal ganglia-thalamo-cortical loop underlies this observation.

11:45 **139.004** Stability of Autonomic Arousal and the Relationship with Cognitive and Social Skills

T. Bazelmans[1]*, E. J. Jones*[2]*, T. Charman*[3] *and S. J. Webb*[4]*, (1)King's College London, London, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA*

Background: There is an increasing interest in physiological biomarkers (such as heart rate (HR) and high-frequency heart rate variability (HRV)) in Autism Spectrum Disorder (ASD). However, we have little information about the reliability of autonomic arousal in children with ASD. Moreover, studies have reported contrasting results when it comes to group differences, with support for lower parasympathetic activity in ASD or no group differences compared to typically developing (TD) children. Also, the relationship between autonomic arousal and developmental abilities is unclear. Within TD children, lower HRV and higher HR during periods of rest has been associated with poorer developmental outcome. In ASD similar results are found in middle-childhood, but not yet earlier in development.

Objectives: This study has three aims: 1. To compare toddlers with ASD and TD on HR and HRV; 2. To look at measurement stability using intra-individual variability and test-retest reliability, 3. To examine the relationship between autonomic arousal and cognitive and social abilities.

Methods: Heart rate was collected during two visits ($M = 19.2$ days apart) for 71 children with ASD and 67 children with TD (2 to 4-years-old). Social and cognitive abilities were measured using the Preschool Language Scale, the Communication and Socialization subscales of the Vineland Adaptive Behavior Scales, and the preschool Behaviour Rating Inventory of Executive Functioning. The children watched four 90-second "rest" videos (wildlife animals) as part of a screen-based battery. Data was analysed in 30-second epochs. First, average HR and HRV between groups was compared using t-tests. Second, stability of the physiological measures was evaluated (a) by calculating intra-individual variation and (b) with interclass correlations. Third, we ran separate regression analyses with HR and HRV as the independent variables and Language, Communication, Socialization and EF as the dependent variables, controlling for age and Visual Reception score of the Mullen Scales of Early learning.

Results: Groups did not differ in HR ($t(136)=-1.33$, $p=.187$, $d=-.23$) or HRV ($t(136)=0.87$, $p=.386$, $d=.15$). Intra-individual variability of HR was higher in the ASD group than the TD group. For HRV, this was only the case for the second visit. Test-retest reliability of HR and HRV was average to good in both groups (ICC range: .59-.73). There was an interaction effect of HR & group and HRV & group for Language, Communication and EF, but not Socialization. The effect on Communication remained after controlling for age and visual reception. Post-hoc analyses showed that only in the ASD group there was a positive correlation between HRV and Communication (partial $r = 0.30$, $p=.013$).

Conclusions: First, in this large sample, measures of autonomic control do not discriminate between 2 to 4-year-old children with ASD and TD during rest. Secondly, test-retest reliability was comparable in both groups; however, the ASD group showed higher intra-individual variability within a session. HRV was positively correlated with communication abilities in the ASD group, but not the TD group. Overall, these findings suggest there is an association between autonomic arousal and communication skills in ASD; variability within a person is important to consider in future research.

Panel Session
Medical and Psychiatric Comorbidity
140 - The Co-Occurrence of Autism and Gender Dysphoria or Gender Incongruence
10:30 AM - 12:30 PM - Willem Burger Hal

Panel Chair: John Strang, *Center for Autism Spectrum Disorders, Children's National Health System, Washington, DC*

Discussant: Annelou L.C. de Vries, *VU University Medical Center, 1007 MB Amsterdam, Netherlands*

The over-representation of ASD among individuals clinically referred for Gender Dysphoria (GD) has been observed across multiple sites internationally; up to 25% of youth gender referrals present with significant autism symptoms. There is also emerging evidence for an over-representation of gender identity differences among ASD-referred youth. The ASD/GD co-occurrence is conceptually and clinically complex, and a range of theories have been proposed to explain it. However, studies to date have addressed the prevalence of the co-occurrence without considering the personal voices and experiences of gender dysphoric autistic individuals. Panelists address key questions for this population: 1. What do autistic transgender youth and their families want and need from care providers?; 2. How are autism and gender dysphoria traits related in the general population? 3. What are the developmental gender histories, experiences, and hopes of autistic transgender youth?; and 4. What are the mental health concerns of autistic youth who report gender dysphoria? These questions are addressed through qualitative and community-based participatory methods, directly capturing the voices of autistic gender dysphoric youth; evaluation of subclinical trait-based relationships in the general population; and assessments of GD traits among ASD-referred youth.

10:30 **140.001** Autistic Gender Dysphoric Youth: Community-Based Participatory Research Development of a Clinical Program

__J. F. Strang__[1], M. Knauss[2], L. Kenworthy[1], D. Gohari[1], M. D. Powers[1] and L. Anthony[3], (1)Children's National Health System, Washington, DC, (2)Alliance of Community Health Plans, Washington, DC, (3)University of Colorado, Denver, Aurora, CO

Background: The co-occurrence of ASD and Gender Dysphoria (GD) in adolescents is clinically complex, as autistic youth often have differences in self and social-awareness, future thinking/planning, and self-advocacy skills, skills critical for both gender identity discernment and, when appropriate, social and physical gender transition. Yet, there are no clinical programs/approaches developed for autistic gender dysphoric (ASD+GD) youth.
Objectives: This study assesses the clinical needs/priorities of ASD+GD youth and their parents, and through Community-based Participatory Research (CBPR) methodology, develops and assesses the acceptability/usefulness of a novel clinical group program for this co-occurrence.

Methods: Youth age 12-19 with concurrent DSM-V diagnoses of ASD and GD (Tanner stage II–V), and their parents (total individuals, N=57), participated in an ongoing clinical group program aimed at supporting autism-related and gender-related needs, coping, and positive outcomes for ASD+GD youth. Youth and parents provided individual written feedback to specific probes following each clinical session addressing what they desired/needed from the clinical service, perceived successful/unsuccessful components of the program, and individual clinical/support needs. Youth and parents also completed in-depth interviews at three-month intervals. Successive clinical group sessions applied participant recommendations from previous youth/parent feedback according to CBPR methodology. Independent Framework Analyses (FA) were conducted with youth and parent data, and compared for thematic convergence/divergence. A key-stakeholder group including autistic, transgender, transgender autistic, and transgender de-transitioned self-advocates, as well as clinical gender and autism specialists reviewed the FA thematic needs/priorities, and the clinical priorities were translated into specific clinical methods/techniques. Youth/parents rated each resulting clinical approach for its usefulness on a continuous 10cm slider scale.

Results: Clinical priorities (themes) shared by both youth and parents include the importance of a group program specifically for gender spectrum autistic youth and their parents (as opposed to separate autism or transgender groups), structured opportunities for gender-role exploration in the group context, and teaching of specific skills for gender presentation (e.g., makeup/styling skills and mannerisms). A youth priority not appearing in the parent thematic framework was the recommendation to create opportunities for youth to meet a range of community visitors at different points on the gender spectrum to serve as concrete role models for diverse gender paths/options. Parent-specific thematic priorities for their children included supports for safety awareness and safety skills and supports to explore whether youth experiences of gender might be impacted/driven by autism-related characteristics (e.g., less flexible thinking). Eighteen clinical techniques were derived from the thematic priorities of youth and their parents. Parent ratings of the usefulness of the clinical approaches were high (Mean for all approaches=87.27; SD=6.96, with a range 0-100, 50 as a midpoint, and higher scores reflecting greater perceived utility), as were youth ratings (M=70.00; SD=15.74).

Conclusions: CBPR methodology captures the clinical priorities of ASD+GD youth and their parents. Novel clinical components emerged including recommendations for introducing ASD+GD youth to a range of adult gender spectrum individuals (e.g., transgender individuals, cisgender formerly transgender individuals, gender expansive individuals who use no medical gender supports, etc.) to assist in gender discernment, and practical instruction in skills for gender expression/style.

10:55 **140.002** Gender Nonconformity and the Autism Spectrum in and Beyond the Clinical Context: An Examination of Children with and without Mental Health Diagnoses

__A. I. van der Miesen__, Child- and Adolescent Psychiatry, VU University Medical Center, Amsterdam, Netherlands

Background: In recent years, there has been a strong clinical and research interest in the overlap between gender nonconformity (GNC) and autism spectrum disorder (ASD). GNC and ASD seems to frequently co-occur in clinical populations. It is unknown, however, whether these previous findings regarding the GNC-ASD link reflect a general clinical phenomenon (i.e., individuals with a clinical diagnosis in general are more prone to have a second clinical diagnosis) or suggest a unique overlap between (symptoms of) ASD and GNC.
Objectives: To investigate GNC in children with a mental health condition, including children who have been diagnosed with ASD, and to investigate potential associations between GNC and symptoms of ASD in children who never have been diagnosed with a mental health condition.

Methods: Parents of children (6-12 years of age) were recruited to participate in a parent-report online questionnaire from June–December 2016. Our participants consisted of a total sample of parents of 2445 children (1198 girls, 1247 boys). Children (*Mean age* = 8.82, *SD* = 1.99) were categorized as either typically developing (i.e., from the nonclinical subgroup; *n* = 2004; 1022 girls, 982 boys) or as part of a clinical subgroup of the population meaning that they had a mental health condition, including for example ASD (*n* = 441; 165 girls, 276 boys).The Gender Identity Questionnaire for Children (GIQC) was used to measure GNC and the Children's Social Behavior Questionnaire (CSBQ) was used to investigate symptom levels of ASD including six different subdomains of ASD.

Results: Our findings showed that GNC was associated with children who have been diagnosed with ASD and sensory processing disorder. Among children who have never been diagnosed with a mental health condition, increased GNC was associated with increased symptoms of ASD. In addition, GNC was associated with the subdomain of ASD of stereotyped behaviors (i.e., stereotyped movements and alternate responses to sensory input) and difficulties orienting socially.

Conclusions: Increased GNC was found to be not only associated with children with an ASD diagnosis, but also with increased symptoms of ASD in a nonclinical population. These findings suggest that GNC may not be unique to ASD in clinical populations only. The relationship between symptoms of ASD and GNC might thus exists beyond the clinical domain, indicating that this association might reflect a more general phenomenon. In addition, in nonclinical populations, the specific symptoms of ASD of stereotyped behavior and orientation problems were found to be uniquely associated with GNC. Elevated levels of GNC in children may thus not be related to all facets of ASD equally.

11:20 **140.003** Gender Histories, Life Experiences, and Future Plans and Hopes of Gender Dysphoric Autistic Youth: A Framework Analysis

M. D. Powers[1], *M. Knauss*[2], *D. Gohari*[1], *L. Anthony*[3], *L. Kenworthy*[1] *and J. F. Strang*[1], *(1)Children's National Health System, Washington, DC, (2)Alliance of Community Health Plans, Washington, DC, (3)University of Colorado, Denver, Aurora, CO*

Background: Despite evidence that autism spectrum disorder (ASD) and gender dysphoria (GD) commonly co-occur, no studies to date have captured the life experiences and perspectives of autistic gender dysphoric youth through their own voices.
Objectives: Identify primary themes in the lived experiences and ambitions of gender dysphoric autistic youth. Reduce researcher bias through participatory methods including the involvement of key stakeholders in the qualitative data analytics.

Methods: We conducted 22 semi-structured clinical interviews of adolescents and young adults (age 12-20 years) who met DSM-V criteria for ASD and current (N=20) or historical/desisted (N=2) GD. 64% of participants were assumed male at birth, and 36% were assumed female at birth, paralleling population-based sex ratios in ASD. Data was analyzed using framework analysis, which systematically analyzes qualitative data in a 5-step process (Ritchie et al., 2003; Bargiela et al., 2016): familiarization with the data, identification of the thematic framework, indexing of statements and related units into the thematic framework, graphic representation of the data and distribution of the participants' responses, and final analysis. The analytic team included key stakeholders (autistic, transgender, and autistic-transgender self-advocates).

Results: The framework analytic process categorized 92% of participant responses, revealing eight categories of thematic statements: feelings about gender and body, gender in social situations, gender discernment, needs, future plans and ambitions, meeting other gender-spectrum people, the existence of bias, and the experience of being both neurodiverse and gender diverse. Twenty-three subthemes were identified under the criterion of >25% participant endorsements. Theoretical saturation for themes and subthemes occurred at 6 participants (van Rijnsoever, 2017). Almost all participants noted that expressing interests and behaviors of the other gender was not enough for them, and that they needed to live as their affirmed gender (i.e., transgender). Further, most indicated that their gender experiences were not related to anxiety about puberty, noting that they wished to go through the puberty of their affirmed gender. About half of the participants described their gender expression as somewhat non-traditional/non-gender binary. Nearly three-quarters described their gender identity as coming into focus over time through development; a similar number of participants believed that their affirmed gender would remain constant in the future. One-quarter of participants discussed the possibility that their gender identity might change in the future (i.e., gender dysphoria desistence). A majority of youth reported that their worries about societal disapproval of transgender and gender diverse people inhibited their gender expression and exploration of gender identity.

Conclusions: Numerous similar life experiences, perspectives, and ambitions emerged among gender dysphoric autistic youth. In directly capturing the perspectives of these individuals, this study gives voice to a previously unheard population. Results are relevant to gender and autism clinicians and researchers, given that up to one quarter of adolescents referred for gender dysphoria have significant co-occurring autism characteristics.

11:45 **140.004** Mental Health Among Gender-Dysphoric Individuals with ASD

M. A. Stokes *and R. George, Deakin University, Burwood, Australia*

Background:
There is increased mental-health adversity among individuals with Autism Spectrum Disorder (ASD). At the same time, gender-dysphoric individuals experience poorer mental health when compared to non-gender dysphoric individuals. Recent research suggests that autistic individuals report increased gender-dysphoric traits (GDT).

Objectives:
The current study aimed to investigate whether as membership of minority grouping becomes increasingly narrowed (i.e.: an individual is a member of an increasing number of minority groups), mental health will worsen as a function of increasingly restrictive minority group membership. We hypothesized that individuals with ASD and individuals with GDT would have higher rates of Depression, Anxiety and Stress, and lower levels of Personal Well-being when compared to their respective control groups, and that as Minority status increases, Mental Health would worsen.

Methods:
The present study compared the rates of Depression, Anxiety, and Stress using the DASS-21 and Personal Well-being using the personal well-being index (PWI) between 261 typically-developing individuals and 309 autistic individuals.

Results:
Results demonstrated that while ASD Diagnosis did not additively worsen Mental Health, when GDT was added to ASD Diagnosis, the effect was to worsen Mental Health, ($p<0.01$). This suggests a hierarchy of threats to Mental Health through Minority-group membership, where the effect of GDT is more extreme than a diagnosis of ASD.

Conclusions:

These results reveal complexity in the manner in which GDT and ASD interact with each other. Further, these results demonstrate that recognition and support for those with ASD around issues of gender is paramount, lest their mental health be further damaged by a lack of recognition of this vulnerable cohort.

Panel Session
Early Development (< 48 months)

141 - How Does It Feel? Emotional Lives of Toddlers with ASD

10:30 AM - 12:30 PM - Jurriaanse Zaal

Panel Chair: Katarzyna Chawarska, *Child Study Center, Yale University School of Medicine, New Haven, CT*

Discussant: Carla Mazefsky, *Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

There is a prevailing notion that the emotional life of children with ASD is dominated by negative emotions. Such a negative affectivity bias may have a profound effect on attention, learning, and social interactions. Yet, research has focused primarily how children with ASD discriminate and understand the emotions of others or strategies they use to regulate their own emotions, rather than on how they react emotionally to the world around them. Thus, little is known about the intensity, valence, and congruency of emotions in response to real-world events in children with ASD, particularly during the early stages of the disorder. Understanding emotional expressivity and their links with attention and physiology will improve our grasp of the inner lives of toddlers with ASD and inform clinical practice and theory by identifying affective factors shaping their developmental trajectories. The multidisciplinary panel of junior and senior researchers will present never-published data from an ongoing large, prospective study of attentional, physiological, and emotional processes underlying early affective development in ASD. The results reveal complex and surprising emotional profiles of toddlers with ASD and show feasibility and reliability of the behavioral, attentional, and physiological measures for studying the emotional lives of toddlers with social disabilities.

10:30 **141.001** Attenuated Fear and Accentuated Frustration Responses to Real-World Challenges Aimed at Eliciting Negative Emotions

S. Macari[1], *F. E. Kane-Grade*[2], *E. Hilton*[1], *A. Milgramm*[3], *P. Heymann*[1], *L. DiNicola*[4], *D. Macris*[1], *K. K. Powell*[1], *S. Fontenelle*[1], *M. Lyons*[1], *A. Giguere Carney*[1], *K. Bailey*[1], *F. Shic*[5] *and K. Chawarska*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (3)Center for Autism and Related Disabilities, Albany, NY, (4)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Background: Expression of emotion is a fundamental capacity present from birth and helps to ensure basic infant-environment interactions (Izard, 1978). Although both anger and fear are negative emotions, anger is expressed in response to goal blockage and results in approach behaviors such as protesting and struggling, while fear occurs in response to threat or uncertainty and is associated with withdrawal behaviors such as turning away and freezing. Positive affect is a relatively neglected dimension. Like anger, it is characterized by approach tendencies and manifests in laughter and increased activity level. Young children with ASD have been described to exhibit a restricted range of emotional expressions (DSM-V, 2013), or less positive and more negative affect than their peers (Garon et al., 2009; Jahromi et al., 2012; Macari et al., 2017; Snow et al., 1987; Yirmiya et al., 1989). However, little is known about emotional reactivity in toddlers with ASD in response to a range of standardized challenges.
Objectives: To examine emotional reactivity in toddlers with ASD compared to their non-ASD peers in response to in-vivo behavioral probes, eliciting three emotions: joy and the conceptually distinct emotions of fear and anger.

Methods: Selected episodes from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999) were administered to 99 toddlers (M=21mo, range: 13-30mo): 43 with ASD and age-matched peers with developmental delays (DD; n=16) or with typical development (TD; n=40). Nine episodes were designed to elicit Fear, Joy, and Anger. Intensity of emotional response was coded offline by blinded coders and standardized composites were computed across facial, vocal, and musculoskeletal channels.

Results: Between-group ANOVAs revealed no significant effect of diagnosis for intensity of joy, ($F(2,99)=.14$, $p=.87$) but significant group differences for intensity of fear ($F(2, 95)=6.44$, $p<.01$) and anger ($F(2,98)=3.54$, $p<.05$). Toddlers with ASD exhibited less intense fear than TD ($p=.002$; $d=.75$) and DD ($p=.011$, $d=.80$) controls and expressed significantly more intense anger than their DD peers ($p=.016$, $d=.73$), and marginally more intense anger than TD ($p=.064$, $d=.40$) controls. Within the ASD group, the ADOS-Toddler Social Affect score was significantly negatively correlated with the intensity of joy ($r=-.33$, $p<.05$) but not with the negatively-valenced emotions.

Conclusions: Results indicate that, compared to non-ASD peers, toddlers with ASD exhibited similar levels of positive affect in response to pleasurable stimuli. This finding is consistent with work showing that processes underlying the neural response to obtaining rewards (i.e., liking, or the hedonic aspect of the reward system) may be intact in ASD (Damiano et al., 2014). However, our results indicate that toddlers with ASD exhibited less intense fear responses to novel and potentially frightening stimuli and more intense angry affect in the context of goal blockage during the Lab-TAB's naturalistic and standardized emotion-elicitation probes. Consistent with studies of typically-developing infants (Planalp et al., 2017), our results suggest utility in isolating components of negative affectivity. The basic attentional and physiological processes underlying attenuated reactivity during frightening situations and accentuated reactivity during frustrating situations require further examination.

10:55 **141.002** Do Toddlers with ASD Express Emotions That Are Incongruent with Valence of Real-World Events?

F. E. Kane-Grade[1], *S. Macari*[2], *K. Villarreal*[2], *A. Zakin*[2], *H. Neiderman*[2], *M. Wilkinson*[2], *E. Hilton*[2], *A. Milgramm*[3], *P. Heymann*[2], *L. DiNicola*[4], *D. Macris*[2], *K. K. Powell*[2], *S. Fontenelle*[2], *M. Lyons*[2] *and K. Chawarska*[2], *(1)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Center for Autism and Related Disabilities, Albany, NY, (4)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Affective expressions are critical for communication and social interaction (Ekman, 1982). Although early conceptualizations suggested diminished affective expressions in children with ASD (*DSM-III-R*, 1987), subsequent research revealed that children with autism are not less expressive (Capps et al., 1993); rather, they may display emotions that are incongruent with the environmental context (McGee, Feldman, & Chernin, 1991; Reddy, Williams, & Vaughn, 2002). Still, little is known regarding whether congruency of emotional expression depends on the valence of environmental events and whether incongruent responses are present regardless of the emotion expression channel (e.g., facial or vocal).
Objectives: 1) To examine intensity of incongruent facial and vocal expressions during positively- (Joy) and negatively- (Frustration and Fear) valenced probes of the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1996) among toddlers with ASD, developmental delays (DD), and typical development (TD); 2) To examine the relationship between the intensity of incongruent emotional expressions and severity of ASD symptoms.

Methods: Participants included 99 toddlers (ASD, *n*=43; DD, *n*=16; TD, *n*=40) (M_{age}=21 months). Nine in-vivo probes were presented to elicit three emotions: Frustration, Joy, and Fear. Sessions were coded offline by blinded coders for peak intensity of emotional expression from two channels: vocal and facial.

Results: Intensity of facial expressions and vocalizations of joy during fear- and anger-eliciting probes were contrasted between the three groups of children via linear mixed effects models. Vocal distress and facial expressions of fear and anger during joy eliciting probes were analyzed between the diagnostic groups using univariate ANOVAs. No group differences in facial expression of joy during negatively-valenced probes (*F*(2, 143)=2.17, *p*=.14) or group by task interaction were found. Similarly, no group differences in facial expression of anger (*F*(1,98)=.93, *p*=.40) or fear (*F*(1,98)=.99, *p*=.38) during Joy probes were found. However, when examining vocalizations, differences between groups emerged. A main effect of diagnosis (*F*(1, 130)=6.57, *p*=.002) showed that toddlers with ASD expressed more intense positive vocalizations than TD (*p*=.001, *d*=.48) and DD (*p*=.01, *d*=.49) toddlers during negatively-valenced probes and produced more intense distress vocalizations than TD (*p*=.03, *d*=.49) and DD (*p*=.05, *d*=.67) toddlers during Joy probes. In the ASD group, intensity of incongruent distress vocalizations during Joy probes was associated with ADOS Social Affect scores (*r*=.37, *p*=.02).

Conclusions: While the intensity of incongruous facial expressions of toddlers with ASD during positively and negatively-valenced probes did not differ from those observed in age-matched DD and TD peers, their vocalizations appeared more atypical. Specifically, their probe-incongruous distressed or positive vocalizations were more intense than those observed in controls. The results suggest ambiguity in vocal expressions in toddlers with ASD, which may result in affective miscommunication between the children and their caretakers and peers and hamper their efforts to convey their needs and interact socially. Examining the mechanisms underlying incongruous emotional expressivity in toddlers with ASD constitutes a novel and highly clinically and theoretically fruitful area of inquiry in autism research.

11:20 **141.003** Decreased Fear Response in Toddlers with ASD Is Linked with Attenuated Changes in Physiological Arousal

***L. Boccanfuso**[1], F. Shic[2], S. Macari[3], L. DiNicola[4], A. Milgramm[5], E. Hilton[3], F. E. Kane-Grade[6], P. Heymann[3], M. S. Goodwin[7], A. Vernetti[3] and K. Chawarska[3], (1)Vän Robotics, LLC, Irmo, SC, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Center for Autism and Related Disabilities, Albany, NY, (6)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (7)Northeastern University, Boston, MA*

Background: Compared to typically developing toddlers (TD) and controls with developmental delay (DD), toddlers with autism spectrum disorder (ASD) express less intense negative emotional behaviors in response to real-world fear-eliciting challenges (Macari et al., 2017;Abstract #1)). It is not clear if this phenomenon is due to differences in behavioral display of emotions or in arousal levels in response to these events. Physiological arousal is thought to be altered in ASD; however, research findings have been inconsistent, likely due to differences in induction techniques, intensity and valence of emotional triggers, and measurement methods.
Objectives: To examine concurrently for the first time, physiological arousal (changes in skin conductance level, ΔSCL) and intensity and valence of behavioral affective responses to structured real-world challenges in toddlers with ASD. (2) To test whether ASD toddlers show greater ΔSCL in response to Anger- and Fear- but not Joy-eliciting probes as seen in typical development (Kreibig et al., 2010). (3) To test whether the magnitude of ΔSCL is associated with intensity of emotions exhibited during Fear and Anger but not during Joy probes.

Methods: Participants included 26 toddlers with ASD (age: M=23mo, SD=3) and 24 age-matched TD controls (age: M=22mo, SD=4). ΔSCL was measured in response to multi-trial conditions eliciting Fear, Anger, or Joy, using an Affectiva Q-Sensor placed on the child's ankle. ΔSCL was calculated between the start and end of each trial, standardized and averaged within each condition. Intensity of emotional behavioral responses was coded offline.

Results: At baseline, the ASD and TD groups showed comparable SCL scores (p>.40). A linear mixed model analysis of ΔSCL indicated no effect of diagnosis (p=.74), a significant effect of condition, (p<.001), and a diagnosis by condition interaction (p=.012)(**Figure1**). ΔSCL in the ASD group was comparable to the TD group in the Anger (p=.58) and Joy (p=.17) conditions, but was lower in the Fear condition (p=.016). In the two groups combined, ΔSCL was positively correlated with intensity of Anger (r(36)=.30, p=.07) and Fear (r(35)=.45, p=.008), but not with Joy (p=.75). Regression analysis of ΔSCL in the Fear condition revealed a significant contribution from parent-reported ECBQ Fear score (p<.002) and observed intensity of anger and fear (both p<.002, Adjusted R^2=.42), but not from autism severity, NVDQ, or VDQ.

Conclusions: Physiological arousal increased in response to negatively- but not to positively-valenced challenges in both groups. The magnitude of changes in physiological response to Anger and Joy probes was comparable between ASD and TD toddlers. However, ASD toddlers showed an attenuated physiological response to Fear, mirroring the differences observed at the behavioral level (Macari et al., 2017). Changes in physiological arousal level were predicted uniquely by both parent-rated fearful temperament and intensity of behavioral fear responses, but not by severity of autism or levels of functioning. These findings show the usability of measuring physiological arousal when examining emotional response in toddlers with ASD and inform both clinical and theoretical approaches regarding response to threat in ASD.

11:45 **141.004** Attentional Capture By Angry Faces and Angry Voices Is Associated with Intensity of Fear Induced By Real-World Challenges in Toddlers with ASD

***K. Chawarska**[1], F. Shic[2], Q. Wang[1], A. Vernetti[1], D. Macris[1] and S. Macari[1], (1)Child Study Center, Yale University School of Medicine, New Haven, CT,* *(2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Background: Behavioral and neurophysiological evidence suggests that biologically-relevant stimuli such as facial expressions (Vuilleumier & Schwart, 2001) and emotionally-valenced sounds (Ethofer et al., 2006) are prioritized in the attentional system as reflected by their enhanced capacity to capture attention. Rapid detection of emotional signals is thought to be affected in ASD, though evidence remains scant and conflicting, particularly in the early developmental stages. Here we examine, for the first time, attention capture by threatening stimuli presented through visual (static faces) and auditory channels (nonsense phrases) in toddlers with ASD and typically-developing (TD) controls. We also examine, for the first time, direct links between attention capture by threat and intensity of fear response during real-world challenges.
Objectives: To examine if attentional capture by threatening stimuli in visual and auditory domains are associated with intensity of fear response during real-world challenges as well as with severity of autism symptoms and verbal and nonverbal developmental quotient in toddlers with ASD and TD controls.

Methods: Toddlers with ASD (n=29) and age-matched TD (n=29) toddlers (Mean age=23 mo, SD=4) participated in an eye-tracking study investigating attentional capture by threatening stimuli. The toddlers completed a preferential looking paradigm in which their latency to orient to static angry faces (Face condition) and angry voices (Voice condition) were measured. Toddlers also completed a series of real-world behavioral fear-inducing probes adapted from the Laboratory Temperament Assessment Battery (LabTAB, Goldsmith et al., 1999). Ratings of peak intensity fear responses were coded offline by a blind rater. Subsequently, we evaluated correlations between latency to orient to threat and intensity of fearful emotions during the challenges.

Results: The groups did not differ in the latency to orient to angry faces (p=.467) or angry nonsense phrases (p=.566). In the combined groups, the latency to orient to the threatening targets was not associated with severity of autism symptoms, or with verbal or nonverbal DQ in either condition (all p-values>.4). However, there were significant correlations between the intensity of fearful behavioral responses during the Lab-TAB probes and latency to orient to angry voices (r(54)=-.32, p=.020) and faces (r(26)=.45, p=.023).

Conclusions: This is the first study to report on associations between attention capture by threatening information conveyed through visual and auditory channels and intensity of negative affect in response to real-world fear-inducing challenges. Latency to orient to threat was not associated with severity of autism symptoms or levels of verbal or nonverbal functioning. However, children who responded with more intense fear tended to orient faster to angry voices and slower to angry faces. The mechanisms underlying this disparity are not known, but they may be related to differences in temporal structure of the stimuli or to differences in neural networks involved in processing emotional signals in visual and auditory modalities. Data collection for this project is ongoing and we plan to examine these questions in greater detail. These findings provide novel insights into threat processing and the complex associations between affective attention and emotional expression in very young children with and without ASD.

Panel Session
International and Cross-Cultural Perspectives

142 - Reducing Racial and Ethnic Disparities in Early Detection and Treatment of Children with ASD

10:30 AM - 12:30 PM - Arcadis Zaal

Panel Chair: Sandy Magaña, *Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX*

Discussant: David Mandell, *Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

This panel is focused on efforts to reduce racial and ethnic disparities in autism diagnosis and treatment. Substantial racial and ethnic disparities have been documented among children with ASD with respect to early detection, diagnosis, and receipt of evidenced-based (EB) interventions. For example, Black and Latino children have been found to be underdiagnosed with ASD, diagnosed later, and when diagnosed, less likely to receive EB treatments. In this panel, we use the framework of health disparities research outlined by Kilbourne and colleagues (2006), which describes three phases: 1) detecting disparities, 2) understanding disparities and 3) reducing disparities. Research that has documented disparities in diagnosis and treatment fits into the detecting disparities phase. There is some research on the understanding disparities phase related to barriers to receiving diagnosis and treatment. While more research is needed in each of these phases, interventions to reduce disparities in autism are beginning to emerge. These interventions can occur on the individual/family level, the provider level, or the policy level. In this panel, we describe research that represents all three levels.

10:30 **142.001** Autism Screening in Primary Care: Who Benefits and How?

C. Nadler^{1,2}, *C. Low Kapalu*^{1,2}, *V. Staggs*^{1,2}, *K. Williams*^{1,2}, *Y. Tupa*^{1} *and S. Nyp*^{1,2}, *(1)Children's Mercy Kansas City, Kansas City, MO, (2)University of Missouri Kansas City School of Medicine, Kansas City, MO*

Background: While the American Academy of Pediatrics recommends standardized screening for autism in primary care, the 2016 United States Preventive Services Task Force (USPSTF) statement found the evidence for this practice to be inadequate. While tools like the Modified Checklist for Autism in Toddlers (M-CHAT) are recognized as robust and early intervention is recognized as effective, the downstream impact of universal screening has not been well investigated, particularly for individuals facing known health disparities (i.e., reduced access to autism diagnostic and treatment services).
Objectives: To investigate the effects of correct identification of autism risk via standardized screening in primary care using a matched sample of children whose positive autism screens were overlooked by their providers as a naturalistic control group.

Methods: We extracted health records for 5771 children receiving care at an urban academic medical center who attended at least one 18 or 24/30 month well visit (Time 1; T1), as well as at least one second well visit between 4-6 years of age (Time 2; T2). For T1 visits, provider interpretation of the M-CHAT was compared to results from manual rescoring, yielding groups of children whose positive screens were either correctly identified or overlooked. To adjust for differences between the groups due to non-random assignment, we used 1:1 propensity score matching to select a sample in which the two groups were balanced on demographics, number of M-CHAT items failed (i.e., symptom severity), and other T1 variables. To investigate the effects of correct identification, we compared the groups on T2 diagnostic outcomes and services access using logistic regression.

Results: Of the 534 children with positive M-CHATs at T1, only 54 were correctly identified by their providers; of these, 47 had appropriate matches among the group whose positive screens were overlooked. Combined (n = 94), children in the matched samples reflect the significant racial/ethnic diversity of the clinic population (43.6% Black, 28.7% Latino, 17.0% White, 10.6% Other). Controlling for number of M-CHAT items failed at T1, correctly identified children were more likely to be diagnosed with autism (aOR = 29.42, p = .020) or another psychiatric condition (aOR = 2.90, p = .037) at T2. Notably, correctly identified and overlooked children with positive screens had similarly low rates of access to intervention at T2 (43% and 38%, respectively; aOR = 1.18, p = .719), with no differences related to demographics.

Conclusions: These results provide mixed support for universal primary care autism screening. While correct identification of a positive screen by 30 months of age was significantly associated with being diagnosed with autism by age 6, correct identification was not associated with improved access to intervention. There was little evidence that correct identification led to differential diagnostic outcomes or access to intervention based on race/ethnicity, sex, or socioeconomic status, so universal screening may mitigate health disparities in diagnosis and treatment access observed in previous research. However, the functional benefits of screening may be limited if the low rates of access to services observed here are representative for diverse populations.

10:55 **142.002** Improving Autism and Developmental Screening for Practices Serving Latinos: The REAL-START Project

K. Zuckerman[1], *A. E. Chavez*[1,2], *L. Wilson*[3], *C. Reuland*[4], *M. King*[5], *J. Scholz*[6], *K. Ramsey*[7], *K. Unger*[8] *and E. Fombonne*[9], *(1)Division of General Pediatrics, Oregon Health & Science University, Portland, OR, (2)Psychology, UMass Boston, Boston, MA, (3)Divison of General Pediatrics, Oregon Health & Science University, Portland, OR, (4)Pediatrics, Oregon Pediatric Improvement Partnership at Oregon Health & Science University, Portland, OR, (5)Early Life Health, Health Share of Oregon, Portland, OR, (6)Oregon Pediatric Society, Portland, OR, (7)Oregon Health and Science University - Portland State University School of Public Health, Portland, OR, (8)Pediatrics, Oregon Health & Science University, Portland, OR, (9)Psychiatry, Pediatrics & Behavioral Neurosciences, Oregon Health & Science University, Portland, OR*

Background:

U.S. Latino children are diagnosed with Autism Spectrum Disorder [ASD] less often, at older ages, and at the point of greater severity. Improving ASD identification in the primary care setting may increase access to diagnosis and treatment and reduce disparities.

Objectives:

We conducted a 12-month intervention in 6 Oregon primary care practices serving Latino communities. The goal of the intervention was to raise rates of adherence to American Academy of Pediatrics [AAP] ASD and developmental screening guidelines at 18- and 24-month well child visits, and to increase Early Intervention [EI] referrals for children with high risk of ASD or other developmental conditions.

Methods:

Forty-two medical providers from 6 practices attended a 1 ½ - hour initial in-person training on the ASQ-3 (Ages and Stages -3; general developmental screener) and MCHAT-R/F (Modified Checklist for Autism in Toddlers – R/F; autism screener), and on proper referral practices for children with screen failure. Three 1-hour follow-up trainings at 3, 6, and 9 months addressed topics specific to Latinos, such as communication about screening to families with low health literacy, the relationship between bilingualism and language delays, and access to autism services through Medicaid. Practice leaders met with a facilitator 4 times to review practice- and provider-level data on screening and referral rates, and conducted quality improvement activities to improve these rates. A medical record review captured screening and referral rates for all 18- and 24-month well visits at baseline and at 3, 6, 9, and 12 months after the initial intervention. A query of the Oregon Early Intervention database assessed EI eligibility rates. Estimates of screening rates accounted for clustering at the clinic and provider level and are adjusted for child age.

Results:

In total, 2357 18- and 24-month well child visits were captured during the intervention; 39% of visits were for Latino children. Practices improved age-adjusted rates of ASD screening with MCHAT-R/F at well visits, from 58% of well visits screened at baseline to 89% at the end of the intervention (p<0.001). Practices also improved rates of general developmental screening with ASQ-3, from 59% to 95% (p<0.001). Rates of complete adherence to AAP guidelines (i.e., conducting both screens) increased from 35% to 87% (p<0.001). The greatest improvements in screening rates occurred in the first 6 months of the intervention. Screening and referral rates were comparable for Latinos and non-Latinos throughout the intervention. While the proportion of children referred to EI due to screen failure stayed relatively constant, the absolute number of referrals increased. Additionally, the absolute number of children who qualified for EI services increased slightly (3.0 to 4.5 per study period; p = 0.28), but the proportion of children referred to EI who were found to be eligible decreased slightly.

Conclusions:

This longitudinal intervention was effective in sustainably increasing screening for ASD and other developmental disabilities in primary care settings with many Latino patients. Increased screening rates were associated with increased Early Intervention referral rates, and a trend toward increased EI eligibility.

11:20 **142.003** Adapting an Ebi for Children with ASD for Community Implementation with Latino Families: Therapist and Parent Recommendations for Adaptations

C. Chlebowski[1], *B. Wright*[2], *S. Magaña*[3], *E. Hurwich-Reiss*[4] *and L. Brookman-Frazee*[5], *(1)National Institute of Mental Health, Bethesda, MD, (2)University of California, Los Angeles, Los Angeles, CA, (3)Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX, (4)University of California, San Diego, La Jolla, CA, (5)Psychiatry, University of California, San Diego, San Diego, CA*

Background: Disparities exist in identification, diagnosis, and treatment for Latino children with ASD. There is increased focus on the use of evidence based interventions (EBI) in mental health treatment and the need for culturally responsive EBIs has been identified (APA, 2006). Identifying culturally appropriate ways to adapt EBIs using input from stakeholders is critical.

Objectives: This qualitative study used focus groups and interviews to gather parent and therapist perceptions of implementation of a structured EBI for children with ASD (*An Individualized Mental Health Intervention for ASD* (AIM HI)) when utilized with Latino families with the goal of identifying potential training and EBI adaptations.

Methods: Data collection occurred from focus groups with therapists (n=17) and semi-structured interviews with Latino parents (n=29) who participated in the AIM HI community effectiveness trial. Of the therapists, 35% self-identified as Hispanic/Latino and 47% reported speaking Spanish. All parents self-identified as Hispanic/Latino; 86% spoke Spanish and 66% preferred Spanish. Focus groups and interviews were transcribed and coded to identify relevant themes.

Results: The following themes were identified using rapid assessment analysis process (RAP) of focus groups and consensus coding of interviews. Three salient themes emerged regarding potential adaptations.

Theme 1 Adapting training: The most frequent themes for training adaptations were related to helping therapists deliver AIM HI with Latino, or non-English speaking families. A clear need was identified for increased training in using a culturally-informed approach to intervention delivery and individualizing AIM HI for diverse families. The need for training when working with an interpreter was another identified theme.

Theme 2 Adapting AIM HI: Salient themes regarding adapting AIM HI focused on making the intervention more accessible to parents by simplifying behavioral terminology and adding a parent workbook. Increasing the accessibility of AIM HI to Spanish speaking families was a salient theme with therapists identifying the need for additional translated AIM HI materials to provide information and context to non-English speaking families. Adaptations to increase the utility of AIM HI included adding a parent module with psychoeducation about ASD (in both English and Spanish).

Theme 3 Adapting AIM HI delivery: Themes regarding adapting intervention delivery differed by stakeholder group. Therapists advocated using technology (text messages, phone based app) to communicate with parents during treatment; however, no parents endorsed wanting to be sent treatment information weekly via electronic method. The majority of parents (61%) reported that they preferred information from their therapist to be delivered in *both* verbal and printed format (e.g., resources and handouts); 64% reported that they preferred their therapist to provide treatment forms and materials to them incrementally week by week as opposed to receiving a complete workbook at the beginning of treatment (an option preferred by 32% of parents).

Conclusions: These findings highlight the need to adapt EBI training and intervention delivery for Latino families, with a focus on understanding the needs of stakeholder groups. Based on these findings, future study in our research program will involve developing and piloting testing a toolkit specifically addressing the recommendations generated from this qualitative data.

11:45 **142.004** Randomized Control Trial: Impact of the Parents Taking Action Program on Latino Children with ASD and Their Parents

K. Lopez[1]*, S. Magaña*[2] *and M. Morales*[3]*, (1)Arizona State University, Phoenix, AZ, (2)Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX, (3)Disability and Human Development, University of Illinois at Chicago, Chicago, IL*

Background:

ASD prevalence among Latino children has increased dramatically over the past decade and research has documented substantial disparities in treatments and services among Latino children with ASD compared to White children. To reduce disparities for Latino children with ASD, Parents Taking Action (PTA), a culturally informed psychoeducation program, was developed. PTA is based on an ecological validity model, which addresses specific dimensions of culture in the development of interventions. PTA is a 14-week program delivered by promotoras de salud (community health workers). Promotoras are bilingual Latina mothers of children with ASD and have been identified as active members in their community. PTA content informs parents about ASD and their child's rights, and teaches parents evidenced-based (EB) strategies grounded in applied behavior analysis to use with their children.

Objectives:

To test the efficacy of PTA with respect to parent outcomes (utilizing EB strategies), and child outcomes (reduction of symptoms, increase in service use).

Methods:

Participants included 89 Latina mothers and 93 children in Illinois and California. Children were all diagnosed with ASD. Following a baseline assessment, dyads were randomly assigned to a treatment now or treatment later group. Those in treatment now (mothers mean age 37.9, SD=5.3; children mean age 5.5, SD=1.8) immediately received PTA along with two follow-up assessments (after completing the program and 4 months later). The treatment later group (mothers mean age 36.2, SD=6.6; children mean age 5.2, SD=1.8) was offered the PTA program after completing two follow-up assessments (4 and 8 months post-baseline). Assessments included the Childhood Autism Rating Scale, Social and Communication Questionnaire (SCQ), Family Outcome Survey (FOS), service use questions, and measures specific to the study regarding efficacy in using EB strategies and frequency of using the EB strategies. The data included in the present study are from the baseline and time 2 assessments.

Results:

The linear mixed effects model for the child outcome showed that the treatment group had reduced SCQ scores at time 2 (lower score = less impairment). For parent outcomes, the linear mixed effects model showed a significant interaction between time and treatment group on efficacy in using the EB strategies and frequency in the use of strategies, showing an increase in these outcomes for the treatment group. We did not find a treatment effect for the FOS. Service use increased for the treatment group in California but not in Illinois.

Conclusions:

The results show that PTA is a culturally informed program for Latino families that enhances parents' abilities to apply evidenced based strategies with their children, which can lead to enhanced social communication skills among children. Future analysis should examine the impact of all outcomes over time, and could examine the efficacy of the program for other underserved communities.

Poster Session
143 - Technology Demonstration
10:00 AM - 1:30 PM - Hall Grote Zaal

77 **143.077** Connecting through Kinect: A Participatory Approach to Designing a Collaborative Emotion Recognition Game with and for Autistic Individuals

K. Gillespie-Lynch[1]*, M. Kholodovsky*[2]*, D. S. Smith*[3]*, R. Arab*[2]*, P. Asanov*[2] *and D. Sturm*[2]*, (1)Department of Psychology, College of Staten Island; CUNY*

Graduate Center, Brooklyn, NY, (2)College of Staten Island, Staten Island, NY, (3)CSI, Brooklyn, NY

Background: Autistic people face challenges communicating with others in-person which are often reduced online (Gillespie-Lynch et al., 2014). However, evidence that computer-mediated interventions are effective in helping autistic people develop *generalizable* social-communicative skills remains limited (Whyte et al., 2015). Participatory research wherein autistic people are involved as collaborators in game design/evaluation can help address the disconnect between the *potential* of computerized autism interventions and limited benefits documented thus far. Parsons and Cobb suggested that effective technologies to support autistic people are developed by aligning Theory, Technologies and Thoughts (autistic perspectives).

Objectives: We aim to document the process of including autistic youth in designing/evaluating a game to help autistic people understand complex emotions and collaborate and to determine if the game is effective at scaffolding collaboration and emotion recognition.

Methods: Our game is designed to support generalizable skills by providing an immersive environment wherein participants can simultaneously engage digitally and in-person while learning how to interpret emotions. Standing near one another, participants complete collaborative emotion matching puzzles using Kinect technology. Animated tutorials teach gameplay. All instructions are nonverbal so that the game is accessible for people with diverse communicative abilities. In the core game, two players use gestures to move puzzle pieces. Each puzzle depicts the outline of a figure in an emotional context. After players construct the body; they must agree on the correct emotion for the face by selecting from three emotions. This collaborative component was adapted from a picture-matching task that was effective at promoting collaboration among minimally verbal autistic children (Holt & Yuill, 2014).

Results: We invite autistic college students in our mentorship program to provide feedback on design and become more involved if interested. Two autistic college students and their mentors provided initial feedback. Later, five autistic students and their mentors were videotaped playing the game and completed structured interviews. Students provided detailed suggestions about how to improve the look, feel and content of the game including: providing demos, making rewards meaningful, improving image quality, and giving the game a relatable storyline. Qualitative coding of game play revealed that players typically looked at the screen rather than each other while playing although they exhibited positive affect and communicated verbally.Therefore, we created a story focused on a protagonist facing a challenge many autistic youth face, bullying, about how friendship (with a friendly dragon) can help one overcome bullying (Figure 1). We added a pause feature to to encourage direct interaction during the collaborative phase and a tutorial demonstrating collaboration. Qualitative coding of five mentees playing the revised game revealed that the pause feature fostered more in-person interaction. After completing usability evaluations, we will examine benefits of repeated engagement with the game for minimally verbal autistic individuals and their siblings.

Conclusions: Our autistic collaborators have provided useful suggestions that have led to extensive improvements in game design. They reminded us to incorporate key design principles (a storyline and an interpretable reward system) that are believed to promote generalization but are often lacking in games designed for autistic people.

78 **143.078** Design of a Multi-Sensory Stimulation and Data Capture System for Investigating Multi-Sensory Trajectories in Infancy

*D. Bian[1], Z. Zheng[2], A. Swanson[3], A. S. Weitlauf[4], **Z. Warren**[5] and N. Sarkar[2], (1)Electrical Engineering & Computer Science, Vanderbilt University, Nashville, TN, (2)Vanderbilt University, Nashville, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, NASHVILLE, TN, (4)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (5)Vanderbilt University Medical Center, Nashville, TN*

Background: Differences in behavioral responses to basic sensory stimuli are hallmark features of ASD that may impact the deficits in social responsivity which characterize the disorder over time. While the neural basis of complex social and communicative behaviors develops throughout childhood, brain responses to more basic, sensory stimuli are in place much earlier, making sensory processing differences a potential target for earliest detection. Characterization of these sensory differences and prospective study of their developmental impact has been limited by a scarcity of methods by which to assess them in infants. Current single-sensory-modality studies contrast with the rich multisensory environment of human infants, with tools and paradigms for charting this more meaningful and complex processing sorely lacking.

Objectives: To investigate the feasibility and tolerability of a multi-sensory paradigm including the sense of touch.

Methods: We developed a precisely controlled system for multi-sensory (auditory, visual, and tactile) stimuli delivery endowed with the capacity to monitor eye gaze, peripheral physiological, and electroencephalogram (EEG) data. We designed a mechatronic device to simulate affective touch, which can be synchronized with other sensory deliveries. All the data can be captured with user-defined event markers for later data segmentation. A feasibility study with 10 participants aged between 3- to 20-months-old was conducted. All participants watched a series of videos where a female actress was seen and heard reciting a prepared English or Spanish monologue. To determine how much time participants spent gazing at core areas of the face, we defined three principal regions of interest (ROIs) around the eyes, the nose and mouth, respectively, on the face of the talker. The videos were played twice in random order. We manipulated the affective touch simulation device to stroke the participants' forearms for one of the identical stimulus displays.

Results: Seven out of the 10 participants went through all of the experimental procedures. Eye gaze data, peripheral physiological data (PPG and GSR), and EEG data were all properly recorded with event markers. Three participants pulled their arms out of the tactile device in the middle of the experiment, which might be because the current design of the tactile device has difficulty in fixing small arm in place. The data were collected regardless of the absence of the tactile stimulus. Results indicated that participants looked at the stimulus screen 27% of the time, with gaze toward demarcated ROI for 57% of this time. No specific differences in the tactile stimulus conditions were noted across groups (with and without affective touch).

Conclusions: This work describes a novel multi-sensory stimulus delivery system that can record multi-dimensional data in real time. This feasibility study demonstrated that the system is tolerated by infants aged 3- to 20-months-old. Eye gaze data, peripheral physiological data, and EEG data were successfully recorded. Such a system could potentially be used to help study multisensory differences and process differences over time for both high- (e.g., infant siblings of children with ASD) and low-risk infants.

79 **143.079** Design and Evaluation of an Artificial Intelligent Agent to Measure Communication Skills of Children with ASD

*L. Zhang[1], A. Swanson[2], A. S. Weitlauf[3], **Z. Warren**[4] and N. Sarkar[1], (1)Vanderbilt University, Nashville, TN, (2)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, NASHVILLE, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (4)Vanderbilt University Medical Center, Nashville, TN*

Background:

Researchers are increasingly exploring virtual reality environments as potential intervention platforms for children with Autism Spectrum Disorder (ASD). A Collaborative Virtual Environment (CVE) is a virtual reality environment that could facilitate real-time interactions with peers across distance. However, interactions within CVEs change based on specific partner input and as such, fundamentally limit consistent, controlled, and replicable interactions within the CVEs. In addition, manual coding of interactions is necessary to understand patterns of communication for meaningful measurement, creating a resource burden that fundamentally limits realistic paradigm scale-up. An Artificial Intelligence (AI) agent may address these problems by interacting with children as a consistent partner and automatically measuring their verbal communication patterns. Therefore, a virtual intelligent system (VIS) that combines CVE and AI technologies may facilitate complex, dynamic real-world interactions with social partners, as well as automatically measure these interactions to enable scale-up of CVEs to improve social communication skills.

Objectives:

We present a novel VIS that could not just promote peer-based interaction in real time, but also yield quantitative metrics of social communication that can be used within system to facilitate salient aspects of social collaborative learning. The objective of this work is to evaluate whether the VIS could be used as a consistent partner to measure social communication skills of children with ASD in peer-based interactions.

Methods:

Our VIS was composed of a CVE and an AI agent. The CVE was developed with Unity3D game engine (http://unity3d.com/). A series of 9 puzzle games were designed in a shared virtual environment. The interaction in the CVE was governed by implicit rules that required cooperation and communication in order to achieve success. An AI agent was designed to i) monitor the peer-based interactions in the CVE, and ii) to be a consistent partner that could talk and play these games with each child. The AI agent was composed of five modules, i.e., a speech recognition module, a natural language understanding module, a dialogue manager module, a natural language generation module, and a text-to-speech module. In the natural language understanding module, the AI agent could generate communication related features for meaningful measurements using natural language processing and machine learning technologies.

Results:

The Unity-based CVE system was developed with 9 different collaborative tasks. The AI agent was developed with the capability to achieve real-time conversation and interactions. We conducted an initial pilot study with 20 age-matched and gender-matched pairs. All participants enjoyed communicating and playing games with both human-partners and AI-partners. The AI agent was able to capture some communication features, such as number of words, frequency of questions, and frequency of response, which could be used to measure the communication skills of children with ASD.

Conclusions:

The initial pilot study indicated the potential value of VIS in automatically measuring social communication skills of children with ASD in peer-based interactions. This automatic measurement capability will enable a future adaptive system that will modify tasks based on the communication skills of each individual to enhance social communication with peers.

80 **143.080** Autism Data Goes Big: A Publicly-Accessible Multi-Modal Database of Child Interactions for Behavioural and Machine Learning Research

J. Shen[1], *E. Ainger*[2], *A. M. Alcorn*[2], *S. Babović Dimitrijevic*[3], *A. Baird*[4], *P. Chevalier*[5], *N. Cummins*[6], *J. J. Li*[5], *E. Marchi*[7], *E. Marinoiu*[8], *V. Olaru*[8], *M. Pantic*[1], *E. Pellicano*[9], *S. Petrović*[3], *V. Petrović*[3], *B. R. Schadenberg*[5], *B. Schuller*[6], *S. Skendžić*[3], *C. Sminchisescu*[10], *T. Tavassoli*[11], *L. Tran*[1], *B. Vlasenko*[7,12], *M. Zanfir*[8], *V. Evers*[5] *and C. De-Enigma*[13], *(1)Department of Computing, Imperial College London, London, United Kingdom, (2)Centre for Research in Autism and Education, University College London, London, United Kingdom, (3)Serbian Society of Autism, Belgrade, Serbia, (4)Chair for Embedded Intelligence for Health Care and Wellbeing, University of Augsburg, Augsburg, Germany, (5)Human-Media Interaction, University of Twente, Enschede, Netherlands, (6)Informatics, University of Augsburg, Augsburg, Germany, (7)Complex Intelligent Systems, University of Passau, Passau, Germany, (8)"Simion Stoilow" Institute of Mathematics of the Romanian Academy (IMAR), Bucharest, Romania, (9)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (10)Institute of mathematics Simion Stoilow of the Romanian Academy (IMAR), Bucharest, Romania, (11)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (12)Idiap Research Institute, Martigny, Switzerland, (13)DE-ENIGMA project consortium, Enschede, Netherlands*

Background: Advances in artificial intelligence (AI), machine learning and "big data" have been almost exclusively developed based on neurotypical adult data, meaning that these tools may substantially misinterpret or fail to recognise the facial, vocal, and physical behaviours of autistic children. Existing (non-medical, non-genetic) autism datasets have been "small data": insufficient to train autism-specific algorithms, and infrequently shared between researchers. Thus, the autism and technology subfield has been largely excluded from harnessing the cutting-edge techniques present elsewhere in academic research and industry, limiting our ability to deliver personalised, intelligent technologies for education, intervention, and daily life. More—and shareable—data is needed to advance research in this area. Previous projects with adults' data have demonstrated that publicly accessible databases are logistically feasible, can operate on ethical terms acceptable to participants, and can accelerate research in related areas (e.g. https://semaine-db.eu/).

Objectives: To develop the first free, large-scale, publicly available multi-modal database of autistic children's interactions that is suitable for both behavioural and AI research. It will use data collected in DE-ENIGMA project studies on autistic children's emotion learning with a humanoid robot (http://de-enigma.eu/).

Methods: 62 British and 66 Serbian children aged between 5 and 12 years (19 female), participated in DE-ENIGMA studies on emotion recognition teaching. Each child was randomly assigned to robot-assisted or adult-assisted activities. These were based on steps 1-4 of the emotion training programme, "Teaching Children with Autism to Mind Read" (Howlin, Baron-Cohen, & Hadwin, 1999). Each child participated in 4-5 sessions, all recorded by multiple audio, video, and depth recording devices (see Table 1 and Figure 1). The parents of 121 of these children have granted consent for database inclusion.

Results: The DE-ENIGMA project has created a multi-modal database accessible via a web portal (http://db.de-enigma.eu), to which academic researchers worldwide may apply for access under a licensing agreement that prohibits commercial or governmental use. It includes ~13 TB of multi-modal data, representing 152 hours of interaction. The database is filterable based on data type (audio, video, depth, annotations) and session characteristics (child age group, study condition, country). Furthermore, 49 children's data have been annotated by experts for emotional valence, arousal, audio features in English or Serbian, and body gestures.

Conclusions: This database will be the largest existing dataset of its kind (i.e. autistic interaction, rather than genetic or medical data). The audio and video in particular represent a rich resource for behavioural research questions about autism, such as child-robot or child-adult interactions, emotion recognition, social and communicative behaviours, and cross-cultural comparison. It also provides the required scale of data needed for furthering machine learning, computer vision, audio processing and other technical techniques that include autistic behaviours. The annotated data are in effect ready-labelled training data for future autism-focused machine learning research. Finally, the DE-ENIGMA database should accelerate both new behavioural and technological work on autism by providing free starting data to researchers, a potentially enormous saving of time and resources that may also reduce the many obstacles to participation in this area.

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143.081 Autism Characteristics, Adaptive Skills, and Performance in an Emotion-Recognition Teaching Programme with a Humanoid Robot

A. M. Alcorn[1], *D. Girard*[2], *E. Ainger*[1], *T. Tavassoli*[3], *S. Babović Dimitrijevic*[4], *S. Petrović*[4], *S. Skendžić*[4], *V. Petrović*[4], *E. Pellicano*[5] *and C. De-Enigma*[6], *(1)Centre for Research in Autism and Education, University College London, London, United Kingdom, (2)Psychology, University of Quebec in Montreal, Montréal, QC, Canada, (3)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (4)Serbian Society of Autism, Belgrade, Serbia, (5)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (6)DE-ENIGMA project consortium, Enschede, Netherlands*

Background: Several existing projects have shown promise in using robot-assisted interventions for teaching social and academic skills to autistic children, including emotion recognition. Most such work, however, has included older, so-called 'high functioning' autistic children and has therefore neglected to address the feasibility of robot-assisted emotion interventions for young autistic children, those with intellectual disability, or limited spoken language. Given claims that robot-assisted interventions could present lower, less complex social demands than human-led interventions, it is *particularly* important to investigate their feasibility for children whose social, daily life, or language skills may present barriers to participation in "traditional" interventions.

Objectives: This project tested the feasibility of an emotion-recognition training programme in developing the potential of robot-assisted interventions for a large sample of autistic children in Serbia and in the UK.

Methods: 128 autistic children aged 5-12 years were assessed in a 6-step emotion-training programme based on "Teaching Children with Autism to Mind Read" (Howlin, Baron-Cohen, & Hadwin, 1999). In the robot-assisted condition (n=64, 10 females), a Robokind R25 humanoid robot ("Zeno"; see Figure 1) helped to deliver the programme controlled covertly by the adult, whilst 64 children (9 females) participated in the therapist-assisted comparison condition. Parents completed the Vineland Adaptive Behaviour Scales – 2nd edition (Sparrow et al., 2005), and researchers completed the CARS2-ST (Schopler et al., 2010) based on direct observation and parent information.

Results: Children in the robot- and therapist-assisted conditions were closely matched on autism severity and adaptive behaviours (Table 1). Emotion recognition performance, operationalised as the proportion of correct answers in steps 1-2 of Howlin et al.'s emotion-training programme, was inversely correlated with CARS-2 scores in both the robot-assisted (r = -.40, p < .001) and therapist-assisted conditions (r = -.47, p < .001). Higher Vineland composite scores (i.e. better adaptive behaviours) were significantly positively correlated with task performance for children in the therapist-assisted (*r* = .38, *p* < .01), but *not* the robot-assisted condition (*r* = .16, *p* = .27). Using the Vineland communication subscale as a proxy for language skills, better language was positively associated with performance in both conditions, but more strongly for the children in the therapist-assisted (*r* = .50, *p* < .001) than in the robot-assisted condition (*r* = .28, *p* < .05).

Conclusions: This study examined the relationship between everyday adaptive behaviours and emotion recognition performance within robot-assisted and therapist-assisted activities, as part of establishing the feasibility of using such interventions with a younger and less able participants than those studied thus far. Results suggest that while it *is* generally feasible for this group to participate, individual performance moderately correlated with lower CARS-2 scores and higher adaptive behaviour and language scores, *but less so in the robot-assisted condition*. This pattern may support claims that robots impose lower social demands, or are less complex to work with than a person. This study was the first phase of data collection for a large-scale project, with further studies iteratively developing a new robot-assisted emotion teaching intervention.

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143.082 Are Some Emotions Harder Than Others? a Study of Autistic Children Recognising Human and Robot Facial Emotion Expressions in the UK and Serbia

D. Girard[1], *A. M. Alcorn*[2], *E. Ainger*[2], *T. Tavassoli*[3], *S. Babović Dimitrijevic*[4], *S. Skendžić*[4], *S. Petrović*[4], *V. Petrović*[4], *E. Pellicano*[5] *and C. De-Enigma*[6], *(1)Psychology, University of Quebec in Montreal, Montréal, QC, Canada, (2)Centre for Research in Autism and Education, University College London, London, United Kingdom, (3)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (4)Serbian Society of Autism, Belgrade, Serbia, (5)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (6)DE-ENIGMA project consortium, Enschede, Netherlands*

Background: Although difficulties in accurately recognising human facial expressions are well established in autism, recent findings indicate that autistic individuals are just as good at recognizing robot faces as neurotypical individuals. Several studies further highlight the potential of using robot-based technology as assistive tools in interventions for autistic children, which tend to have intact or superior abilities to comprehend and manipulate closed, rule-based, predictable systems. It is unclear, however, whether some emotions are more difficult to recognise than others in robot- versus therapist-assisted interactions.

Objectives: This study sought to compare autistic children's ability to recognise static and dynamic facial emotion expressions (angry, afraid, happy, sad) between robot- and therapist-assisted interactions. These comparisons were made in two distinct cultural contexts (Serbia and the UK).

Methods: 128 autistic children (UK: n=62; Serbia: n=66) aged 5-12 years were assessed in a 6-step facial emotion recognition training programme for 4 basic emotions (fear, anger, happiness, sadness) based on Howlin, Baron-Cohen, and Hadwin's (1999) approach. Steps 1-2 consisted of correctly matching across static emotional images. Steps 3-5 consisted of correctly matching or identifying dynamic real emotional displays. Performance on the task was operationalised as the percentage of correct answers for each emotion separately in both steps 1-2 and steps 3-5. Children were randomly assigned either to a robot-assisted condition (n=64, 10 female), where a Robokind R25 humanoid robot ('Zeno') helped to deliver the programme (controlled covertly by an adult), or a therapist-assisted comparison condition (n=64, 9 female). Researchers assessed autism symptomatology using the CARS2-ST (Schopler et al., 2010) based on direct observation and parent information.

Results: All subgroups were closely matched on age (p=.67) and had, on average, mild-to moderate autism severity symptoms. We used Mann-Whitney U test to compare the performance of our groups as the performance distribution for each emotion was highly skewed. For static facial expressions (steps 1-2), there were no significant differences in children's recognition performance between robot- and therapist-assisted conditions – with the exception of fearful expressions, which were more easily recognised by Serbian children in the robot-assisted condition (U=373, p=.010). For dynamic facial expressions (steps 3-5), Serbian children in the robot-assisted condition were significantly more accurate in recognising fearful (U=398, p=.043) and sad faces (U=403, p=.043) compared to the therapist-assisted condition. There were no significant differences, however, between UK children's recognition accuracy in robot- and therapist-assisted conditions (all ps>.05).

Conclusions: These results indicate that children's performance for static and dynamic facial expressions was similar for robot- and therapist-assisted interactions. For Serbian children, implementation of the emotion-training programme within the robot-assisted interaction seemed to benefit their recognition accuracy for static and dynamic fearful faces, as well as dynamic sad faces. These results suggest that the extent to which a robot-assisted training programme can facilitate emotion recognition in autistic children may vary as a function of cultural context. Also, the use of the robot technology seems to help correctly identify only *some* specific type of facial expressions. These findings will inform the next phase of this large-scale project.

83 **143.083** Design of a Robot-Based Emotion-Mirroring Game to Engage Autistic Children with Emotional Expressions

B. R. Schadenberg[1]*, P. Chevalier*[1]*, J. J. Li*[1]*, E. Ainger*[2]*, A. M. Alcorn*[2]*, S. Babović Dimitrijevic*[3]*, V. Charisi*[1]*, S. Petrović*[3]*, D. Reidsma*[1]*, E. Pellicano*[4]*, D. K. Heylen*[1] *and V. Evers*[1]*, (1)Human-Media Interaction, University of Twente, Enschede, Netherlands, (2)Centre for Research in Autism and Education, University College London, London, United Kingdom, (3)Serbian Society of Autism, Belgrade, Serbia, (4)Macquarie University, Sydney, Australia*

Background: Autistic children often have difficulty recognising emotional facial expressions of others relative to typically developing children. One possible way for children to learn to recognise facial expressions may be to observe their face being imitated by another party. Game-like interactions that include imitation and mirroring can help young autistic children to attend to and "play" with emotional facial expressions, as a building block in recognising those expressions and grasping emotional concepts. A social robot could be particularly useful in this regard by providing a less complex, more predictable - and potentially less threatening - way of interaction than a human.

Objectives: In a novel emotion-mirroring game, autistic children can play with a social robot who mirrors their facial expression in real-time. This study sought to determine whether autistic children understand and enjoy playing this game with the robot.

Methods: Data collection is ongoing. One autistic child (aged 8, male) from a regular elementary school in the Netherlands participated in this pilot study. The child played the emotion-mirroring game for 4 minutes, followed by another game for an additional 4 minutes. The emotion-mirroring game is set up as a triadic interaction between child, an adult, and the robot, which is the Robokind R25 humanoid robot, called "Zeno". Computer vision is used to track the child's facial features through a webcam, which are translated to the robot's facial features. This game aims to gradually familiarise the child with Zeno, prepare the child to (1) pay attention to Zeno's facial features specifically, (2) to generate facial expressions in response to Zeno, and (3) to understand the cause-and-effect nature of mirroring. To that end, the game starts with the adult and child making faces using an ordinary mirror, while Zeno is out of sight. Once the child understands the concept of a mirror, the adult introduces the robot to the child. Zeno mirrors the child face and the adult scaffolds cause-and-effect understanding. The game ended with the child being asked to imitate Zeno's happy and sad facial expression.

Results: The child completed the game with ease. After playing with the mirror and being told that "now Zeno is the mirror", the child spontaneously started making facial expressions without being explicitly asked to do so. In the last step, Zeno asked the child to imitate its facial expressions. The child imitated the happy expression by opening the mouth and raising the eyebrows, but missed the smile. The sad expression was perfectly imitated by the child. Overall, the child appeared very interested in the robot, called it the "best visitor ever", and was reluctant to leave at the end. Additionally, there was one spontaneous initiation towards the robot and two to the adult.

Conclusions: The game design appeared to have been successful in explaining the emotion-mirroring game to the autistic child and creating an enjoyable interaction. The next step is to assess the effectiveness of this and other similar games in teaching emotion recognition to autistic children in controlled experiments.

84 **143.084** Feasibility, Enjoyment, and Effectiveness of a Robot Social Skills Intervention for Children with ASD

J. B. Lebersfeld*, C. J. Brasher, C. D. Clesi, C. E. Stevens, F. J. Biasini and M. I. Hopkins, University of Alabama at Birmingham, Birmingham, AL*

Background: Children with Autism Spectrum Disorder (ASD) demonstrate difficulty with social skills, including understanding emotional facial expressions. Children with ASD are intrinsically motivated by technology. To capitalize on this, a robotic monkey (SAM: Socially Animated Machine) was developed to lead a social skills intervention. Research found that this intervention was feasible and enjoyable for children with ASD and average cognitive ability, and participants improved in complex emotion recognition following intervention.

Objectives: Given the aforementioned success, the current study aimed to investigate the effectiveness for children with ASD across all levels of cognitive ability. This study examined whether the robot intervention improves 1) emotion matching, 2) facial recognition, 3) social skills, and 4) is enjoyable for this population.

Methods: Fifteen children with ASD ages 5-14 with well below average to average cognitive skills participated in the study. ASD diagnosis was confirmed using the Autism Diagnostic Observation Schedule, Second Edition. Participants were assigned to the intervention group (n=8) or control group (n=7). Both groups completed eight weekly sessions with the robot. The intervention group played emotion games with SAM, and the control group played non-emotion games. Emotion matching accuracy, facial recognition (Benton Facial Recognition Test), and social skills (Social Responsiveness Scale (SRS-2), parent and teacher) were compared across groups pre- and post-intervention. After completion, parents and children rated the child's enjoyment on a 0-10 scale.

Results: Univariate ANCOVAs were adjusted for pre-intervention scores. One outlier was excluded from emotion matching accuracy analysis. Accuracy for both groups improved from pre- to post-intervention (Intervention: *M*=81.0% to *M*=95.2%, Control: *M*=72.6% to *M*=83.9%). Overall post-intervention accuracy did not differ between groups. Emotions were separated into simple emotions (happy, sad) and complex emotions (anger, fear, surprise, disgust). Although groups did not differ on simple emotions, the analysis of complex emotions trended toward significance (*F*(1,11)=4.516, *p*=.057; Intervention: *M*=92.2%, Control: *M*=79.2%). For individual emotions, the intervention group significantly improved in matching facial expressions displaying fear (*F*(1,11)=6.637, *p*<.05; Intervention: *M*=96.4%, Control: *M*=75.0%) and disgust (*F*(1,11)=9.239, *p*<.05; Intervention: *M*=97.5%, Control: *M*=66.8%) but not anger or surprise. Analyses indicated no significant group differences in facial recognition or social skills. Both groups enjoyed talking with SAM (*M*=9.43, *SD*=1.51) and wanted to interact with the robot again (*M*=8.93, *SD*=2.13). Parents indicated that their children enjoyed the sessions (*M*=8.86, *SD*=1.56), were motivated to attend (*M*=8.36, *SD*=1.99), and would like to have additional interactions (*M*=8.64, *SD*=1.55).

Conclusions: The SAM robot intervention is feasible, enjoyable, and motivating for children with ASD across a range of cognitive skills. Considering that children with ASD acquire skills more effectively while engaged and motivated in the learning process, this study shows further evidence for the use of robots with this population. The SAM robot intervention improved emotion recognition for some complex emotions, but not all, and improvements did not generalize to other measures. It is possible that the outcome measures chosen did not adequately capture acquired skills. Aspects of the SAM robot intervention will be explored further to maximize effects and generalizability, including the content, dose, frequency, and duration of sessions.

85 **143.085** Cloud Computing Enabled Social Robot Platform for Children with Autism Spectrum Disorders

Z. Tan[1], *B. Xing*[2], *W. Song*[2], *W. Cao*[1], *H. Zhu*[2,3], *L. Yi*[4] *and J. Chen*[5], *(1)South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (2)Centre for Optical and Electromagnetic Research, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (3)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, Guangzhou, China, (4)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China, (5)School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden*

Background:

Children with autism spectrum disorder (ASD) have a core problem in terms of social communication deficits. Recent advances in social robots, which are capable of interacting with humans by following social behaviours and rules attached to its role, open a way to promote engagement and communicative exchange in children with ASD. Many researches have demonstrated that social robots can offer children with ASD a safe environment, and facilitate diagnosis and assessment. However, it is of key importance that the social robot provides accurate response to children with ASD, which might be difficult to be realized with limited computation power offered by the robot itself.

Objectives:

We are aiming at developing cloud computing enabled social robot platform that engages in developing social communication skills of children with ASD. The platform facilitates fast and reliable connections between the social robots and remote data centres that provide sufficient computation capability in supporting timely and precisely interactions with children.

Methods:

Figure 1 presents the schematic diagram of our developed cloud computing enabled social robot platform. Two inset pictures are the examples to illustrate how the social robots are interacted with the participating child. The cloud enabled platform is composed of a web client, social robots, external equipment for data collection, and data centres. All collected data (that could be from the social robots and/or external equipment) is then sent to data centres, which can be either third-party cloud or operated locally, through WiFi or cable connections. The web client used for management can view the information sent to the data centres and communicate remotely with the robot.

Results:

We have tested automatic voice response that is carried out by our platform. All the measurements were done in Chinese. The test question is “what is your name?”. The question itself lasts 1.39s. 7 different answers, all of which address questions precisely, were received for 7 measurements. The length of the answering audio varies from 1.78s to 6.31s. The total waiting time, which is defined as the time duration from the end of question to the beginning of answering, varies from 3.20s to 5.77s. More than 90% of the waiting time is spent for the social robot uploading the audio file to the data centres. It is because of very limited data rate provided by the network interface embedded in the social robot. To further reduce the latency, the uploading data rate should be improved. On the other hand, compared to our developed cloud enabled platform, the stand-alone social robot performs less stable and is not always able to provide proper answers, which implies it might not be an appropriate solution to interact with children with ASD.

Conclusions:

We developed cloud computing enabled social robot platform, which provides fast and reliable interactions, and assists in diagnosing and assessment, for developing social communication skills of children with ASD. The developed platform is able to provide automatic and precise response to the participants, which is hardly realized by the stand-alone social robots.

86 **143.086** Converting Existing Vocabulary Tests into Robotic Programs

S. Walsh Matthews[1] *and A. R. Marquis*[2], *(1)Languages, Literatures, and Cultures, Ryerson University, toronto, ON, Canada, (2)Psychology, Ryerson University, Toronto, ON, Canada*

Background: Recent studies (e.g., Walsh Matthews et al. 2016; Kim et al. 2015; Ismail et al., 2012) show increased social communicative behaviour by children with Autism Spectrum Disorder (ASD) following human robot interaction (HRI). To further these test effects, we designed a study that would substitute human-conducted vocabulary testing with HRI by re-creating Tager-Flusberg’s (1985) experiment to examine the nature of substantive lexical semantic representations in children with ASD. The HRI programming allowed for the examination of basic level and superordinate semantic categories might aid in cognitive representational tasks and that longer, more intensive interactive robotic programming would promote the production of more accurate responding by minimising the observers’ impact during in-session observations.

Objectives: To program novel robotic behaviours on the small humanoid NAO to mimic the Peabody Vocabulary Test (PVT) via randomized Robotic

Vocabulary Tests (RVT.) The test is to be administered with children previously diagnosed with ASD. Participants would have an opportunity to interact with NAO to see which of the dances/songs would promote greater interactivity between participant and robot. From our first observations, rewards were generated at different intervals and of different lengths to further evaluate the role of interaction and its relevant effect on responses.

Methods: The study is grounded in Tager-Flusberg's (1985) experiment 1 to assess autistic children's understanding of words "for basic and superordinate level categories" (1169). Replacing the PVT with a programmed RVT version, stimuli (images representing two overall categories: superordinate including tools and food and basic including boat and birds) were transferred into accessible image cards recognised by the robot. Within each category there are three possible stimulus types: match (central members of a category), false lure (related nonmembers), and unrelated objects (unrelated nonmembers). The robotic script runs four randomized RVTs which include two short versions with 5-second robotic dances and songs and two longer versions that have multiple and randomized robotic diversion programming. Select ASD participants (aged 4-9), interacted with NAO once per week for three consecutive weeks.

Results: The length of HRI did not have a significant impact on the participant's *overall* accuracy performance at both time points (p = 0.87 and p = 0.54, respectively). However, when analyzing the performance based on category level, where we would expect to find differences, we see differential performance. Based on our preliminary analyses, (see Figure 1), participants perform better on basic level cards when the interaction is long compared to short, and a slight increase in performance for superordinate level cards when the interaction is long compared to short.

Conclusions: Findings from Tager-Flusberg's original experiment found children likely had inflexible categorical semantic organization. Inconsistent with this, we see that children show improvements in their semantic organization when the robot's behaviours are more interactive. Further analyses will be needed to confirm this trend, however, early findings supports our hypotheses driven by Idealised Cognitive Models (Lakoff, 1987), such that HRI would increase the potential for new conceptual categories, or at least invite opportunities to engage with them.

87 **143.087** Fostering Real-World Interaction in Autistic Pupils with Digital Technology: Design Recommendations from Practitioners in Special Education

M. H. Laurie[1], *A. Manches*[2] *and S. Fletcher-Watson*[3], *(1)Patrick Wild Centre, University of Edinburgh, Edinburgh, United Kingdom, (2)Moray House School of Education, University of Edinburgh, Edinburgh, United Kingdom, (3)University of Edinburgh, Edinburgh, United Kingdom*

Background:

Technology is widely used by autistic children, and is increasingly used to develop skills in language, communication, curriculum learning and the social domain. However, alongside the demonstrated benefits of educational technology for autistic children, there is ongoing concern from parents and practitioners that technology is socially isolating, and prohibits real-world interaction. It is essential to understand this point of view in order to create, implement, and evaluate technologies for use by autistic children.

Objectives:

To draw on practitioner experiences to determine how technology might influence real-world interaction in autistic children, i.e. what types of interaction have the potential to be impeded / fostered by technology, and what technologies inhibit / promote interaction.

Methods:

186 education practitioners (including teachers, educational assistants, therapists and psychologists) completed a survey about technology use in autism education. We collected information about demographics, pupil profiles, technology use (hardware, software, purpose) and attitudes to technology. Subsequently, two focus groups with class teachers at different schools were conducted (*n* = 11), in which the impact of digital technologies on social interaction was discussed.

Results:

For most practitioners, socially interactive uses of technology were not overtly considered or prioritised, and instead, technology was most frequently used to support learning and communication. In the survey, practitioners were almost evenly split between strongly agreeing and strongly disagreeing that technology contributed to social isolation, producing extremely mixed results, and practitioners provided anecdotal experiences of both scenarios in open-ended questions. In the focus groups, most practitioners felt that technology could discourage social interaction amongst their pupils, particularly screen-based medias such as mobile tablets. However, the same practitioners also reported many scenarios and examples of where technology encouraged and fostered interaction amongst their pupils. These interactions ranged from simple to complex, and included tolerating others, sharing space, verbal communication, turn-taking, and forming relationships through shared interests, with interactions directed towards both staff and peers. From the focus groups, factors related to the individual child, the technological hardware, the software, and the environment emerged as influential to technology's impact on social behaviour. Features related to digital technologies that had most influence on social interaction, according to practitioners, included physical affordances, customization and flexibility, context of technology use, and collaborative opportunity.

Conclusions:

Technology has the potential to foster real-world interaction in children with autism, according to education practitioners. Social interaction via technology is an unexpected benefit, rather than an intended outcome, despite the importance of developing social skills in autistic children. The data will be interpreted and presented as a set recommendations for practitioners and tech developers, to derive design criteria that can maximise opportunities for social interaction in autistic children using technology.

88 **143.088** Digital Social Stories

E. Smith[1], *H. Johnson*[1], *A. Constantin*[2] *and M. Brosnan*[3], *(1)University of Bath, Bath, United Kingdom, (2)University of Edinburgh, Edinburgh, United Kingdom of Great Britain and Northern Ireland, (3)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

Social stories are a widely used intervention for people with a diagnosis of Autism Spectrum Disorder (ASD). Practitioners perceive them to be highly effective but meta analyses of the research literature reveals mixed findings. Crucial influences upon the effectiveness of social stories is argued to be in the consistency of their development and delivery as well as the behaviours targeted for intervention. The majority of existing research literature has focussed on evaluating effectiveness relating to either increasing or decreasing a specific behaviour. However, in practice the most common use of social stories by parents and practitioners is for supporting children with novel events and transitions.

Objectives:

The Digital social stories iPad app has been developed through participatory design and was evaluated for its impact upon supporting children with ASD in preparation for a novel event.

Methods:

Participants were 10 autistic children (8 male; 2 female), aged 7-11. All children were due to attend a 4-day school summer camp and their teacher had identified a specific area/event that was anticipated to cause a high level of concern/anxiety and problematic behaviours (e.g. being away from their family, eating different food). A unique social story was written for each child within the digital social stories app and presented on the iPad. The researcher read the social story with the child every day during the week before the camp. The child's teacher rated their level of anxiety, understanding and closeness to their individual target goal (identified in the social story) on an 11 point scale (0-10) before and after the social story intervention. A rating of problem severity during camp was also obtained.

Results:

Results revealed a significant increase in the child's perceived level of understanding ($t = 2.34$, $p = 0.044$), a move towards achieving the child's individual goal ($t = 4.15$, $p = 0.002$), and a decrease in perceived anxiety levels ($t = 4.49$, $p = 0.002$) when comparing the pre- and post- intervention teacher ratings. Problem severity during camp was also significantly correlated with getting closer to the goal (difference between pre- and post measure) $r = 0.66$, $p = 0.038$. Changes in anxiety ($r = .57$, $p = 0.089$) and understanding ($r = 0.50$, $p = 0.14$) were not significantly correlated with problem severity but did indicate a trend in the right direction.

Conclusions:

Empirical support was found for using Digital social stories to help children prepare for a novel, potentially challenging event by decreasing anxiety, increasing understanding and facilitating a move towards the child's individual target goal. Much research on social stories to date has been single case study design and this study represents a relatively large sample size, as well as focussing upon supporting upcoming events that may be challenging, rather than a specific challenging behaviour (which is typically the focus within the research literature).

The Digital social stories iPad app will be present, and participants can interact with the system to develop Social Stories. Funding for the project was provided by The Leverhulme Trust.

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143.089 Evidence-Based and Scalable Parent Training for ASD

D. Grodberg[1]*, R. A. Oien*[2] *and K. Larsen*[3]*, (1)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (2)The Arctic University of Norway, Tromso, NORWAY, (3)Oslo university hospital, Oslo, Norway*

Background: To address the need for increased access to care and lower-cost treatments for children with ASD, researchers have investigated the effectiveness of solely parent-delivered treatment with positive results (Hardan et al., 2014; Minjarez et al., 2011; Coolican et al., 2010). Moreover, a recent RCT indicates that teaching parents ABA principles via video coaching is effective, and treatment acceptability is equivalent between the telemedicine and clinic-based groups (Lindgren et al. 2016). MindNest Health is a digital health tool that trains parents to implement ABA skills and strategies as well as positive behavioral approaches. A self-guided curriculum comprising animated parent-child simulations trains parents in ABA strategies and skills. A behavioral coach helps parents identify target goals for their child and supports parents as they navigate the program from training to implementation. Coaches refer to a higher level of care when clinically indicated. Pilots of the MindNest Health digital tool are beginning in the US, Norway, and China.

Objectives: This project aims to use the Behavior Intervention Rating Scale (BIRS) to record users' acceptance of this technology solution in the context of user testing performed by a user testing company. Users will mark a likert scale indicating whether they Strongly disagree (1), Disagree (2), Slightly Disagree (3), Slightly agree (4), or Agree (5) with questions that measure perceived acceptability and effectiveness of the intervention.

Methods: The BIRS was filled out by 6 parents after participating in user testing.

Results: Responses on the BIRS filled out by users in the context of user testing by an independent user testing company predominantly reflected high scores.

Conclusions: MindNest Health's digital platform holds promise to improve access to evidence-based and scalable interventions for children with ASD. A live demo will be presented during the poster session.

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143.090 Remote Mentoring Model for Autism Assessments in the India

S. Nagesh*, Latika Roy Foundation, Dehradun, India*

Background: Reductions in under five mortality rates has shifted global program and policy focus to lives that thrive and live with or without disability in most parts of the world. In the Indian Himalayas, identification and assessment of developmental disabilities in young children poses a huge challenge, and intervention therefore remains a far dream. With no developmental pediatricians in Uttarakhand, the Himalayan state of India, the program uses expertise from a qualified early development expert based in a high income country to train, support and supervise a team of local professionals in the field of Autism, for assessment and intervention.

Objectives: The model provides expert supervision and support in the local language and maximizes use of limited resources of time, money and personnel. The model depends on a strong mentorship capacity, committed time by professionals to assess, record, share and seek guidance, and deep relationship building which in turn strengthens the support between the family and the team

Methods: The program began with on site training on the use of new tools for autism diagnosis (ADOS and ADIR). The module initiated with training to build the knowledge base and was followed by multiple hands-on sessions on the use of assessment tools with families whose children were suspected to have autism. Multiple sessions with close supportive supervision were followed by the local professional teams conducted the assessments independently. The assessments reports were emailed to the consultant and video recordings were uploaded on the Internet using strict privacy settings. The local team received immediate feedback and timely support with diagnoses and intervention plans for the child and the family. Technical assistance also involved access to web resources, and training for parent groups. The consultant and the local team meet face to face twice a year to develop further insights, review complex cases, facilitate parent meetings, and training in advanced modules.

Results: In six months, the team assessed, diagnosed and provided intervention support to fifty children with autism. The model did not need funding and provided on-site training support using new assessment tools and distance support to validate assessments and diagnoses thereafter to a team of local professionals for children with autism. Children and families receive the benefit of best practice interventions and specialist inputs that would otherwise not be available for them. While we understand the pivotal role technology plays in this program, we cannot undermine the value of on-site visits and face-to-face meetings.

Conclusions: Though the technology is not complex, for local professionals to learn and use the video camera, email, whatsapp and youtube are innovations in their own right. This model can be adapted and applied to settings where there is a need for training and support. The distance-mentoring model can supplement the more traditional model of site based service delivery and support. The foundation is aiming to scale the model for children with cerebral palsy and Down syndrome.

91 **143.091** Let Us Converse Virtually! Conversation Skills Training through Virtual Reality

Y. Politis[1]*, L. Goodman*[1]*, M. Leahy*[2] *and C. Sung*[3]*, (1)University College Dublin, Dublin, Ireland, (2)Michigan State University, East Lansing, MI, (3)Department of Counseling, Educational Psychology and Special Education, Michigan State University, East Lansing, MI*

Background: People with ASD typically have difficulties with communication and socialization skills, and they may exhibit repetitive behaviours or have restricted interests (Fombonne, 2005; Levy & Perry, 2011; Rivet & Matson, 2011; Suzuki 2011). Such difficulties have been shown to be linked to the development of problem behaviours, and thus people with ASD do struggle to keep or find employment, become part of the community, and they overall report low quality of life ratings (National Research Council 2001). Assistive technology's role for people with ASD is to primarily improve their quality of life and help them in their transition from education and training to independent living. The Virtual Reality (VR) technology first appeared in the 1960s, but was neither a commercial success nor was it very engaging. VR has re-emerged in recent years as a more affordable, user friendly platform, that has reached a point where it can imitate the real world (Freina & Ott, 2015). Moreover, VR can assist in making conversations easy, structured and inclusive (Newbutt, 2013).

Objectives: To examine the effectiveness of a training intervention on conversation skills for people with ASD, through a Virtual World (VW) environment (using a laptop which is a non-immersive delivery method).

Methods: The paper will initially describe the VW development phases, where a Participatory Design approach was adopted. This will be followed by a description of the intervention process. The participants initially interact with the researcher physically (Phase 1) and then virtually (Phase 2) to determine whether virtual reality on itself has a positive impact. Phase 3 involves instruction (PowerPoint presentations, videos, and quizzes) in the virtual environment followed by the same interaction to determine whether instruction in virtual reality is beneficial. Phase 4 will be a repeat of Phase 1 to determine whether the participants bring any skill acquisition from the virtual to the real world. The intervention is a Multiple Baseline Design (MBD) with 3 participants and consists of at most 17 sessions over a 7 to 9-week period.

Results: The user feedback on the VW development has revealed ways we can change the VW to make it more appealing, acceptable, and user-friendly to the participants. The users offered several suggestions regarding: the content of instructional material (e.g., conclude each PowerPoint presentation with a quiz), organization of content (e.g., better organise video playlist) and visual presentation of content (e.g., enlarge video screens and increase text font). The paper will also present the analysis of the ongoing MBD, based on an adapted assessment tool from the Conversation Skills Rating Scale. A comparison of the results between phase 1 and 4 will determine the effectiveness of the training, if the baseline is stable.

Conclusions: The user feedback received to date suggests that VR has a significant role to play in training for people with ASD and that immersive VR (head mounted displays) could possibly be even more effective. Overall the feedback was constructive and will result in a better product for a follow-up study in 2018.

92 **143.092** Social Visual Attention Training Using Virtual Humans and Eye-Tracking

O. Grynszpan[1]*, J. Nadel*[2] *and J. C. Martin*[3]*, (1)LIMSI CNRS UPR3251, Université Paris-Sud, Orsay, France, (2)French National Centre of Scientific Research (CRNS), Paris, France, (3)LIMSI, Orsay University, Orsay, France*

Background: Visual attention is essential to grasp the transient emotional information expressed by faces during human social interactions. During the last two decades, a sizeable amount of literature on eye-tracking has reported diminished visual attention to faces in individuals with Autism Spectrum Disorder (ASD) when they attend to social scenes. Addressing such deficits with educational approaches raises complex issues as there are no systematic rules as to when faces should be looked at during a social interaction.

Objectives: Our goal is to test a novel method for training visual attention to relevant emotional signals expressed by faces based on the use of virtual humans and eye-tracking technology.

Methods: Twenty one adolescents with ASD (3 girls and 18 boys) participated in the study. They were randomized to an experimental group and a control group that were matched for verbal and non-verbal abilities. Participants in the control group were allotted to a computerized educational program in geometry. The experimental group were trained with a system that enabled users to control a graphic interface with their eyes via an eye-tracker. Participants were placed in front of a screen that displayed a virtual human that addressed them. The graphic display was entirely blurred except for a rectangular viewing window that followed the gaze of the participant. One of the utterances of the virtual character could be interpreted in two distinct ways according to the context. The context was provided by the character's facial expressions that enabled disambiguating this key sentence and therefore understanding the whole message. Participants then had to answer close-choice questions that assessed their understanding of the virtual human's message. To answer correctly, participants had to look at the relevant emotional features of the face at the right time while they were attending to what the virtual human was saying.

Results: Social and communicative abilities were assessed before training, after training and after a two months follow-up period. The evaluation was based on a battery of social tests that were not used for training. There was a significant improvement on the test which was the most proximal to the training task. It involved understanding a written dialog between characters whose faces could be displayed on demand.

Participants in the experimental group scored higher then control participants on this test after training [*F*(2,38) = 4.76 *p* = 0.035].

Conclusions: The efficacy of the novel social training method that we designed was supported by the results of this pilot randomized controlled study. The presentation will involve a live demo of the system, that is, the audience will be able to use the software, see the virtual humans and control the viewing window with their eyes via the eye-tracker.

Acknowledgments: This work was supported by a grant from the Orange Foundation (project #71/2012)

93 **143.093** Discovr - Virtual Reality Social Cognition Training for Adults with Autism

B. van Pelt[1,2] *and K. Greaves-Lord*[1]*, (1)Erasmus MC, Rotterdam, Netherlands, (2)Yulius, Dordrecht, Netherlands*

Background:

Deficits in social cognition are amongst the most challenging aspects of autism spectrum disorder (ASD), making it a core symptom, impairing individuals throughout their lives. Building relationships or finding a job does not come naturally, when the intention and comprehension of basic rules and subtle cues of social interaction are poorly understood. This, leading to social exclusion and deteriorating quality of life. Social skills training is usually initiated for handling problems in the emotional- & social perception and poor metalizing skills (Theory of mind). Interventions based on Cognitive Behavioural Therapy (CBT), have proven their efficacy. However, it is crucial for the effectiveness of the training to achieve transfer of knowledge and skills, to situations in everyday life and novel environments. In conventional training, pictures, text, comics, movies or role-playing is used. Although these can be a good method for didactic purposes (providing knowledge/insights), it is important for practicing social skills that this can happen in a setting that has the same dynamic, complex and interactive nature of true social situations. Advancements in technology make it possible to offer a more tailored social cognition training, incorporating the environment of the patient into their therapy. Virtual Reality(VR) is such an advancement. VR provides a safe, dynamic and interactive treatment setting, that could transcend the social cognition training as is available today. Research shows that Virtual Reality is a promising tool in strengthening social cognition in people with ASD (Kandalaft et al. 2013, Parsons et al., 2002 & 2006). VR offers an 'ecologically valid', immersive environment to experiment with (new) social behavior in a secure, controlled setting that provides direct feedback and learning experiences. Scenarios from the person's life can be trained with gradual intensity, making VR a sufficiently realistic way to transfer skills to the person's own environment.

Objectives:

In a pilot-study we explore a CBT based Virtual Reality intervention, to enhance social cognition of adults diagnosed with autism. Primary outcomes of this study are: (1)Feasibility, Tolerance and Acceptance of the intervention and (2) Improvement in Social Cognition.

Methods:

The intervention protocol is dived into modules (16 sessions over a 8 week period, 1 hour sessions), training the patient in Emotion recognition, Social perception/Theory of Mind and interactive social interaction. An Avatar mediated system enables the therapist to communicate directly with the patient in the Virtual world. Through voice alteration and avatar selection, the therapist can mimic social situations from the patient's life. A pre-post assessment design (with 8 week follow-up) enables us to assess the usability, tolerance and effectiveness of the intervention.

Results:

Starting April 2018, the treatment will be embedded into multiple mental health organisations in the Netherlands. A small usability study (n=2) will be presented to show qualitative data from our patient panel. We will present the VR apparatus along with a poster on the protocol and pilot study. Visitors are welcome to experience the VR-world.

Conclusions:

Based on previous research, VR intervention could be a valuable addition to the therapeutic instruments for improving social cognition/skills in ASD.

94 **143.094** The Use of Cultural Animation to Teach Students with Autism in Mixed-Classroom

N. Sari*, Erasmus Rotterdam University, Rotterdam, Netherlands*

Background: N/A

Objectives: This pilot project aimed to explore the feasibility of using animations to facilitate the learning of spoken English for students with autism in an inclusion school in Indonesia. The aim of the animation was to increase students' with autism attention during class activities.

Methods: Sample: The animation was used for 8 students with autism attending an inclusion school in Jember, Indonesia. Students with autism were spread across five classes: one in the second grade, 2 in the third grade, 3 in the fifth grade, and 2 in the sixth grade. Students with autism were between eight and twelve years of age, and diagnosed with ASD through comprehensive diagnostic evaluation.

The animation: The duration of the animation was five minutes and the theme was based on cultural diversities in Indonesia. The animation was developed by the researcher and presented seven characters, each representing one of the ethnicities from Indonesia. The targeted language expression was how to ask and give opinion in English. So, the use of "what do you think" and "I think..." were the main learning topic for the students with autism.

Use of the animation in the classroom: The teacher played the animation in the beginning of the class and paused at several parts. The goal of pausing was to highlight the language expression. After the students with autism watched the animation, the teacher applied roleplay models of non-autistic students and then asked the students with autism to speak the targeted English expression in front of the class. The teacher used concise, friendly and comprehensible instructions, and avoided verbal overload (Addabbo, 2004).

Students with autism and teachers were interviewed about their experience of the animations in the classroom. In addition, the use was documented by videos and photos.

Results: Students with autism were confident to use the animations and did the roleplay in front of the class. Moreover, students with autism paid attention enthusiastically during the class. The teachers mentioned that the animation was effectively inviting the students' with autism attention. In addition, students with autism were more enthusiastic about the next English class.

Conclusions: Preliminary findings indicated that animations could be used in inclusive classrooms to support teachers' knowledge and teaching skill in teaching language skills to students with autism.

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143.095 “Doctor Tea” Helps Children with ASD Going to the Hospital without Fear

L. Boada[1] *and M. Parellada*[2], *(1)Hospital Universitario Gregorio Marañón. Child and Adolescent Psychiatry. IISGM. CIBERSAM, Madrid, Spain, (2)Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background:
People with autism spectrum disorder (ASD) have greater medical needs than the rest of the population (Gurney, McPheethers and Davis, 2006), and they also have particular characteristics that make it very difficult for them to access the medical services (need for anticipation, lack of flexibility, problems identifying and describing symptoms, hypersensitivity to certain stimuli, stress over waiting times, etc.). A specific program for medical specialty care of ASD subjects was started in 2009 at the Hospital Gregorio Marañón (Parellada, 2013). Subsequently, a web-based tool was developed to help decrease the anxiety and stress associated with medical visits and procedures in attendees to the clinical program.

Objectives: To evaluate the effectiveness of this web program for reducing patient stress and anxiety, improving the family's quality care perception, and reducing medical visit time.

Methods:

1. **"Doctor TEA" software is built on a Web platform** and is composed of a set of structured contents (in film format of a real hospital, in 2D, in 3D, with cartoons and pictograms) showing the physical spaces, medical professionals, techniques, and instruments used for a selected medical examination–magnetic resonance, electroencephalogram, orthopantomography, blood test and stomatology or ophthalmology visits-. (Please, see http://www.doctortea.org/entra/pruebas/**).** The website also includes interactive games showing different aspects of a medical visit.
2. **Evaluation:** Pilot study. Participants: 40 patients with autism spectrum disorder recruited through the ASD Comprehensive Medical Care Program at Gregorio Marañón University Hospital in Madrid (Parellada, 2013).
3. Procedure: 20 patients will use the "Doctor TEA" software for 2 weeks and 6 sessions of 15 minutes. The other 20 will not receive any intervention. Participants in these two groups will be matched for clinical diagnosis, mental retardation, age, and type of medical visit/test they will require. Following the experimental period, they will have their actual medical visit/test. Next, an evaluation will be performed in both groups using three specific questionnaires completed by families, patients (when possible), and a health professional. The main dependent variables will be: patient comfort perceived by the doctor/nurse, patient self-rated anxiety, next-of-kin rated anxiety).

Results: At the present time the software is complete and we are collecting data for its effectiveness evaluation.

Conclusions: Daily clinical practice suggests that anticipation and specific desensitization for medical procedures training, patient anxiety towards medical procedures is considerably reduced. The reasoning behind this program, which are freely available to the public, is to try to demonstrate that TICs can help people with autism to anticipate and understand medical visits and tests that any hospital or health centre may perform.

Interactive demonstration will be presented in the technical session.

Financial support: Orange Foundation has already developed several software tools which are publicly available to facilitate the integration of persons with ASD (www.fundacionorange.es).

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143.096 Project Leapp(Learning to Eat App): Developing an Ipad-Based Video Modelling Intervention to Increase Food Variety in Children with Autism Spectrum Disorder.

C. Lee[1], *R. Perlin*[1], *C. Raffaele*[1], *J. Wiegelmann*[2], *M. Pena*[3], *A. Zarem*[1], *C. Ferreira*[1], *A. Hodge*[1], *A. Dupuis*[4], *E. Biddiss*[1] *and S. Smile*[1], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Geneva Centre for Autism, Toronto, ON, Canada, (3)Holland Bloorview Bloorview Kids Rehabilitation Hospital, Bloorview Research Institute, Canada, Toronto, ON, Canada, (4)Biostatistics, University of Toronto, Dalla Lana School of Public Health, Toronto, ON, Canada*

Background: Feeding difficulties (FD) are identified in up to 89% of children with ASD[1]. FD can lead to challenges such as disruptive mealtime behaviors, strained parent-child interactions and adverse health effects for the child[2-3]. A multidisciplinary team approach is recommended to address FD in ASD. However, barriers include access and availability of feeding specialist team, cost, and time. Early intervention programs geared at preventing and/or addressing FD in ASD in preschoolers is lacking. Video modeling intervention (VMI) is a novel and promising approach where a child is expected to imitate the behaviours of interest after viewing a recording of it[4-6]. VMI has been successful in teaching play and communication skills to children with ASD, but to our knowledge has not been attempted as a strategy targeting feeding behaviours in ASD. We intend to create a novel VMI with an animated model to deliver an early intervention program to address FD in ASD.

Objectives: To develop and pilot an animated VMI, Learning to Eat Application (LEApp) that provides auditory and visual feedback along with positive reinforcement to increase food variety in children with ASD. We hypothesize that an animated VMI can be designed for use by preschoolers with ASD and their parents to be implemented in a naturalistic environment.

Methods: Our methodology combines the principles of participatory design[7] and interaction design [8] . Three focus groups (i) an inter-disciplinary panel (comprising of speech and language pathologist, occupational therapist, family leader, game programmer, illustrator, behavioural therapist and developmental paediatricians), ii) parents of children with ASD, and ii) community clinicians) were recruited to address the design and content of LEApp (n=13). A descriptive thematic analysis was applied to the focus group data [9]. Focus groups occurred in an iterative manner to inform the development of the LEApp prototype.

Results: A final LEApp prototype was created through analysis of focus group data. Themes that emerged reflected common areas of content and design: (1) feeding expectations; (2) feeding strategies; (3) application specific recommendations. Overarching themes relating to (1) challenges and (2) parent education aided the formulation of the information content of the application.

Conclusions: Project LEApp represents the first step in the creation and exploration of a novel tool that has the potential to impact an essential skill early in the lives of children with ASD. By involving children, their parents and multidisciplinary specialists throughout the process, LEApp has the potential not only to impact feeding outcomes, but can also be shared and utilized universally by families in any setting, thus filling a need in existing feeding intervention. LEApp also provides an educational platform for families to learn about strategies to address FD within their home setting and at their own pace.

Tech demo description: We would like to demonstrate LEApp's functionality by displaying the parent-child interface of the application. The application features an animated character, Nibbles, who takes the parent and child through three different video modeling sequences that highlight five stages of feeding (i.e., touch, smell, lick, taste, eat).

97 **143.097** Multi-Spring: Facilitating Social Interaction through a Customizable, Multimodal Learning Platform

K. T. Johnson[1]*, C. S. Ferguson*[2] *and R. W. Picard*[2]*, (1)MIT Media Lab, Cambridge, MA, (2)MIT, Cambridge, MA*

Background:

Practitioners have long explored using motivating, personalized reinforcement to achieve developmental goals for children with Autism Spectrum Disorder (ASD) (Koegel & Mentis, 1985; Vismara & Lyons, 2007). SPRING – Smart Platform for Research, Intervention, and Neurodevelopmental Growth – is a customizable, interactive research-and-play platform, built to systematically probe the effects of these reinforcement modalities on learning and physiological regulation (Johnson & Picard, 2017). SPRING has shown promise in facilitating increased engagement and skill development for children with autism and other neuro-differences, but it has lacked multi-user functionality and built-in means to prompt social skills, such as joint attention, turn taking, and cooperative play -- until now. Adding this functionality allows practitioners to customize the reinforcement and developmental challenge of each individual SPRING unit while simultaneously encouraging social engagement by linking the units over a virtual network.

Objectives:

Here, we present a Multi-SPRING system designed to
(1) Stimulate early social experiences, such as joint attention, turn taking, and cooperative play;
(2) Facilitate simultaneous play between individuals with different skill levels, such as typical and autistic peers or siblings, while providing personalized reinforcement tuned to each individual's motivating interests;
(3) Reduce anxiety associated with unaided social interactions and extend engagement in a multi-person activity;
(4) Passively capture time-synchronized, quantitative measures of users' affective states via wearable physiological sensors and data of users' play progressions via SPRING.

Methods:

Each SPRING unit has a removable, modular center that can be adapted to the needs of an individual child by inserting different physical modules. An integrated smartphone and embedded LEDs allow user-selected customization of motivating reinforcement, such as favorite video clips, images, music, or colorful light displays. The smartphone also enables scaffolded difficulty levels within a single module so each child can be met with the "just right" challenge. Embedded digital sensors capture and store time-stamped data of a child's interaction with SPRING. Paired with wearable physiological sensors, these data allow multimodal analysis of a child's affective state and learning progression.

The new Multi-SPRING system links multiple SPRING units in real-time through a virtual private room, much like a chat room. This method enables social multi-player interactions, such as turn taking and cooperative play, while continuously capturing activity data logs from every child for future study.

Results:

Early results with Multi-SPRING suggest that the system can elicit both cooperative and competitive play and can increase time spent in a multi-person play environment. Our INSAR demonstration will showcase data and analysis from several Multi-SPRING trials, including videos with synchronized physiological and performance data. It will also include opportunities to interact with the system and provide feedback for further development.

Conclusions:

We have created a new customizable, multi-user research-and-play platform designed to facilitate social skill development for children with ASD. Through the highly motivating, individualized play environment, children can progress at their own pace while practicing social skills. Early results suggest that SPRING's novel multi-player environment elicits social interaction in a way that can engage learners with very different interests.

98 **143.098** A Multimedia Screening System to Predict Later ASD Symptoms in Diverse Community Settings: A Machine-Learning Design for Infants and Toddlers

F. Shic[1]*, K. Chawarska*[2]*, E. S. Kim*[3]*, C. A. Wall*[4]*, M. Wilkinson*[2]*, E. Barney*[1]*, J. C. Snider*[5]*, Q. Wang*[2]*, Q. A. Yang*[5]*, M. Kim*[5]*, B. Li*[6]*, M. Mademtzi*[2]*, C. Foster*[7]*, D. Macris*[2]*, F. E. Kane-Grade*[8]*, A. Milgramm*[9]*, P. Heymann*[2]*, E. Hilton*[2]*, A. Zakin*[2]*, H. Neiderman*[2]*, K. Villarreal*[2]*, K. K. Powell*[2]*, S. Fontenelle*[2]*, M. Lyons*[2]*, A. Giguere Carney*[2]*, K. Bailey*[2]*, Y. A. Ahn*[10]*, M. C. Aubertine*[11] *and S. Macari*[2]*, (1)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (4)Department of Psychology, University of South Carolina, Columbia, SC, (5)Seattle Children's Research Institute, Seattle, WA, (6)Computer Science and Engineering, University of Washington, Seattle, WA, (7)Binghamton University, Binghamton, NY, (8)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (9)Center for Autism and Related Disabilities, Albany, NY, (10)University of Miami, Miami, FL, (11)Seattle Children's Hospital and Research Institute, Seattle, WA*

Background:

There is a need to create more efficient, accessible autism screening systems so as to reach more diverse populations, decrease parent burden, and provide a roadmap for incorporating advances in digital and machine learning technologies to facilitate state-of-the art prediction of developmental outcomes. The Yale Adaptive Multimedia Screeners (YAMS-One and YAMS-Toddler) were designed to meet these needs.

Objectives:

To describe the development of the YAMS-One system, designed to predict autism symptoms at 18 months from questions asked to parents when their child is 12-months-old, and the YAMS-Toddler, designed to predict concurrent levels of autism symptoms via questions asked when children are 18- to 24-months of age. Results described are based on machine-learning results acquired from n=386 infants and toddlers.

Methods:

Phenotypic data from participants seen at a research clinic fed machine learning algorithms. Participants were [YAMS-One] high-risk infant siblings of children with ASD seen at 12- and 18-months of age (n=76), and [YAMS-Toddler] toddlers seen between 15- and 27-months of age (n=310: ASD, n=102). Machine learning algorithms were tuned to predict ADOS Module 1 scores from questionnaire and assessment items at either 12-months [YAMS-One] or their ADOS-concurrent visit [YAMS-Toddler]. From over 400 items in both versions, spanning autism-specific, developmental, and temperament/regulatory-focused instruments, manual data cleaning and participant culling was followed by: (1) variable imputation (kNN, n=5, median); (2) variable selection (elastic net); (3) machine learning fitting. 100 repeats of 10-fold cross validation were used to estimate prediction accuracies.

Results:

[YAMS-Toddler] Naïve approaches using linear regression and no variable selection were inadequate for predicting ADOS totals (r=.02). Support vector regression was a benchmark for machine learning (r=.641), but required all items. Tree-based CART provided adaptive item parsimony, but suffered from generalization problems (r=.440). Random-forests, like SVM, showed good performance (r=.603) but also required all items. A hybrid sparse-forest variant of CART was developed to create sets of 5 trees that together showed robustness comparable to random forest (r=.548). Results were similar for [YAMS-One], r=.511.

Discussion:

Items unsuited for video-based translation were rejected and training restarted. Final items were examined for redundancy and collapsed into composites via forum review by clinicians and developmental scientists. Items were translated into scripts enacted by mothers and their children (reflecting diverse demographics) for developing professionally-filmed content. Video clips were incorporated into a tablet-based system alongside digital consent, demographic surveys, and implementations of text-based [YAMS-One] CSBS-ITC (Wetherby & Prizant, 2002) or [YAMS-Toddler] M-CHAT-R/F (Robins et al., 2014) for validation. Clinical review screens were developed so health providers could act on validated CSBS/M-CHAT results. Handshaking with backend servers facilitated data monitoring. YAMS was recently piloted in diverse pediatric and research clinics, and showed promising results (e.g. YAMS-Toddler & ADOS scores: *r*(46)>.60, *p*<.001).

Conclusions:

This study reflects the development of a multimedia screener reflecting the multidisciplinary expertise of clinical, developmental, and computer science. The resultant screening system was based on machine learning results adapted for parsimony in delivery and reflected necessary tradeoffs based on clinical and practical needs. Results of the deployment of the YAMS-systems are ongoing.

99 **143.099** Tracking Toddlers' Head Movement with Facial Landmarks during the Viewing of a Social Scene

Q. Wang[1], *A. Milgramm*[2], *S. Macari*[1] *and K. Chawarska*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Autism and Related Disabilities, Albany, NY*

Background: Infants at high risk for developing autism spectrum disorder (ASD) exhibit atypical head movements as early as 1-2 months after birth (Denisova & Zhao, 2017). However, it is challenging to track or quantify head movement with subjective observation. With improvement of computer vision technologies, automated tracking of head movement in toddlers can be a helpful quantification tool for this behavior.
Objectives: (1)To apply 3D head movement tracking with facial landmarks in behavioral videos; (2)To compare spontaneous head movement in toddlers with and without ASD engaged in a free-viewing eye-tracking task involving social scenes; and (3)To examine the extent to which head movement is correlated with social affect (ADOS-SA) and restricted and repetitive behaviors (ADOS-RRB). We hypothesized that ASD toddlers would exhibit increased head movement, and that this would be related to RRB symptoms.

Methods: Openface implementation (Amos et al., 2014) with dlib was applied for face detection and facial landmark extraction from video frames with classic Histogram of Oriented Gradients (HOG) feature combined with a linear classifier (Kazemi & Sullivan, 2014). The positional and rotational position and their changes through time were identified by head pose estimation in dlib (Kazemi & Sullivan, 2014). Participants included 26 toddlers (ASD, n=13, M_{age}=41.70±3.03; typically developing (TD), n=13; M_{age}=37.87±2.69) who completed a 3-minute head- and eye-tracking task consisting of an actress engaged in dyadic bids for engagement. Linear mixed model (LMM) analyses were used to examine fixed effects of actress' speech (present/not present), actress' gaze direction (mutual/averted), clinical diagnosis (ASD/TD), and their interactions on the maximum amplitude of toddlers' head positions (pxyz) and rotation angles (rx,ry,rz; see Figure 1).

Results: LMM analyses of pxyz revealed a main effect of speech (*F*(1,799)=9.08, *p*=0.003); less head movement was observed when speech was present. There was no main effect of gaze direction, clinical diagnosis, or their interactions, and no correlation with ADOS-SA or RRB (*p*'s>.1). Analyses of rx, ry, and rz also revealed a main effect of speech (*p*'s<.05) with less rotation at speech presence, but no effect of gaze direction (*p*'s>.1). While ry analysis revealed a main effect of diagnosis (*F*(1,24)=5.01, *p*=0.035; ASD>TD), rx revealed no effect (*F*(1,24)=2.44, *p*=0.13; ASD=TD) and rz revealed a marginal effect (*F*(1,24)=3.70, *p*=0.066; ASD>TD). In toddlers with ASD, rx correlated with ADOS-SA (*r*(13)=0.73, *p*=0.005); rz marginally correlated with SA (*r*(13)=0.54, *p*=0.055); ry did not correlate with SA (*p*>.1). None of the rotational angles correlated significantly with ADOS-RRB (*r*'s=.113-.266; *p*'s>.1).

Conclusions: Both groups displayed less head movement in the presence of speech, suggesting that speech may elicit greater attentional engagement with the stimuli and associated suppression of extraneous motor activity. Gaze direction, however, had no effect on toddlers' head positions or rotation angles. ASD toddlers displayed more rotational head movement then TD controls in both y and z directions. Further, rotational head movement was related to social affect, but unrelated to repetitive behavior. This finding suggests that during a dyadic condition, head rotations may be a result of diminished interest in or uncomfortableness with social situations rather than unsuppressed motor behavior.

100 **143.100** Integrating Deep Learning with Behavior Imaging to Accelerate Industry's 'Learning' of Autism Core Deficits

R. Oberleitner[1], *J. Schwartz*[2], *C. J. Smith*[3], *M. Morrier*[4], *U. Reischl*[5], *J. Fodor*[6], *B. Martin*[6] *and C. E. Rice*[7], *(1)Behavior Imaging Solutions, Boise, ID,* *(2)Behavior Imaging, Boise, ID, (3)Southwest Autism Research & Resource Center, Phoenix, AZ, (4)Psychiatry and Behavioral Sciences, Emory University School of Medicine, Decatur, GA, (5)Boise State University, Boise, ID, (6)University of Idaho, Moscow, ID, (7)Emory Autism Center, Decatur, GA*

Background: During the past several decades, the worldwide prevalence of children diagnosed with autism spectrum disorder (ASD) has increased dramatically. Since ASD does not have clear biomarkers and is a behaviorally defined disorder, a key element in the diagnostic process is direct observation of behavior and expert diagnosticians. This approach can lead to significant variability in results . However, new approaches using Artificial Intelligence (AI) are being developed that have the potential to improve the diagnostic accuracy of this process.
Objectives: 1. How Deep Learning Method Can Be Deployed to 'Learn' from 1 to 1000 Clinicians' Assessments of Patient Video Data 2. How Clinicians Evaluating Children via Archived Video can document Atypical Behaviors related to Autism

Methods: A Deep Learning (DL) computational method called a ‘DL Classifier’ is being introduced to help clinicians analyze video information collected by a telehealth assessment called NODATM (Naturalistic Observation Diagnostic Assessment). NODA results in a diagnostic category (ASD v. non ASD) based on clinician-annotated videos performed by expert diagnosticians. Clinicians identify both atypical and typical behaviors in children at specific moments on video samples parents collect and share from their home. Given a large enough dataset, the DL Classifier delineates the behavioral information into recognized patterns that can be automatically ‘flagged’ on video data as typical or atypical - for review by an expert diagnostician. The more clinicians train the DL Classifier, the better it gets in recognizing atypical and typical behaviors. A DL Classifier was developed to compute patterns in 244 videos captured and previously shared by families as part of the NODA diagnostic assessment process; these videos cumulatively had 6,243 atypical / typical tags previously applied at select time points by clinicians. The Classifier was applied in several iterative computational methods to analyze 1. still images within NODA video, then 2. short video segments associated with associated tags applied by clinicians.

Results: All ‘Deep Learning’ tags suggested by the Classifier were compared to tags used to generate the classifier. Classifier resulted in 80% accuracy based on analysis of still images, and 86% accuracy based on analysis of video segments.

Conclusions: A more commercial-grade 'DL Classifier' is being integrated into the existing Behavior Imaging / NODA platform, and we’re predicting accuracy will improve with more Classifier development, and more training of the NODA 'data set' by clinicians. When further validated, the proposed NODA DL classifier represents a significant advancement in the diagnosis and care of children with ASD, especially by building an industry-wide consensus on autism symptoms, and specifically -- through a reduction of time that will be required to obtain an accurate diagnosis.

101 **143.101** Scalable Gaze Analysis for ASD Is in Your Pocket

Z. Chang[1], *J. Hashemi*[1], *K. L. Carpenter*[2], *G. Dawson*[3] *and G. Sapiro*[1], *(1)Department of Electrical and Computer Engineering, Duke University, Durham, NC, (2)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (3)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Background:
Eye tracking technology is widely used in Autism research as studies show that infants and toddlers with Autism Spectrum Disorder (ASD) have a tendency to focus on non-social features (i.e., toys, objects). Conventional autism research studies are carried out in controlled clinical settings with expensive commercial eye/gaze trackers that require explicit user calibration. This setup is not scalable, introduces environmental bias, and is challenging for participants. New computer vision techniques can estimate the eye gaze of a person using a single photo taken from a cellphone camera without any explicit calibration, opening up new screening methods that are feasible beyond the clinical settings.

Objectives:

To incorporate eye tracking into mobile devices for large-scale, remote data collection and screening and monitoring of ASD children in a naturalistic environment.

Methods:

We developed an iPhone and desktop application that displays a stimulus consisting of dots appearing sequentially on the screen. The user is asked to tap each dot as it appears, during which an image of the user’s face is recorded using the front facing camera of the iPhone (or desktop camera). The user’s face and eye regions are automatically detected using computer vision algorithms and used as input to train a neural network for gaze estimation. The output of the network is the corresponding region in which the dot falls within.

Results:

We tested our eye tracking algorithm on 9 naïve subjects (7 male, 2 female) of varying ethnicity and age. When holding the iPhone in landscape, on average we achieved 93% accuracy discriminating whether the user was looking at the left or right half of the screen without explicit calibration. We also achieve over 80% accuracy discriminating between 3 regions in landscape and 2 regions in portrait.

Conclusions:

We incorporated eye tracking technology into a mobile (or desktop) application for remote, large scale data collection of ASD children. We demonstrate that we are able to achieve sufficiently high accuracy in estimating the user’s focus of attention on the phone screen without the need for explicit calibration. The proposed region based gaze analysis approach is sufficient for ASD and other behavioral analysis techniques, with properly defined stimuli, e.g., social half vs, non-social half. Application of calibration-free eye tracking on mobile devices could lead to scalable new behavioral imaging methods for detecting subtle neurologic processes relating to attention, and may be useful for early Autism screening and monitoring.

102 **143.102** A New Ipad Game for Ecological Motor Assessment of Children: Bespoke Wearable and Smart Tablet Engineering for Autism-Friendly Assessment.

A. Mitchell[1], *A. Maggio*[2], *L. Millar*[3], *D. Campolo*[4], *P. Rowe*[5] *and J. Delafield-Butt*[6], *(1)Humanities & Social Sciences and Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom of Great Britain and Northern Ireland, (2)Humanities & Social Sciences and Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom, (3)Faculty of Engineering, University of Strathclyde, Glasgow, United Kingdom, (4)Robotics Research Centre, School of Mechanical & Aerospace Engineering, Nanyang Technological University, Singapore, Singapore,* *(5)Department of Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom, (6)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom*

Background:

Increasing evidence suggests motor control disruption in individuals with autism spectrum disorder (ASD) may be a cardinal symptom. Thus, recording sub-second kinematics may lead to the identification and objective quantification of motor characteristics specific to autism, potentially allowing a novel instrument to aid early screening and diagnosis. Kinematic analysis has traditionally involved expensive and laborious optical motion tracking systems. With the recent advent of wearable inertial movement units sensors (IMUs), new possibilities are afforded for accessible serious game platforms for the measurement of goal-directed hand movements to a target, with many repetitions for high-grade statistical analysis.

Objectives:

This study: To engineer a serious game paradigm for fun, fast, and ecologically valid computational kinematic assessment of possible autism-specific goal-directed arm motor patterns in children.

Methods:

Equipment. An integrated platform of (i) a bespoke engineered wearable IMU with tri-axial accelerometer and gyroscope, (ii) smart tablet device (iPad mini), and (iii) a bespoke engineered forceplate (fPad).

Wearable sensor was engineered with an Arduino component protected within a 3D-printed acrylic container strapped to the child's wrist (60g). The fPad contained 4 strain gauges on metal legs bolted to the underside of an acrylic plate allowing measurement of applied forces during gameplay. The iPad was situated upon the fPad and pre-loaded with a browser-based game. The iPad and fPad were encased within a handcrafted balsa wood case with sanded edged, painted matt-black for maximum screen contrast.

Data were sampled at 80Hz, sent to an on-site server over Wi-Fi and synchronised.

The game, Bubble-Pop, encouraged regular arcing motions to hit targets in corners of the screen. Targets were bubbles 2.7 cm in diameter, with centres distanced at 11.2cm horizontally or 7.2cm vertically from each other. Level 1 has 4 bubbles, one in each corner, requiring 40 pops with choice of popping order. Level 2 has 2 bubbles, in the top corners, requiring 30 pops with 1 target at a time. Levels are played 3 times to generate 210 windows of movement over 7 minutes.

Results:

Motor kinematic profiles generated from the wearable, iPad, and fPad include: hand acceleration and jerk, duration, impact force to target acceleration, target accuracy and precision, target contact duration, touch gesture variables, and variability of these features. Motor profiles are compared within and between groups for improved characterisation of children's motor pattern.

Conclusions:

Sub-second motor kinematic data is achievable using a wearable, iPad, and fPad serious game solution. Children enjoy the game and repeat goal-directed movements many times per trial (>210 movements in ca. 7 mins) providing high-quality data for robust statistical analyses of motor kinematics. In sum, we have designed a new, fun bespoke technological tool to facilitate motor assessment of children with or without ASD. It may ultimately lead to improved diagnosis of ASD in early childhood with cheaper, simpler, faster and more accessible assessment of movements in children than currently available. In future work we will employ this technology to identify motor patterns unique to ASD in a large cohort (n>100) of children 2-5 years old.

103 **143.103** Towards an Automated Analysis of Social-Communication Behaviors in Autism Spectrum Disorder

Z. Tősér[1], *Z. Arnold*[2], *M. Csakvari*[3], *A. Lorincz*[3], *E. V. Ocampo*[2], *M. Pollack*[2], *A. Wainer*[2] *and L. Soorya*[2], *(1)Argus Cognitive, Inc., Lebanon, NH, (2)Department of Psychiatry, Rush University Medical Center, Chicago, IL, (3)Department of Software Technology & Methdology, Eotvos Lorand University, Budapest, Hungary*

Background: Clinical assessment of autism spectrum disorder (ASD) involves sophisticated and psychometrically sound assessment of characteristic behaviors such as emotional expressions, reciprocity, and atypical mannerisms. Available gold standard assessments require highly trained evaluators and an expert clinical eye – constraining crucial early detection and intervention needs in communities. Additionally, available tools have limited utility in research settings seeking objective assessments of subtle behaviors for mechanistic and treatment research. Objectives: This collaborative project integrates artificial intelligence (AI) methods and clinical expertise to advance methods for detecting and monitoring social-communication behaviors associated with for ASD and related neuropsychiatric conditions.

Methods: Forty-seven individuals were enrolled in the pilot feasibility study to refine protocols and procedures for quantitative assessment of social-communication behaviors with approximately half (n=23) completing initial analysis and quality control checks. Participants included typically developing children (n=13), individuals with rare genetic disorders associated with ASD (n=7), and children with idiopathic ASD (n=28). System components included sensors such as off-the-shelf cameras and microphones, secure data analytic protocols to transfer data from clinics to "core lab", and analytic software to turn sensor data into clinically relevant behavior codes. Data below are reported from images collected during administration of the Autism Diagnostic Observation Schedule-2 (ADOS-2, Lord, Rutter, DiLavore, Risi, Gotham, & Bishop, 2012). Evaluators wore Tobii Glass 2 in clinical assessment rooms equipped with 2-D and 3-D cameras. No additional modifications were made to the clinical environment or ADOS-2 protocol. Data was also collected during multi-modal clinical research protocols utilizing semi-structured behavioral assessments such as the Unstructured Imitation Assessment (UIA, McDuffie, et al, 2007), clinical assessments such as the Clinical Global Impressions Scale (CGI), and caregiver reports such as the Social Responsiveness Scale-2(SRS-2, Constantino, 2012).

Results: Analytic software measured several behavioral features of ASD including gaze contact, gaze distribution, responsive gaze, facial expressions of emotion, vocalizations, speech content, speech quality, and integration of vocalization and body language. Data from subset of verbally fluent, children with ASD (n=8) were compared to clinical scores from the ADOS2 Module 3 for initial clinical validation. Spearman's rho was used to provide an estimate of the strength of the relationship between biometric data and qualitative clinical scores. These preliminary analyses suggest moderate to strong correlations between ADOS-2 summary codes (e.g. amount of reciprocal social communication) with patient behaviors (e.g. average duration patient looks at clinician), clinician behaviors (e.g. clinician initiates eye contact) as well as interactions (e.g. average duration of eye contact between patient and clinician). Analysis and system training is underway for the full scope of social-communication behaviors described above, as well as validation with clinical assessments and caregiver reports of social-communication behaviors.

Conclusions: An understanding of hallmark social-communication features of ASD has been crucial to advancing clinical care and research. Automated, objective assessments are exciting and promising developments but require standardization and clinical validation. Research applications may see more near-term benefits from use of digital biomarkers to elucidate relationships between observable behaviors and molecular & neurobiological variables; as well as measure target engagement & outcomes from clinical trials.

104 **143.104** Automated Detection of Stereotypical Motor Movements in Children with Autism Spectrum Disorder Using Geometric Feature Fusion

*C. Tralie[1], **M. S. Goodwin**[2] and G. Sapiro[3], (1)Duke University, Durham, NC, (2)Northeastern University, Boston, MA, (3)Department of Electrical and Computer Engineering, Duke University, Durham, NC*

Background:

One of the two main diagnostic criteria for autism spectrum disorder (ASD) in the DSM-5 is restricted, repetitive patterns of behavior, interests, and/or activities, and one of the ways these behaviors manifest in ASD is stereotypical motor movements (SMM). Traditional measures of SMM primarily include rating scales, direct behavioral observation, and video-based methods, all of which can be subjective, inaccurate, time-intensive, and difficult to compare across different individuals with ASD. More reliably, accurately, and efficiently detecting and monitoring SMM over time could provide important insights for understanding and intervening upon a core symptom of ASD.

Objectives:

Leverage a novel set of features based on sliding windows and topological data analysis to computationally detect the onset and type of SMM using accelerometer data from children with ASD. Also demonstrate that novel features we developed enable a more parsimonious representation of periodic SMM when combined with previous methods that, collectively, boost automated classification performance reported in the published literature.

Methods:

We used publicly available data from [Goodwin etal. 2014] to study automated classification of SMM in a subset of 6 subjects, with each session spanning approximately 20 minutes. Each subject had a 3-axis accelerometer on his/her left wrist, right wrist, and torso to measure stereotypical hand flapping and body-rocking. Each accelerometer time series was accompanied by annotated ground truth labels provided by human coders indicating time-stamped onset and offset for the following three operationally defined SMM: flap, rock, and flap+rock. We segmented all of the accelerometer data into 2-second windows that overlapped by 130 milliseconds. For each window, we extracted both recurrence quantification analysis (RQA) features (as in [Großekathöfer et al. 2017], 9 dimensions per accelerometer, 27 dimensions total) and applied novel topology-based "persistence" features that measure "roundness" of a sliding window reconstruction of the joint embedding of the 3-axis accelerometers using persistent homology (novel feature, 1 number per accelerometer, 3 dimensions total). After subsampling the windows corresponding to periods when no SMM was observed to balance the data, we analyzed the ability of our features to classify SMM into the three target classes by running simple cross-validation experiments.

Results:

After combining all labeled sessions, we tested using 10-fold cross validation with a decision tree using only RQA features, only persistence features, and both combined. For the task of identifying the class of a SMM in a 2-second window or the absence therein, RQA features produced 85.9% classification accuracy, and persistence features (which use an order of magnitude fewer dimensions) yielded a similar classification accuracy of 84.8%. Moreover, when these methods were combined, they together yielded automated classification performance of 90.6% accuracy, demonstrating that in addition to their parsimony, the newly developed feature enables increasingly more accurate automated detection of SMM.

Conclusions:

Based on recent theory on periodicity analysis using geometry, this study demonstrates the feasibility and validity of achieving excellent performance for automatically detecting and classifying SMM computationally in a low dimensional space with only 3 degrees of freedom.

105 **143.105** The Canadian National Autism Neuroinformatics Platform Phase I: Development and Validation of a Universal Library of Instruments

***L. A-Abbas**[1], R. Bruno[2], C. Rogers[3], T. Savion-Lemieux[2], A. Yusuf[4], F. Duhamel[5], J. Frei[2], S. Bentata[5], P. Kostopoulos[3], S. Das[3], A. C. Evans[6], M. Elsabbagh[7] and I. Peltekova[8], (1)Research Institute - McGill University Health Centre, Montreal, QC, Canada, (2)Research Institute-McGill University Health Centre, Montreal, QC, Canada, (3)McGill Centre for Integrative Neuroscience, Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (4)Psychiatry, McGill University, Montreal, QC, Canada, (5)McGill University Health Center, Montreal, QC, Canada, (6)Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (7)McGill University, Montreal, PQ, Canada, (8)McGill University, Montreal, QC, CANADA*

Background:New approaches in neurodevelopmental research increasingly seek to integrate enormous amounts of data through sophisticated informatics so as to determine the relationship between genotypes and phenotypes,both structural and functional,as they change over time during development. Such approaches dwarf the resources of most laboratories, who are increasingly moving toward "cloud computing" solutions.Canada has several large scale projects and cohort studies that currently utilize independent and uncoordinated neuroinformatics solutions. A newly established National Autism Neuroinformatics Platform addresses this informatics problem by connecting existing infrastructure of large scale Canadian studies in autism and deploying high impact solutions already successful in other areas of research,e.g.,CBRAIN and LORIS.Key platform building blocks currently under development include a Testothèque (instrument library),family registry,project-specific data capture platforms,and a Federated/curated gene-brain-behavior data repository.

Objectives: In Phase 1 of this platform development, we focused on integration, documentation, and increasing accessibility of commonly used behavioral and clinical research measures.Hundreds of assessment tools are used in autism studies,overlapping with those used in clinical services.Despite the apparent simplicity and low cost of electronic data capture, few instruments are customized and accessible for large registries and multi-sites clinical studies.This led to the development of a new Testothèque:A library of electronic data capture instruments to support large scale projects at various stages.

Methods:A number of steps were taken to ensure the validity and accessibility of the Testothèque:(1)We integrated all behavioral and clinical research measures currently in use across multiple large scale national autism studies into a common database;(2)we established guidelines for the development and validation of electronic data capture instruments using an iterative process involving technical, clinical, and data experts;(3)we applied the guidelines in the development and validation of bilingual English and French data capture instruments customized for various platforms including RedCap and LORIS;(4)we are currently building a user-friendly interface to increase the accessibility and utility of the Testothèque to the research community.

Results:We completed databasing of over 50 behavioral and clinical research measures into the Testothèque.Informed by users of multidisciplinary backgrounds,fields were designed and populated to facilitate search,selection,and comparison of various measures,e.g.,constructs measured,age range,versions,copyrights.We also designed data capture instruments corresponding to each measure.Bilingual versions were developed, and automated scoring was implemented where possible.Using a new Development and Validation Checklist,each instrument was iteratively validated by two experts (content and technical) and 2-3 reviewers (target users).Validation criteria include:completeness/accuracy of library fields,instrument content and data validity(including captured and scored data),target user experience (e.g.parent,research assistant),and compatibility/inter-operability with existing large-scale project databases.

Conclusions:Our first phase has highlighted key challenges for future integration of behavioral data with other data modalities, including neuroimaging and genetics.Conventional platforms used in autism research do not allow for such integration.Further, implementation of a truly open platform, e.g.,creating an open Testothèque, is currently limited by copyrights and pre-existing agreements restricting data access.However, implementation of the National Autism Neuroinformatics Platform has already led to substantial gains in time efficiency, reduction/elimination of data entry errors,improved progress tracking/reporting,ease of data export, and increased overall transparency in complex study protocols.Some challenges were also identified and will be addressed in subsequent phases.

106 **143.106** Using Baby Facereader to Investigate Facial Expressiveness in at-Risk Populations

***A. Maroulis**, VicarVision, Amsterdam, Netherlands*

Background: Autism spectrum disorders (ASDs) are characterized in varying degrees by difficulties in social interaction, verbal & nonverbal communication (NVC) and repetitive behaviors. Looking at the face as a medium of NVC, researchers have often limited their research scope in studying smiles or laughter at high-risk (HR) populations. While smiling is a facial action with strong relevance to ASD, a detailed investigation into intensity, variability and lability of facial expressions is highly relevant but often avoided due to the cumbersome nature of detailed behavior coding such as the Baby Facial Action Coding System. Automatic facial expression coding solutions in the field of computer vision are a promising approach to overcoming this difficulty. To date, however, such solutions measure facial expression in adults and do not generalize well to infant populations. This demonstration presents Baby FaceReader, a novel solution that automatically measures infant facial expressions. Furthermore, the demonstration shows how Baby FaceReader can be used to investigate facial expressiveness in HR populations.
Objectives: To demonstrate that Baby FaceReader is a valid tool to measure facial expression behavior in terms of action units (AUs) in infants. To use Baby FaceReader to evaluate intensity, variability and lability of facial expression behavior in HR populations.

Methods: To evaluate Baby FaceReader's validity we collected all images from the Baby FACS manual that have been comprehensively coded for Action Units. After removing duplicates, the dataset consisted of 74 images. We ran Baby FaceReader on the dataset to extract AU classifications and computed F1 scores for each AU. F1 scores are a standard evaluation metric of predictions in pattern recognition and are computed using the formula in figure 1.

To evaluate intensity, variability and lability of facial expression behavior in HR we ran Baby FaceReader on a dataset of videos of two-year infants (20 HR, 5 control) during the social stimuli presentation of an eye-tracking paradigm. To compute (a) intensity, we took the average intensity of all expressed AUs during the social stimuli presentation; (b) variability, we counted the number of different facial configurations produced during the social stimuli; (c) lability, the number of times the infant's facial configuration changed during the social stimuli.

Results: Based on previous results, we expect to reach an average F1 score of at least 0.7 across all AUs in our evaluation of Baby FaceReader. We have not yet evaluated intensity, variability and lability in our video dataset.

Conclusions: Automatic coding is a promising advance in studying infant facial expression as it allows more time and depth for analysis. Baby FaceReader is one such complete solution that could be used in the study of ASD during development.

107 **143.107** Screening Tool for Autism Risk Using Technology – START: Developing a Tablet-Based Platform to Detect Autism Risk in Low-Resource Settings

***B. Chakrabarti**[1], I. Dubey[1], M. Belmonte[2], T. Gliga[3], G. Estrin[3], R. Bishain[4], J. Dasgupta[5], D. Mukherjee[5], S. Bhavnani[5], M. H. Johnson[6], S. Chandran[4], V. Patel[7], S. Gulati[8] and G. Divan[9], (1)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (2)Com DEALL Trust, Bangalore, India, (3)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (4)Computer Science and Engineering, Indian Institute of Technology, Bombay, India, (5)Centre for Chronic Conditions and Injuries, Public Health Foundation of India, Gurgaon, India, (6)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (7)Department of Global Health and Population, Harvard Medical School, Boston, MA, (8)Child Neurology Division Department of Pediatrics, All India Institute of Medical Sciences, Delhi, India, (9)Sangath, Bardez, Goa, India*

Background: Early diagnosis is key to early intervention and thereby to best outcomes in Autism Spectrum Conditions (ASC). In low-resource settings such as India, lack of access to early detection poses a significant barrier. Latest WHO data on India show that the ratio of specialists (psychiatrists) to patients can be as low as 0.30 per 100,000 people. In rural areas, furthermore, psychiatric expertise is non-existent. To fill the gap between the need for early identification and limited availability of expertise, it is important to develop alternative methods and tools that can be used by a low-skilled workforce, are inexpensive, and are portable so that they can be taken to the field without requiring any additional infrastructure.
Objectives: The "Screening Tool for Autism Risk using Technology" (START) project is developing an open-source, scalable autism screening tool in the form of an app that can be run on a tablet computer with minimal training.

Methods: This project is an interdisciplinary collaboration between neuroscientists, mental health professionals, public health researchers, computer vision scientists, app designers and app developers. Eight institutes/organisations (University of Reading, Birkbeck University of London, Nottingham Trent University, Indian Institute of Technology, All India Institute of Medical Sciences, Public Health Foundation of India, Sangath, and Therapy Box Ltd) from three countries (India, UK, and USA) participate in this consortium, funded by the UK Medical Research Council Global Challenge Research Fund. The project is divided into three work streams. The first stream is responsible for putting together a battery of behavioural tasks suitable for children between ages 2-5 years, to capture social, cognitive, and sensory-motor aspects of development relevant for autism. The second work stream is responsible for building a scalable pipeline to carry out data quality checks, data transfer to a central server, and maintenance of the research database. The third work stream will undertake field testing of the tool in India, collecting data from children with and without autism for validation.

Results: The app includes parent-report questionnaires and behavioural tasks to measure social preference, motor function, and sensory interest. A key innovation is tablet-camera based eye tracking, allowing capture of very low-resolution gaze direction data for coarse measures such as preferential looking and attentional disengagement, without the need for an external eye-tracker. Motor function tests are built in light of the emerging data from similar tablet-based tasks on the iOS platform (Anzulewicz, Sobota, & Delafield-Butt, 2016; Belmonte et al., 2016). The app also includes a task measure of social motivation previously associated with a group difference in children with autism (Ruta et al., 2017). Finally, the app includes a free-play section that provides an opportunity to video-record parent-child play interaction for subsequent analysis.

Conclusions: The working prototype establishes feasibility of a portable platform that can capture multiple task and interview measures, including eye-tracking and assays of motor function. The platform integrates mobile health technology for task-sharing application in low-resource settings by non-specialist community health workers, and offers the potential for scaling up as part of regular community health assessments.

108 **143.108** An Embodied Computational Model to Explore Environmental-Neural Interactions in Disorders of E/I Balance.

P. J. Hellyer[1], *F. E. Turkheimer*[2], *E. J. Jones*[3] *and R. Leech*[4], *(1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, UK, London, England, (2)Institute of Psychiatry, Psychology and Neuroscience, King's College London, UK, London, United Kingdom, (3)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (4)Imperial College London, London, United Kingdom*

Background: Computational simulations of spontaneous neural dynamics have revealed the importance of local homeostatic excitation/inhibition (E/I) balance mechanisms for the maintenance of flexible neural dynamics in the healthy brain. Further, imbalances in E/I regulation have recently emerged as a leading candidate causal path to autism and common comorbidities like epilepsy. E/I balance is particularly vital during early development, where massive changes to both the structure and function of the brain occur over a relatively short time-period. Maintaining regulation during this period is challenging, and changes in homeostatic set point through alteration of E/I balance may enable waves of new learning. However, current experimental approaches lack a mechanistic understanding of how E/I balance may affect behaviour and brain development. Thus dynamic modelling approaches must be used.

Objectives: Here, we demonstrate a tool for exploring the effect of E/I based homeostatic mechanisms on specific modes of behaviour using an 'embodied' computational model; and consider putative applications of this for the emergence of autism-related traits during development.

Methods: Our approach begins by defining a virtual 'agent' that can move within a 2-dimensional plane, bounded by surrounding walls (Figure 1). ‘Neural’ Dynamics in the model are provided using a range of structurally based computational models, tuned to the specific hypothesis (e.g. [1] (Figure 1A/B). Movement of the agent in the virtual environment is determined by activity within two pre-defined “motor” nodes in the model. Direct manipulation of a group of experimenter-defined task-positive nodes simultaneously enables both “visual” and “somatosensory” inputs to the model - providing an 'open loop' interaction between the dynamics of the 'brain' of the agent and its subsequent manipulation of the environment (Figure 2).

Results: Using this framework we demonstrate the potential of a range of simple manipulations of this model to enable exploration of local and large-scale E/I homeostatic mechanisms during learning and development - particularly those described in [2]. Such an approach raises the possibility of rapidly testing and manipulating hypotheses drawn from rich computational accounts of neural stability dependent on E/I balance. Our demonstration highlights the use of this tool to illustrate that local homeostatic balancing of E/I at the local level enables the emergence of exploratory behavioural dynamics (Figure 3). Moreover, we show that such mechanisms, manipulated during critical points of development lead to long-term alteration in the rich computational dynamics in the brain.

Conclusions: We demonstrate here a role for homeostatic plasticity in local E/I circuits in the emergence of stable exploratory behaviour (trajectories through the environment). Our initial work highlights the possible use of such a tool to explore GABAergic and Glutamatergic models of Autism - providing an in-silico model from which to explore novel treatment approaches. Our longer-term goal is to test predictions from this model within developmental datasets, such as prospective longitudinal cohorts of infants at risk for autism.

109 **143.109** Is Acttrust a New Device to Measure Sleep Problems in Autism?

P. Ballester-Navarro[1], *E. Martínez-Saíto*[2], *E. Fernández Jover*[3], *A. Palazón*[4] *and A. Peiró*[5], *(1)Hospital General Universitario de Aucante, Alicante, Spain, (2)Department of Clinical Pharmacology, Organic Chemistry and Pediatrics, in the University Miguel Hernández, Madrid, Spain, (3)Bioengineer Institute, Elche, Spain, (4)Paediatrics Service, Alicante, Spain, (5)Clinical Pharmacology, Alicante, Spain*

Background: Sleep problems in adults on the autism spectrum are poorly studied in adulthood, where insomnia is the most prevalent. Establishing quantitative criteria with an adequate equipment to analyse, is important for translational research.

Objectives: The aim of the study is to compare ActTrust, Condor instruments device with Ambulatory Circadian Monitoring (ACM) a method already validated.

Methods**:** Adults diagnosed with autism by DSM-5, wore two devices (ActTrust and ACM, 1 week) to study sleep parameters (Sleep onset latency (SOL), Time in bed (TIB), total sleep time (TST), num. of awakenings, wakes after sleep onset (WASO) and sleep efficiency (SE)). Insomnia was defined by any of those conditions SOL>30min, TST<7-9h, WASO>30m, SE<85%. Fisher exact test was used to compare the results. Also, receiver operator characteristic (ROC) curves were generated for all sleep variables to examine sensitivity and specicity of the sleep measures.

Results: Fifty-two adults on the spectrum (age 31 (11) years old, 77% males) completed the study. No significant differences were found for insomnia cases, when compared by Fischer exact test (p =.091). ROC curves for the ACM were greater than for ActTrust (except for TIB and TST), which could mean a better control-case discrimination .

Conclusions: Insomnia prevalence was well estimated by any of the two devices. ROC curves in ACM estimate better insomnia except for TIB and TST. Further studies should be performed to complete ActTrust validation to define SP in autism.

110 **143.110** Multi-Modal Data Platform for Autism Research

ABSTRACT WITHDRAWN

Background:

The growing quantity and diversity of data collections in autism research has created a demand for neuroinformatics platforms harmonizing multi-modal cohorts across large-scale distributed collaborations. Providing researchers with integrated analysis tools to leverage these combined data assets in a robust, sustainable and transparent manner is pivotal to the future of neurodevelopmental research. Data sharing initiatives such as the NIMH Data Archive (NDA) and research networks critically rely on secure online platforms to manage distributed datasets spanning diverse modalities of brain, behavior and genotypic data.

The 'MNI Ecosystem' (Das 2016, fig.1) consisting of LORIS (Das 2012), CBRAIN (Sherif 2014) and BrainBrowser (Sherif 2015) provides an open-source neuroinformatics environment designed to address these challenges, hosting large-scale projects such as the NIH MRI study of Pediatric Development (NIHPD), the IBIS autism network, and developing initiatives such as the Canadian National Autism Neuroinformatics Platform.

Objectives:

LORIS, CBRAIN and BrainBrowser are open-source software packages developed at the Montreal Neurological Institute (MNI), designed to integrate data capture, analysis and visualization within a unified context. This 'MNI Ecosystem' combines demographic, neuroimaging, clinical/behavioral, biobanking and summary genetic data via web-accessible databasing and a user-friendly online suite of data management tools. Transparency, flexibility and interoperability with other data systems are core principles of this neuroinformatic ecosystem.

Methods:

LORIS is a web-based data capture and management system designed for seamless interoperability with other clinical/behavioral, imaging and genomic data platforms. Modality-specific tools native to LORIS include secure online surveys, data uploaders, mobile-friendly data input and quality control workflows. Customizable instruments are programmed with complex scoring and multi-language support. BrainBrowser, a web-based visualization tool embedded within LORIS, provides an interactive 3D viewer for neuroimaging scans. Data capture systems for MRI, EEG and modalities such as eye-tracking can load data directly into LORIS, and summary genomic and biobanking data are integrated via extensible modules.

Integrated querying tools enable users to design, curate and save custom datasets, exporting them to processing suites and platforms such as CBRAIN, a high-performance computing portal. Once a dataset is exported to CBRAIN, software pipelines analyze and return post-processed results to be stored in the LORIS database.

Results:

In autism and neurodevelopmental research, LORIS serves as the core infrastructure for large-scale longitudinal projects such as the IBIS autism research network and the NIHPD database. These initiatives have contributed significantly to the interoperability and core data standard development of the NIMH Data Archive (NDA).

In the context of autism and related disorders, the Canadian National Autism Neuroinformatics Platform is deploying a combined gene-brain-behavior data platform in LORIS and CBRAIN. This initiative plans to leverage existing data collections with new multi-modal cohorts, to amplify the translational impact of these data assets across the Canadian research community.

Conclusions:

Combined in a single platform, LORIS, CBRAIN and BrainBrowser provide a robust neuroinformatics infrastructure for acquisition, validation and analysis of data collected from many domains. Customizable for large-scale multi-modal ASD cohorts, the MNI ecosystem platform enables powerful and transparent leveraging of resources and tools for cross-disciplinary computational approaches in autism and neurodevelopmental research.

111 **143.111** Automated Artifact Detection for EEG Data Using a Convolutional Neural Network

***T. McAllister**, A. Naples and J. McPartland, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Electroencephalography (EEG) is a valuable tool for studying Autism Spectrum Disorder (ASD). It provides a rich, temporally precise measure of brain activity that is inexpensive and appropriate for individuals of all ages and levels of cognitive ability. However, EEG is easily contaminated by artefactual signal generated by movement and muscle activity. It is necessary to identify and exclude artefactual data, and there is little consensus on methodology for its automated detection. Consequently, EEG, particularly in developmental and clinical populations, is still checked for artifact by hand, a time intensive and error-prone process. In other domains, such as high-level image recognition, convolutional neural networks (CNN) have been effective in automating complicated classification tasks and show promise for automatically classifying EEG artifact.

Objectives: We (1) develop a CNN to classify contaminated EEG collected from infants at normal and high risk for ASD; (2) assess its performance against human experts; and (3) assess its performance in classification between normal and high-risk infants to explore potential differences in artifact across groups.

Methods: Data collected in 118 EEG sessions of infants at normal (NR) or high-risk (HR) of developing ASD were split into event-related epochs and manually coded by a human expert as artefactual or normal. Epochs were converted into two dimensional arrays of amplitude by time across EEG channels, yielding 5834 artefactual and 5388 clean examples. These were split into a training set (N=8800) and validation set (N=2422) for a six-layer CNN built with the python library Tensorflow. Data were processed in two CNNs: the first downsampled (DS) data into 256 discrete values, the second rescaled (RS) data to range from (-100,100) μV.

Results: The CNNs were tested using the validation set of novel epochs. Clean epochs incorrectly labeled artefactual were considered false positive epochs (FPE) while overlooked artifacts were considered false negative epochs (FNE). Both the DS-CNN and RS-CNN classified EEG with approximately 80% accuracy. The DS-CNN had 14% FPE and 6% FNE. The RS-CNN had 4.6% FPE 16% FNE. However, performance was differential in the CNN network. When the DS-CNN was tested with only HR epochs, it was correct 80.6% of the time, and had 17% FPE. With only NR epochs, the DS-CNN was correct 76% of the time, and had 15% FPE. When the RS-CNN was tested with only HR epochs, it was correct 78.5% of the time, and had 4% FPE. When the RS-CNN was tested with only NR epochs, it was correct 80.5% of the time, and had 6% FPE.

Conclusions: Our results show that CNNs can accurately classify EEG artifact at rates approaching human expert performance in a fraction of the time and warrant further development. With different pre-processing or more specifically tailored networks, CNNs could be a valuable method of EEG artifact detection. Ongoing analyses of classification performance between groups will allow us to detect differential patterns of artifact by risk status allowing for advances in automated classification while generating insights into patterns of activity that differentiate groups based on risk status.

112 **143.112** Kinect Motion Capture of Toddlers with Autism during ADOS Assessments

I. Budman[1]*, I. Menashe*[2]*, G. Meiri*[3] *and I. Dinstein*[4,5,6]*, (1)Department of Biomedical Engineering, Ben Gurion University, Beer Sheva, Israel, (2)Public Health Department, Ben-Gurion University, Beer Sheva, Israel, (3)Soroka Medical Center, Beer Sheba, Israel, (4)Negev Autism Center, Ben Gurion University of the Negev, Beer Sheba, Israel, (5)Department of Cognitive and Brain Sciences, Ben Gurion University of the Negev, Beer Sheba, Israel, (6)Department of Psychology, Ben Gurion University of the Negev, Beer Sheba, Israel*

Background:
Motion tracking is a very promising technology for quantifying repetitive movements and motor problems in autism. In addition, motion tracking of multiple interacting individuals (e.g., clinician and child) could yield informative measures regarding social capabilities and preferences. Such measures may aid not only in the initial clinical evaluation of toddlers with autism, but also as longitudinal measures that might change with age and in response to interventions. Most motion capture systems require placement of markers/sensors on the body of participants, which preclude their use with toddlers who have severe symptoms and sensory hyper-sensitivities. The Microsoft Kinect system, however, enables marker-free motion tracking that would be possible with all children. This system is being implemented as part of the data collection for the regional autism database initiative at the Negev Autism Center in Israel (www.negevautism.org).

Objectives:
To develop an automated motion tracking tool that will quantify repetitive movements, motor problems, and measures of social interaction during a 45 minute ADOS assessment involving a clinician and toddler. In addition, to identify motion tracking measures that are correlated with autism severity and can aid with the clinical diagnosis of autism and longitudinal follow-ups.

Methods:
We have developed an automated marker-less motion-capture system consisting of 4 Kinect sensors arranged in a rectangular arrangement, in the corners of the ADOS assessment room. Recordings of the clinician and the toddler are performed at 30fps for a length of at least 45 minutes. The sensors are calibrated and synched using ipiSoft, which also fits the depth-data from the sensors to a human skeletal model. Initial analyses were carried out with skeletal data of the torso and head only, separately for the clinician and the child. This enabled assessment of distance between clinician and child as well as the deviation angle between the direction that the clinician was facing and that of the child.

Results:
To date, we have successfully analyzed data from 8 children, which have revealed excellent quality and reliability throughout the 45 minute recordings. We extracted the distance and deviation angle for each frame in the recording and examined the relationship between the mean of each measure and symptom severity as estimated by the ADOS. Analysis of additional recordings that are currently carried out at a rate of 6 new children per week will enable us to perform statistical tests regarding these relationships.

Conclusions:
Marker-less motion tracking using the Kinect system are likely to yield important informative measures regarding the severity of autism in individual children. Further development of this tool will also enable quantification of repetitive behaviors and motor problems in the same children.

113 **143.113** Early Detection of Autism Using a Mobile Application: Asdetect

J. Barbaro[1]*, N. Sadka*[1]*, W. Nadachowski*[2]*, M. Burnside*[3]*, L. Burnside*[4]*, C. Dissanayake*[1]*, M. Leahy*[4] *and M. Denham*[4]*, (1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Autism Cooperative Research Centre, Melbourne, Victoria, Australia, (3)Salesforce.com, Melbourne, Victoria, Australia, (4)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Victoria, Australia*

Background: Early detection of autism is critical as it provides access to early intervention, improving children's developmental outcomes and quality of life, and decreasing family stress. Over the past 10 years, two large-scale community-based studies for the early detection of autism have been conducted within the Victorian Maternal and Child Health (MCH) system in Australia, using Social Attention and Communication Surveillance; SACS; Barbaro & Dissanayake, 2010; 2013). Monitoring over 30,000 children, the SACS is the most accurate and sensitive early detection method for autism currently available, with 81% positive predictive value (PPV), and estimated sensitivity and specificity of 83.8% and 99.8%. To make this research accessible to the world's population, including Lower Middle Income Countries (LMICs), an app based on the SACS was developed called ASDetect.

ASDetect (asdetect.org) is a free mobile application for the early detection of autism (11-30 months) that incorporates a modified version of the SACS. Short videos demonstrate key social-communication behaviours followed by a question, with automatic calculation of a child's 'likelihood' for autism (high/low).

Objectives: To determine the psychometric properties of ASDetect in sensitively and accurately identifying children with autism, and to evaluate its acceptability amongst parent users and professionals.

Methods: Parents of children aged between 11-30 months are invited to participate via their MCH nurse, or via social media/word of mouth. Parents register their child's details on a webpage, download ASDetect, and complete an assessment. All children at 'high likelihood' for autism, and a small percentage of children at 'low likelihood' for autism, are invited for a free diagnostic assessment by the ASDetect team. Children are assessed at intake and every 6 months until 24-months, with the ADOS-Toddler, Mullen Scales of Early Learning, and ADI-R administered.

Results: To date, 175 parents have registered, with 127 completing an assessment. 26 children (20.5%) were identified at 'high likelihood' for autism, with 12 of the 13 children assessed thus far meeting criteria for autism; the remaining child had a developmental/language delay. Updated results to May 2018 will be presented at the conference.

Conclusions: These preliminary data show very promising results for ASDetect's positive predictive value (PPV; accuracy) in identifying children with autism. However, more data are needed to determine its overall psychometric properties, and acceptability by parents and professionals, which will continue to be collected until 2019, with all children followed up to 30-months-of-age.

114 **143.114** Automatic Computer Vision Analysis of Emotional and Behavioral Responses of Children with Autism

J. Hashemi[1]*, K. L. Carpenter*[2]*, K. Campbell*[3]*, S. Espinosa*[1]*, Q. Qiu*[4]*, S. Marsan*[5]*, E. Adler*[4]*, H. L. Egger*[6]*, G. Dawson*[7] *and G. Sapiro*[1]*, (1)Department of Electrical and Computer Engineering, Duke University, Durham, NC, (2)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (3)Duke Center for Autism and Brain Development, Durham, NC, (4)Duke University, Durham, NC, (5)Psychology and Neuroscience, Duke University, Durham, NC, (6)Department of Child and Adolescent Psychiaty, New York University Langone Health, New York, NY, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Background: The gold standard for Autism Spectrum Disorder (ASD) screening involves parental report of child behaviors followed by observational assessment by a trained clinician. With emerging methods in computer vision and machine learning and wide spread access of mobile devices, new low-cost, scalable, and objective screening methods of child behavior are feasible. These include designing and displaying specific video stimuli on the screen while simultaneously coding behaviors while he/she is watching.

Objectives: To develop and deploy multiple video stimuli, designed to elicit behaviors relevant to ASD screening, on a mobile device and validate them with computer vision methods that automatically code affective and attentive child responses.

Methods: Multiple short video stimuli (<1 minute) designed to elicit specific social and emotional responses were displayed on an iPad, while at the same time the front facing camera recorded the child's face at 1080p resolution and 30 frames per second. Computer vision algorithms to assess head position, head turns, and affect were developed. In addition, human raters trained on Facial Action Coding System for Infants and Young Children coded multiple videos for ground truth affect and head turn labeling. A subset of the responses coded by the human raters and computer vision methods were analyzed for agreement. All responses coded by the computer vision methods were analyzed to determine whether stimuli differentially elicit child behavior.

Results: 104 toddlers (22 with and 82 without ASD) ages 16-31 months participated in the study with informed consent and IRB oversight. All of the participants' facial and head behaviors were coded with the automatic computer vision methods while a subset of them (15 ASD and 18 non-ASD) were also coded by human raters. Out of the 97 videos that were coded by human raters for affect, the automatic methods agreed with the raters on 82% of the frames. Out of the 87 head turns that were coded by human raters, the automatic method correctly identified 81% of the head turns. Compared with toddlers without ASD, toddlers with ASD displayed reduced positive emotions throughout many of the stimuli. From the automatic coding, toddlers with ASD also displayed longer latency between the time when their name was called and when they social referenced by turning their heads.

Conclusions: We developed and deployed multiple video stimuli on a mobile device to elicit ASD-specific behavioral responses. From the video data and our computer vision methods, we were able to automatically code affective and attentive responses. We validated our automatic methods with trained human raters, and demonstrate the effectiveness of our video stimuli to differentially elicit child behaviors. Applications such as the one presented could lead to new or refined behavioral risk marker assessments.

Technology demonstration: We will have a demo where the audience can watch a video stimuli on a mobile device while the front facing camera records their face. After the video, we will present facial statistics (affect, head movement) that were automatically computed with our methods.

Poster Session
144 - Early Development (< 48 months)
11:30 AM - 1:30 PM - Hall Grote Zaal

1 **144.001** A Comparison of High-Risk Siblings with Multiplex and Simplex Familial Risk Status: A Baby Siblings Research Consortium Study

N. M. McDonald[1]*, L. Carver*[2]*, T. Charman*[3]*, K. Chawarska*[4]*, S. Curtin*[5]*, I. Hertz-Picciotto*[6]*, E. J. Jones*[7]*, A. Klin*[8]*, R. Landa*[9]*, D. S. Messinger*[10]*, S. Ozonoff*[11]*, W. L. Stone*[12]*, H. Tager-Flusberg*[13]*, S. J. Webb*[14]*, G. S. Young*[11]*, L. Zwaigenbaum*[15] *and S. Jeste*[16]*, (1)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (2)University of California San Diego, La Jolla, CA, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)University of Calgary, Calgary, AB, Canada, (6)University of California at Davis, Davis, CA, (7)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (8)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (9)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (10)University of Miami, Coral Gables, FL, (11)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (12)Psychology, University of Washington, Seattle, WA, (13)Psychological and Brain Sciences, Boston University, Boston, MA, (14)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (15)University of Alberta, Edmonton, AB, Canada, (16)University of California, Los Angeles, Los Angeles, CA*

Background: Converging evidence suggests that there are multiple genetic pathways to autism spectrum disorder (ASD). One high-risk group that has been studied widely includes infants with older siblings with ASD, with risk modulated by the number of affected individuals in a family (multiple affected: multiplex, one affected: simplex). Investigation of multiplex siblings offers a unique opportunity to determine the quality of differences in early development associated with heightened genetic load for ASD in children with and without ASD outcomes. This study contrasts developmental profiles associated with different levels of familial risk in a large, multi-site sample of children from the Baby Siblings

Research Consortium (BSRC) database.
Objectives: To compare children with multiplex and simplex familial risk for ASD on: (1) rates of ASD, atypical, and typical outcomes at 36 months; (2) developmental abilities, adaptive skills, and ASD symptoms within no ASD and ASD outcome groups.

Methods: Participants included 885 (simplex: 806, multiplex: 79) children with familial risk who were enrolled in longitudinal studies across 10 BSRC sites. Simplex children had one older sibling with ASD and multiplex children had two or more older siblings with ASD. *Developmental abilities* were measured with the Mullen Scales of Early Learning (MSEL), *adaptive skills* with the Vineland Adaptive Behavior Scales-2nd Edition (VABS-II), and *ASD symptoms* with the Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview-Revised (ADI-R). Children were placed into one of three groups at 36 months: Typical (MSEL ^{3}85, ADOS <3), Atypical (MSEL <85, ADOS severity ^{3}3), ASD (Clinical Best Estimate & ADOS ^{3}4).

Results: See Table 1 for detailed results and statistical analyses. (1) Multiplex children were less likely than simplex children to be classified as Typical and more likely to be classified as ASD or Atypical. (2a) In the no ASD group, multiplex-no ASD children had lower MSEL scores than simplex-no ASD children; the Receptive Language subscale most strongly differentiated the groups. ADOS, ADI-R, and VABS-II scores did not differ. (2b) In the ASD group, there were no differences in ADOS scores, but multiplex-ASD children had higher ADI-R Communication scores than simplex-ASD children. Multiplex-ASD children tended to have lower MSEL and VABS-II scores than simplex children, particularly on the VABS-II motor scale, although these did not reach significance.

Conclusions: Results are consistent with previous reports of a twofold increase in ASD risk for multiplex siblings. In contrast with a study of school-age children with ASD (Cuccaro et al., 2003), we found evidence that multiplex children with and without ASD were somewhat more affected than simplex children. Within the no ASD group, these deficits were primarily characterized by lower developmental abilities. Findings may reflect an increased incidence of inherited risk variants in multiplex children that, while increasing the likelihood of atypical outcomes, may also be less specific to ASD. Further analyses will include longitudinal modeling of developmental trajectories in the first years of life to identify the earliest markers of atypical development in multiplex siblings. Results support the need for direct examination of genetic contributions to neurodevelopmental phenotypes of infant siblings.

2 **144.002** A Longitudinal Analysis of Early Social Anxiety Risk Factors in Siblings of Children with Autism Spectrum Disorder

A. L. Hogan[1]*, N. Poupore*[1] *and J. E. Roberts*[2]*, (1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Psychology, University of South Carolina, Columbia, SC*

Background: Siblings (ASIBs) of children with autism spectrum disorder (ASD) are at elevated risk for a variety of suboptimal developmental outcomes, including anxiety disorders. Childhood anxiety can have detrimental long-term effects that carry into adulthood and impact quality of life. However, early intervention for anxiety has been shown to ameliorate these long-term impacts. In neurotypical (NT) infants and toddlers, several early risk markers for social anxiety have been identified. These include high and stable expression of behavioral inhibition, a temperament profile characterized by excessive fear in response to novelty, and reduced physiological reactivity, as indexed by blunted respiratory sinus arrhythmia (RSA) responses. Identifying early risk markers of social anxiety in ASIBs can provide important insight into the emergence and trajectories of prodromal anxiety features in this high-risk population.
Objectives: To examine the developmental trajectory of early social anxiety risk markers in non-ASD ASIBs and low-risk controls (LRCs) in the first two years of life.

Methods: Participants included 32 later-born siblings of children with ASD who were not diagnosed themselves with ASD at >=24 months (non-ASD ASIBs) utilizing standard clinical best estimate procedures including the ADOS-2. Low-risk controls (n=42) with no personal or family history of ASD or related disorders were included. Participants were assessed at several timepoints from 7 to 28 months of age, for a total of 214 observations (ASIB: n = 90; LRC: n = 124) Behavioral inhibition was measured via the Fear subscales from the IBQ-R (< 18 months) and ECBQ (>=18 months) (Gartstein & Rothbart, 2003; Putnam, Gartstein, & Rothbart, 2006). Physiological reactivity was measured through heart activity recorded during a baseline period and the Stranger Approach paradigm (Goldsmith & Rothbart, 1996), which is designed to elicit behavioral inhibition in response to a novel adult. Reactivity was defined as Baseline RSA – Stranger RSA.

Results: Multi-level growth models were employed, with age, group, and age by group interaction entered as predictors. For parent-rated behavioral inhibition, significant main effects of age (b = -0.03, p < .01) and group (b = 0.39, p < .05) were revealed, with a non-significant interaction effect (b = -0.03, p = .11) (Figure 1). For physiological reactivity, the age by group interaction was significant, (b = -0.07, p < .05) (Figure 2), indicating that physiological regulation in ASIBs becomes more blunted with age.

Conclusions: Results suggest that non-ASD ASIBs exhibit elevated behavioral inhibition throughout the first two years of life, though by the age of 2, they are approaching normative levels. Conversely, physiological reactivity in response to a novel stranger becomes more atypical as non-ASD ASIBs age. These patterns of behavioral inhibition and blunted physiological reactivity are early risk markers for social anxiety in neurotypical infants. Thus, it appears that even ASIBs without ASD themselves are showing atypical social responsivity and may be at elevated risk for later social anxiety symptoms and diagnoses.

3 **144.003** An Ultrasound Study of Fetal Biometrics in Relation to Maternal Autistic Traits.

E. Aydin[1]*, R. Holt*[1]*, D. Chaplin*[2]*, R. Hawkes*[2]*, T. Austin*[2] *and S. Baron-Cohen*[3]*, (1)University of Cambridge, Cambridge, United Kingdom, (2)Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: The prenatal period is a critical time for brain development. During this period of early development, the unborn child has the potential to be negatively influenced by factors such as maternal infections and teratogens. Such epigenetic factors in the intrauterine environment have been linked to the development of many neurodevelopmental outcomes, including Autism Spectrum Conditions (ASC). Research has shown that autistic traits are partly heritable. Therefore, we predict mothers' scores on the Autism Spectrum Quotient (AQ) will influence fetal growth development. To date, only a handful of studies have observed prenatal development in relation to ASC. All studies have observed this potential marker of abnormal development retrospectively, either from measures taken at the time of birth or using growth measures from medical ultrasounds at 12 and 20 weeks.

Objectives: This study observed longitudinal fetal growth measures taken at 12-, 20- and between 26-30 weeks of pregnancy to observe the potential influence of material autistic traits on fetal development.

Methods: The sample comprises of 130 singleton pregnancies with no immediate family with an ASC diagnosis. Prenatal ultrasounds were procured from medical records at 12- and 20-weeks, and an additional ultrasound between 26-30 weeks pregnancy. 2D and 3D scans were performed using a GE 8 Expert Ultrasound system. Mothers were asked to complete an AQ at the time of their 3rd scan. Fetal head circumference (HC), abdominal circumference (AC), femur length (FL) and ventricular atrium (VA) measures were taken at each time point and standardised according to UK fetal biometry reference charts. Using partial correlations, the standardised growth measures and the discrepancies between them were compared across maternal AQ scores. This was carried out separately for each gestation and growth parameter.

Results: There was no significant correlation between fetal growth (HC, AC, FL or ventricular atrium) and mothers' AQ score even when controlling for gender and gestational age.

Conclusions: These preliminary findings suggest that there is no association between fetal physical development and mothers' AQ scores. This supports previous retrospective findings suggesting there are no differences in fetal biometry in children diagnosed with ASC. However, all pregnancies included in the study were low risk for ASC due to a lack of a diagnosis in the immediate family. The absence of any significant relationship here could reflect the narrow range of AQ scores, of the effects of parental traits on child development could be subtler, and are more likely to be evident in child behaviour later in development. Previous research has implicated a relationship between HC and brain size, suggesting the inference of fetal brain growth from HC. However, this is yet to be tested. This study will further explore brain development in relationship to HC during fetal growth and will follow these infants' development until they are 18-months old to observe subsequent physical and behavioural development.

4

144.004 Assessment Modality (Parent Questionnaire vs. Clinical Interview) Impacts Adaptive Functioning Scores in Preschoolers at Heightened Genetic Risk of ASD

*M. Cola[1], A. Faggen[1], J. Parish-Morris[1], S. Paterson[1], R. T. Schultz[1], **J. Pandey**[1] and .. The IBIS Network[2], (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)University of North Carolina, Chapel Hill, NC*

Background: The DSM-5 emphasizes the significance of adaptive function in the diagnosis of neurodevelopmental disorders, but these skills can be difficult to characterize in young children using standardized assessments. To date, there has been a paucity of research comparing adaptive functioning measures to each other, specifically within the preschool age group. Strong correlations have been reported across some adaptive functioning assessments when used with typically developing populations, but research in ASD populations has found significant discrepancies between assessments (Lopata et al., 2013). Prior literature suggests that at least a sub-group of younger siblings of children with ASD who do not develop ASD themselves are at heightened risk for a variety of developmental difficulties by age 3 (Messinger et al., 2013; Ozonoff et al., 2014). Accurately measuring adaptive functioning in this group is crucial, as these scores are used to design intervention plans that support school readiness. In order to determine the scope and targets of support, it is essential to find standardized assessments that accurately assess the adaptive skills of preschoolers at all levels of functioning.

Objectives: Determine which modality of assessment (parent report or clinician interview) better characterizes adaptive functioning by comparing scores on two commonly used assessments (the Adaptive Behaviors Assessment System, Second Edition (ABAS-II) Parent Form, and the Vineland Adaptive Behavior Scales-II (VABS-II) Survey Interview Form) with each other and with a measure of general developmental functioning (the Mullen Scales of Early Learning; MSEL).

Methods: Twenty-six 3-year-olds returned for a diagnostic visit as part of their participation in the longitudinal Infant Brain Imaging Study (IBIS). Participants fell into one of two groups: (1) at high-familial risk for ASD by virtue of having an older sibling with ASD, but not currently diagnosed with ASD themselves (HR-neg, N=20) and (2) at low-familial risk for ASD with no ASD diagnosis themselves (LR; N=6). All parents were mailed the ABAS-II to complete at home, while the MSEL and VABS-II were administered during the diagnostic visit.

Results: Across all domains of developmental function, children in both groups performed in the average range (Table 1) and did not differ significantly from one another (Welch's *ps*<.10). Within-group correlations were performed to assess relationships between VABS-II, ABAS-II, and MSEL scores. In the HR-neg group, VABS-II scores correlated with scores on the MSEL, while ABAS-II did not. In contrast, neither VABS-II nor ABAS-II scores correlated with MSEL scores in the LR group (which we will add to by the conference date).

Conclusions: Preliminary analyses indicate that the modality of assessment (parent questionnaire vs. clinical interview) impacts children's adaptive functioning scores, particularly when children are at heightened genetic risk for ASD. Our findings suggest that since parents of HR-neg children might not have a typical model to compare against when independently completing a questionnaire about adaptive functioning, that a clinical interview could provide critical support to more accurately capture children's strengths and weaknesses. Therefore, researchers should be cautious in assuming that different measures of adaptive behaviors are comparable in this age range and in HR samples.

5

144.005 Atypical Response to Caregiver Touch in Infants at Risk for Autism Spectrum Disorder

***G. Kadlaskar**[1], B. Keehn[1], A. Seidl[1], H. Tager-Flusberg[2] and C. A. Nelson[3], (1)Speech, Language, and Hearing Sciences, Purdue University, West Lafayette, IN, (2)Psychological and Brain Sciences, Boston University, Boston, MA, (3)Boston Children's Hospital, Boston, MA*

Background: A significant majority of individuals with autism spectrum disorder (ASD) experience hypo-and/or hyper-sensitivity in one or more sensory modalities, which have been linked with deficits in social communication and adaptive behavior. Touch is an important communicative signal, which forms the basis of early caregiver-child interactions and facilitates social communication and language processing in early development. Typically developing infants can use tactile cues to find linguistic units in continuous speech. For example, a touch on a foot while hearing the word "foot" may help infants form word-to-world mappings. Thus, touch may be an essential element aiding in early speech processing, since, when integrated with speech it could be informative as to the linguistic structure. Early aberrant responses to tactile stimulation in ASD, therefore, could impact the language development.

Objectives: To examine orienting frequency and latency to caregiver-initiated touch in 12-month-old infants at high risk for autism (HRA) that did (HRA+) and did not (HRA-) meet later diagnostic criteria for ASD compared to low-risk comparison (LRC-) infants, and the association between touch responsivity and language outcomes at 24 and 36 months.

Methods: To date, we have examined 30 (HRA+=10; HRA-=10; LRC=10), ten-minute videos of caregiver-infant interactions that were recorded during naturalistic play sessions. Trained coders, blind to group membership, evaluated the frequency, type, and location of caregiver-initiated touches to infants during play interactions (e.g., tap on the leg with or without a toy) along with infants' looking behaviors before, during and after each touch. Infants' looking behaviors were coded as 'touch related' (e.g., infant shifts attention to caregiver, touch-related toy, or touch location), 'non-touch related' (e.g. infant shifts attention to non-touch related object or location) and 'no shift' (e.g., no attentional shift).

Results: Preliminary analyses showed no significant differences in the frequency of caregiver touches delivered to infants in all three groups. Analysis of variance indicated marginally significant differences in the percentage of no-shift responses to caregiver touches between groups. Follow-up independent samples t-tests showed that the HRA+ infants had a greater percentage of no-shift responses to caregiver touches (67.1%) compared to HRA- infants (48.4%, *p*=.044) but not LRC- infants (56.9%, *p*=.191). In addition, for all infants, latency of touch-related attentional shifts was negatively correlated with verbal developmental quotient (DQ) scores, as measured by the Mullen Scales of Early Learning, at 36 months but not at 24 months (see Figure 1).

Conclusions: Our preliminary findings suggest that infants that go on to receive a diagnosis of ASD may more frequently fail to shift their attention in response to caregiver touch. These findings are in agreement with prior reports of 'sticky attention' in HRA infants in response to visual cues, and suggest that infants later diagnosed with ASD may show impaired disengagement of attention in response to tactile stimulation. Furthermore, faster orienting to touch was associated with better verbal DQ scores at 36 months, suggesting that touch may be instrumental in early infant language learning.

6 **144.006** Baby Movements in the Womb: Searching for Early Markers of Autism Spectrum Disorders

A. Caruso[1], *F. Fulceri*[1], *L. Iaconianni*[2], *A. Guzzetta*[3,4] *and M. L. Scattoni*[1], *(1)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (2)Diagnostic Ultrasound Center Eco B.I., Rome, Italy, (3)IRCCS Stella Maris Foundation, Calambrone (Pisa), Italy, (4)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy*

Background: To date, the early surveillance leading to an early intervention represents the only successful strategy to improve clinical outcomes in Autism Spectrum Disorder (ASD). The Italian network for early detection of ASD (NIDA) applies a clinical/biological standardized protocol for developmental surveillance in High Risk (HR, i.e. siblings of children with a diagnosis of ASD, preterm and small for gestational age newborns) and Low Risk infants (LR, i.e. siblings of typically developing children) with the aim of identifying early risk indexes of ASD. The NIDA network has recently characterized the early phases of motor development in HR infants detecting abnormalities in general movements in the first two weeks of age. Since fetal movements are considered to reflect the developing nervous system, it has been hypothesized that their examination could be a promising tool to identify early sign of ASD

Objectives: To develop novel multidisciplinary observational methods to identify fetal movements with a prognostic value for ASD.

Methods: The NIDA's standardized protocol for developmental surveillance in HR and LR infants has been implemented with fetal movements screening. Data collected are going to be used to generate normative data and subsequently compare them to data collected on fetuses at risk of developing ASD. Multivariate statistical methods are fundamental to analyze fetal/newborn/infant data to detect early markers of ASD. This undergoing prospective study has been approved by Istituto Superiore di Sanità (ISS) ethic committee and complies with the guiding policies and principles for experimental procedures endorsed by the National Institutes of Health.

Results: The fetal screening standard operative procedures (SOPs) have been defined in collaboration with a child psychiatrist expert on infant movement assessment and with a gynecologist certified by the Fetal Medicine Foundation. First and second trimester ultrasound (US) examinations last ten minutes including five minutes of two-dimensional US followed by five minutes of four-dimensional US. The US probe view approaches the entire fetus or alternatively focuses on the upper torso of the body. One hour of cardio-tocographic recording occurs in the third trimester. Fetal movements are classified into different activities including general movements. The fetal biometric data are also detected across trimesters.

Conclusions: The NIDA project is actually monitoring the neurodevelopment of 70 HR and 75 LR infants. It has been expected that fetal US screening may be helpful in detecting predictive and/or prognostic markers of ASD.

7 **144.007** Can the Social Responsiveness Scale Index Maternal Responsiveness during Play?

A. M. Kellerman[1], ***A. J. Schwichtenberg***[1], *R. Abu-Zhaya*[1], *M. Miller*[2], *G. S. Young*[3] *and S. Ozonoff*[3], *(1)Purdue University, West Lafayette, IN, (2)University of California, Davis, MIND Institute, Sacramento, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA*

Background: The *Social Responsiveness Scale* (SRS) is a commonly used questionnaire to measure elements of the broader autism phenotype (BAP), or what is sometimes referred to as quantitative autistic traits (QAT). Previous studies document the presence of sub-clinical autism traits in families raising children with autism spectrum disorder (ASD) but the functional and treatment-related implications of these traits are poorly understood and understudied. Family members with elevated QAT may require more support when implementing parent-mediated interventions. To identify parents who may need more support, the use of the SRS has been recommended. However, it is unclear if SRS scores are associated with maternal behaviors within a social context.

Objectives: To assess the associations between maternal SRS-2 scores and maternal responsiveness in context (for this study within a play session).

Methods: Dyads were recruited from families with at least one older child with ASD (high-risk group, *n* = 90) or families with no history of ASD (low-risk group, *n* = 62). Play interactions included mothers and a younger infant sibling. Children with ASD where not included to minimize the impact of their social difficulties on maternal ratings of responsiveness. Dyadic interactions were micro-coded for gaze, positive affect, and vocalizations when infants were 6, 9, and 12 months of age. Using these micro-codes, theory-driven composites were created to index observed maternal responsiveness (i.e., initiations, responses, responsiveness timing). Maternal social responsiveness ratings were reported by a spouse/partner on the SRS.

Results: The majority of maternal SRS T scores fell within the normal range of reciprocal social behavior (Figure 1). Maternal SRS T scores were also comparable across risk high- and low-risk groups, *F*(1, 151) = .70, *p* = .40 (high-risk group, range: 43-70, *M* = 49.09, *SD* = 4.85; low-risk group, range:

44-61, *M* = 49.57, *SD* = 3.66). To assess whether SRS scores were associated with observed maternal responsiveness, general linear models were specified, with terms for infant sex and family income. Observed maternal social initiations, responses, and responsiveness timing were not associated with SRS T scores at 6, 9, or 12 month visits (*p* range .07 - .97).

Conclusions: SRS scores were not associated with maternal behaviors within a social context. This study had the power to detect moderate-to-large effect sizes. Although, the lack of association may reflect several factors. First, the SRS was designed to capture more than just social difficulties and includes other elements of the BAP (e.g., rigidity). Second, marked social difficulties may only be apparent with higher scores (severe range) of the SRS, which were not represented in this sample. In sum, the present study does not support the use of the SRS to identify parents who may need additional support during parent-mediated interventions but further research is warranted with parents' scores falling within the severe range.

8 **144.008** Characterisation of Associations between Social and Non-Social Attention and Later ASD Symptoms in Infants with Tuberous Sclerosis Complex: An Eye-Tracking Study

C. Tye[1]*, E. J. Jones*[2]*, L. Mason*[2]*, M. H. Johnson*[3] *and P. Bolton*[1]*, (1)Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Tuberous sclerosis complex (TSC) is a single-gene disorder associated with variable developmental outcomes, with up to 60% receiving a diagnosis of autism spectrum disorder (ASD). The specific mechanisms through which individuals will go on to develop ASD are yet to be clearly defined. An increasing proportion of TSC cases are identified prenatally, providing a unique opportunity to study risk pathways through infancy. Social and non-social attention have been implicated in infants at familial risk for ASD. The degree of homology of association between these attentional parameters and risk for ASD, and the role of early-onset epilepsy, in TSC is unknown.

Objectives: To characterise differences in social and non-social attention in infants with TSC and typically developing infants and explore associations with epilepsy and emerging ASD symptoms.

Methods: The Early Development in Tuberous Sclerosis (EDiTS) Study is an ongoing prospective longitudinal study of infants with TSC (total n=25) and age-matched typically developing infants (total n=25) enrolled from birth to 24 months of age. Infants undergo developmental assessments (e.g. Mullen Scales of Early Learning) at each visit. We use portable eye-tracking technology in the home environment to measure social and non-social attention using a range of tasks. In this study, we focused on two paradigms that have been used in several previous infant studies: a face 'pop-out' task, to measure proportion of time looking at faces, and a gap/overlap task, to measure the disengagement effect (response time in baseline versus overlap).

Results: Data is currently available for 10 infants with TSC and 15 typical infants at 5, 8, 10 and 14 months old, with analysis ongoing. Infants with TSC show a slower gain in skills, particularly in the non-verbal domain from 5 to 10 months of age (p=.007) associated with younger age at seizure onset (rho=.61, p=.04). At 5 months, infants with TSC display increased peak looking time to faces compared to typical infants (2.42 versus 4.17, p=.03), associated with younger age at seizure onset (rho=-.47, p=.08), but not with ASD symptom scores at 14 months (Q-CHAT). Conversely, infants with TSC show longer disengagement times on the gap/overlap task from 10 months of age compared to typical infants (254ms versus 177ms, p<.05), which was associated with increased ASD symptoms at 14 months (rho=.60, p=.05).

Conclusions: These preliminary findings indicate atypical social visual attention from 5 months combined with reduced flexibility in control of non-social visual attention from 10 months in infants with TSC, suggesting early developmental changes that partially mimic ASD risk markers in familial cases. The variable timing in the onset of social versus non-social attentional differences suggest the interaction of multiple brain systems over the first year of life that give rise to variable pathways. In TSC, variation may reflect the differential effect of epilepsy on low- and high-order cognitive domains. Identification of sensitive and objective biomarkers of risk for ASD in TSC will aid in directing more specific interventions and in testing the efficacy of novel early intervention targets.

9 **144.009** Characteristics of Toddlers with Autism Who Are Placed in Special Education Versus Regular Education in Israel

M. Ilan[1,2]*, M. Faroy*[2,3]*, N. Fingher*[4]*, A. Bar-Sinai*[5]*, A. Michaelovski*[2]*, H. Fluser*[2]*, H. Binoun-Chaki*[2]*, A. Horev*[2]*, R. Segev-Cojocaru*[2]*, O. Dotan*[2]*, I. Menashe*[6]*, I. Dinstein*[5,7] *and G. Meiri*[2]*, (1)Department of Psychology, Ben-Gurion University of the Negev, Beer Sheva, Israel, (2)Soroka Medical Center, Beer Sheba, Israel, (3)Tel-Aviv Jaffa Academic collage, Tel Aviv, Israel, (4)Brain and Cognitive science, Ben-Gurion University of the Negev, Beer Sheba, Israel, (5)Department of Psychology, Ben Gurion University of the Negev, Beer Sheba, Israel, (6)Public Health Department, Ben-Gurion University, Beer Sheva, Israel, (7)Negev Autism Center, Ben Gurion University of the Negev, Beer Sheba, Israel*

Background:

In Israel and most western countries, toddlers who receive an autism diagnosis are eligible for placement in either special education settings or regular education settings with an educational assistant. Remarkably little research has compared the efficacy of these educational options, which differ dramatically in their structure, content, and cost. A first important step in determining the efficacy of each option is to examine the initial characteristics of toddlers who are placed in each setting. While several studies with school age children have reported that children with lower communication skills and cognitive abilities are more often placed in special education, it is not clear if the same is true for toddlers and preschoolers. In Israel and most other western countries, the initial educational setting is selected by the parents and clinicians offer very little evidence-based advice regarding the optimal choice. To study this issue we utilized data from toddlers who were recruited to the regional autism database at the Negev Autism Center (www.negevautism.org).

Objectives:

To compare the characteristics of children with autism across educational settings using autism symptom severity measures, cognitive scores, and socio-demographic parameters.

Methods:

105 children with autism ages 1.6 – 4.8 years old (mean: 2.7) were recruited at Soroka University Medical Center (SUMC) in Beer Sheba, Israel. Socio-demographic data was collected from the parents and all toddlers participated in ADOS assessments. Most of the toddlers also completed cognitive assessments. Comparisons were performed between toddlers in regular public daycare with assistance (n=10, average age 2.58) versus

toddlers in special education daycare (n=28, average age 2.01) and between toddlers in regular kindergartens with assistance (n=23, average age 2.95) versus toddlers in special education kindergartens (n=45, average age 3.07).

Results:

Toddlers in special education kindergartens exhibited significantly higher ADOS scores in comparison to toddlers in regular education kindergartens (p = 0.03, t-test). A similar trend was also evident between special and regular day care groups (p = 0.07, t-test). There were no significant differences in cognitive scores (p > 0.19, t test). Paternal education did not differ across groups, but maternal education was significantly higher for toddlers with autism who were placed in regular kindergartens (p < 0.02). There were no significant differences across groups in parental age or socio-economic status of estimated by place of residence.

Conclusions:

Toddlers with autism who have more severe autism symptoms tend to be placed in special education rather than regular education settings in Israel. This difference, however, was relatively small (Cohen's d = 0.6) and no significant difference was apparent in cognitive score and most socio-economic parameters. These data suggest that placement choice is close to random and not guided by structured evidence-based clinical advice. Determining the efficacy of each educational setting for toddlers with different characteristics, using longitudinal studies is, therefore, critical for providing better clinical care.

10 **144.010** Children with Autism Spectrum Disorder (ASD) with or without a History of Developmental Regression: Differences in Developmental Levels, Adaptive Functioning, and Behavior and Emotional Problems

N. Reyes[1]*, G. N. Soke*[2]*, L. Wiggins*[2]*, B. Barger*[3]*, E. Moody*[4]*, J. Reaven*[1]*, C. Robinson Rosenberg*[5]*, A. M. Reynolds*[6]*, L. Schieve*[2] *and S. Hepburn*[7]*, (1)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO, (2)Centers for Disease Control and Prevention, Atlanta, GA, (3)Georgia State University, Atlanta, GA, (4)University of Colorado, Denver, Aurora, CO, (5)University of Colorado / JFK Partners, Aurora, CO, (6)University of Colorado Denver School of Medicine, Aurora, CO, (7)Colorado State University, Fort Collins, CO*

Background: Previous research has documented the occurrence of developmental regression (i.e., the loss of previously-acquired language or social skills) in some children with Autism Spectrum Disorder (ASD). However, there is limited research on the developmental outcomes of children with ASD and a history of regression.

Objectives: We assessed the proportions of language and social regression in preschool children with ASD and examined differences in developmental levels, adaptive functioning, and behavior and emotional problems in children with ASD with or without regression.

Methods: We used data from the Study to Explore Early Development, a US multi-site community-based case-control study. In this analysis, we included 671 children born between 2003 and 2006 who met the SEED case definition for ASD based on the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised (ADI-R). Based on caregivers' ADI-R responses, children were assigned to one of four groups: (1) *no regression*, (2) *language regression only*, (3) *social regression only,* and (4) *language+social regression.* We used the Mullen Scales of Early Learning (MSEL) to evaluate developmental levels (i.e., language, motor, and visual reception abilities); Vineland Adaptive Behavior Scales-II (VABS-II) to assess adaptive functioning, and Child Behavior Checklist-Preschool (CBCL-P) to examine behavior and emotional problems. Descriptive statistics and ANOVA tests were computed to examine differences in these areas according to regression status.

Results: 8.94% (n=60) and 8.64% (n=58) of mothers reported child language regression and social regression, respectively and 8.35% (n=56) reported regression in both domains.

Differences in Developmental Levels: We found significant differences between the four regression groups in MSEL age equivalents (all p-values <0.05). Specifically, children in the *no regression* group had higher age equivalence than children in the *language only* group in visual reception, fine motor, receptive language, and expressive language domains. Also, the *no regression* group had higher age equivalence than the *social only* group in the fine motor domain, and higher age equivalence than the *language+social regression* group in the receptive and expressive language domains. Similarly, the *no regression* group had higher early learning composite standard scores than the *language only regression* group.

Differences in Adaptive Functioning: Significant differences were also found between groups in the VABS-II communication domain only, with children in the *no regression* group having higher VABS-II communication standard scores than children in the *language only* and *language+social regression* groups (*p*=.012).

Differences in Behavior and Emotional Problems: We found significant differences between groups in CBCL-P internalizing behavior t-scores (*p*=.002), but not CBCL-P externalizing behavior t-scores. Children in the *no regression* group had lower t-scores in the internalizing problems domain than children in the *language only* and *social only* groups.

Conclusions: These findings confirm the occurrence of regression in some children with ASD, and suggest that children with loss of skills might have lower developmental levels and adaptive functioning as well as increased behavior and emotional problems. Therefore, children with a history of regression are likely to need more support and interventions to target their specific needs.

12 **144.012** Concurrent Associations between FYI Attentional Constructs and ADOS Scores in 12-Month High-Risk Siblings

H. Neiderman[1]*, S. Macari*[1]*, A. Zakin*[1]*, F. E. Kane-Grade*[2]*, K. Villarreal*[1]*, M. Wilkinson*[1]*, D. Macris*[1]*, S. Fontenelle*[1]*, K. K. Powell*[1]*, M. Lyons*[1] *and K. Chawarska*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA*

Background: Deficits in social attention as well as the presence of atypical sensory attention constitute some of the core symptoms of ASD observed at an early age (Chawarska et al., 2014; Baranek et al., 2013). Current work has focused on identifying behavioral markers of ASD as early as 12 months (Reznick et al., 2006). Recently, researchers used the First Year Inventory (FYI), designed to identify risk for ASD at 12 months, to create new composite scores based on attentional constructs: responding to social attention (RSA), initiating social attention (ISA) and nonsocial sensory attention (NSA; Stephens et al., 2017). Their preliminary analyses revealed that the new algorithm scores predicted some variance in social responsiveness scores at 3 years. However, little research has examined these constructs in relation to concurrent ADOS scores in high-risk siblings.

Objectives: To examine if infants at high and low familial risk for ASD differ in mean scores on attentional constructs and to investigate concurrent associations between attentional construct scores and severity of autism symptoms indexed by the ADOS-Toddler.

Methods: Participants included infants at high-risk (HR) for ASD (N=122; M_{age}= 12.3 months) and at low-risk (LR) for ASD (N=70; M_{age}=12.3 months). At the 12-month visit, parents completed the FYI and clinicians administered the ADOS-Toddler. Differences in mean scores between HR and LR groups on the attentional constructs were tested. Stepwise regression analyses tested the predictive value of the attentional constructs on concurrent ADOS-Toddler Total scores, Social Affect (SA) scores and Restricted, Repetitive Behavior (RRB) scores.

Results: Independent t tests revealed that HR infants showed more deficits in ISA (M=1.90, SD=.60) than LR infants (M=1.64, SD=.55), t(190)=2.97, p<.01) and more deficits in RSA (M=1.57, SD=.35) than LR infants (M=1.44, SD==.33); *t*(190)=2.53, *p*<.05. HR infants also presented with more atypical NSA scores (M=1.62, SD=.34) compared to LR (M=1.78, SD=.43); *t*(190)=-2.86, *p*<.01. All three attentional constructs correlated significantly with concurrent ADOS-T Total scores, *r*=.38(*p*<.001), *r*=.31(*p*<.001), and *r*=.23(*p*=.001) for ISA, RSA and NSA, respectively. There were significant correlations between ADOS SA scores and ISA (*r*=.38, *p*<.001), RSA (*r*=.31, *p*<.001) and NSA (*r*=.20, *p*<.01). Stepwise regression analyses showed that only ISA contributed uniquely to ADOS SA scores (*F*(1,189)=31.763, *p*<.001), accounting for 14.4% of the variance. While there were significant correlations between ADOS RRB scores and NSA (*r*=.225, *p*=.001) as well as ISA (*r*=.18, *p*<.01), only NSA was significantly associated with ADOS RRB scores (*F*(1,189)=13.135, *p*<.01) accounting for 5.1% of the variance.

Conclusions: The attentional constructs derived from the FYI differentiate between HR and LR infants, with HR infants' scores indicative of fewer social initiations and responses and more atypical sensory attention. Levels of responding to social attention was not related to severity of autism symptoms. However, parent-reported indices of initiating social attention as well as nonsocial sensory attention were directly related to ADOS algorithm scores. The initiating social attention construct may be pivotal in detecting early deficits in social attention and the NSA construct shows promise in capturing early RRB behaviors.

13

144.013 Consistency between Parent-Report and Direct Measure of Toddler Temperament

K. Villarreal[1]*, S. Macari*[1]*, H. Neiderman*[1]*, F. E. Kane-Grade*[2]*, M. Wilkinson*[1]*, A. Zakin*[1]*, D. Macris*[1]*, L. DiNicola*[3]*, P. Heymann*[1]*, A. Milgramm*[4]*, E. Hilton*[1] *and K. Chawarska*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (3)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Center for Autism and Related Disabilities, Albany, NY*

Background: According to parent report, toddlers with Autism Spectrum Disorder (ASD) show increased negative emotionality and diminished positively-valenced temperamental features (Clifford et al. 2012; Macari et al. 2017) compared to toddlers with typical development (TD). Complementary to parent report are direct measures of temperament such as the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999), designed to induce emotions through challenges that imitate everyday situations. However, only modest associations have been found between parent report and observational measures in preschoolers (Gagne et al., 2011) and infants (Planalp et al., 2017). Despite the importance of temperament for understanding heterogeneity of syndrome expression in ASD (Macari et al, 2017), little is known about the agreement between laboratory-observed emotional reactions and parent report in toddlers with ASD.

Objectives: To investigate the relationships between intensity of positively- and negatively-valenced emotions elicited during the Lab-TAB and parent reported temperament on related scales of the Early Childhood Behavior Questionnaire (ECBQ; Putnam, Gartstein, & Rothbart, 2006).

Methods: Participants included 74 toddlers, 39 with ASD (M_{age}=21.9 months) and 35 with TD (M_{age}=20.8 months). All toddlers completed the LabTAB consisting of nine behavioral tasks designed to elicit three emotions: frustration, joy and fear. Behavioral ratings of peak fear, anger and joy reactions were coded offline by blind raters using indices of facial, bodily, and vocal emotion expression. ECBQ was used to quantify parental perception of child temperament. Correlation analysis was used to evaluate the relationship between Lab-TAB Frustration and ECBQ Anger; between Lab-TAB Joy and ECBQ Positive Anticipation; and between Lab-TAB Fear and ECBQ Fear separately in the ASD and TD groups. Fisher r-to-z transformations were used to test the significance of the difference between correlations.

Results: The ASD group showed a moderately strong positive correlation for all domains (anger *r*=.415, fear *r*=.414, joy r=.334, all p-values= < .05); the TD group showed moderate to high correlations for fear and joy (*r*=.697 and *r* =.368 respectively, p-values= <.05) but not for anger (*r*= .212 *p*=.221). In terms of differences between diagnostic groups in the magnitude of ECBQ/Lab-TAB correlations, no significant difference was observed for anger or joy (*p*>.05), but for fear, the correlation was marginally higher in the TD group than in the ASD group (*p* =.076).

Conclusions: Both the ASD and TD groups showed moderate associations between parent-reported and observed intensity of joy, however, regarding anger, only the ASD group displayed a significant relationship. Concerning fearful emotion, both groups exhibited significant intercorrelations, but parent ratings in the TD group were more consistent with real-world behaviors as compared to those of the ASD group. This finding suggests that parents of toddlers with ASD may have difficulty gauging the intensity of their toddler's apprehension, which could be related to ambiguity in emotional expression often exhibited in those with ASD (Kane-Grande et al., 2017; Abstract #2 of the panel). A mismatch between what the parent observes and what the child feels may hamper social exchanges within the dyad. Thus, the findings may have important clinical implications in social communication interventions.

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144.014 Construction and Validation of the Esbcq: The Early Social Communicative Behavior Questionnaire

M. Buruma *and E. M. Blijd-Hoogewys, INTER-PSY, Groningen, Netherlands*

Background:

There has been an increasing interest in the diagnosis of Autism Spectrum Disorders (ASD) in infants (children younger than 3 years). These children have limited social communication skills, such as poor joint attention and symbolic play.

In ASD diagnostics, parent questionnaires are often used. In 2009, we developed the Early Social Communicative Behavior Questionnaire (ESCBQ; Blijd-Hoogewys & Buruma, 2009). The ESBCQ items are formulated, based on 1) literature research concerning both typical and atypical development of early social communicative behavior in infants, 2) existing instruments concerning this topic, and 3) clinical expertise with young children with ASD. The following subjects are questioned: eye contact, social interest, reaction to name, emotions, attachment, sharing pleasure, taking turns, looking, following gaze, following a point, pointing, showing, giving, playing, interaction games, imitation, gestures, and language.

Objectives:

The objective of this study was to develop a questionnaire that can be easily used to measure early social communicative behavior in infants in a reliable and valid way.

Methods:

The ESBCQ is a parent questionnaire, consisting of 108 items, questioning early social communication skills that typically developing children should master at the age of 24 months. The ESBCQ-2 is a shortened version of 58 items.

*Research group 1 - Standardization group ESBCQ-1

In order to explore the psychometric properties of the ESCBQ, 1230 parents of typically developing children aged 0-6 years filled in the questionnaire. Also, 108 parents of children with ASD filled in the ESBCQ.

*Research group 2 - Standardization group ESBCQ-2

Data collection is ongoing. Currently, 402 parents have filled in the questionnaire (222 boys, 180 girls). Also, 204 parents of children with ASD (INTER-PSY & Virenze) and 86 parents of children (Driestroom) with an intellectual disability filled in the ESBCQ-2.

Results:

*Research 1:

It takes 20-25 minutes to fill in the ESBCQ. The total score shows a steady increase with age, with a plateau at 30 months, for both boys and girls. The questionnaire has good psychometric properties: the internal consistency, based on inter-item reliability, is good (Cronbach's alpha = .97). Also the test-retest reliability (second measurement after 1 week) is good (N = 43, Wilcoxon Signed Rank test, M1 = 93.19 vs. M2 = 95.63, r = .91, p = .001).

A Principal Component Analysis conveyed three clusters (56% explained variance) (see Figure 1): 1) language, gestures, pretending and symbolic play; 2) pointing and giving; 3) gaze shifting and following attention (gaze and points).

*Research 2:

The ESBCQ was shortened and ameliorated, to make it more user friendly. This resulted in the ESBCQ-2 (Buruma & Blijd-Hoogewys, 2014). This is based on additional item analyzes (Differential Item Analyses) and clinical expertise. The ESBCQ-2 contains 58 items. The completion time is 10-15 minutes. Preliminary results are promising.

Conclusions:

The ESCBQ(-2) is a new questionnaire with good psychometric properties. The three clusters found coincide with what is expected from literature. More research is underway, focusing on the use of the ESCBQ as a 'diagnostic' tool.

15 **144.015** Deployment of a Multimedia Screening Tool for ASD in a Diverse Community Setting: Feasibility and Usability

M. Wilkinson[1], *S. Macari*[1], *K. Chawarska*[1], *E. Barney*[2], *J. C. Snider*[3], *E. S. Kim*[4], *Q. Wang*[1], *Q. A. Yang*[3], *C. A. Wall*[5], *M. Kim*[3], *B. Li*[3,6], *M. Mademtzi*[1], *C. Foster*[1], *D. Macris*[1], *F. E. Kane-Grade*[7], *A. Milgramm*[8], *P. Heymann*[1], *E. Hilton*[1], *A. Zakin*[1], *H. Neiderman*[1], *K. Villarreal*[1], *Y. A. Ahn*[3], *M. C. Aubertine*[9] *and F. Shic*[2], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Seattle Children's Research Institute, Seattle, WA, (4)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (5)Department of Psychology, University of South Carolina, Columbia, SC, (6)Computer Science and Engineering, University of Washington, Seattle, WA, (7)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (8)Center for Autism and Related Disabilities, Albany, NY, (9)Seattle Children's Hospital and Research Institute, Seattle, WA*

Background: With an increase in autism prevalence (Christensen et al., 2012), there is an urgent need to identify children at risk for developing ASD. The American Academy of Pediatrics suggests developmental screening at 9-, 18-, and 30-month well-child visits (Council on Children with Disabilities, 2006). Screening leads to an earlier ASD diagnosis (Miller et al., 2011), yet children are not screened equally across racial groups, with African-American and Latino children being screened later than Caucasians (Herlihy et al., 2011). Thus, it is essential to create screening tools to help identify those at risk, especially among diverse populations. To fill this need, we have created a tablet-based multimedia screener system, the Yale Adaptive Multimedia Screener (YAMS). The application allows for time-efficient screening through an easy-to-understand platform that automates scoring of risk.

Objectives: To examine the feasibility, acceptability, and usability of a tablet-based multimedia screener in a diverse population of children ages 10-33 months in primary pediatric care centers serving under-resourced populations.

Methods: Feasibility of YAMS use at multiple community pediatrics sites was indexed by our success rate in ability to identify and approach the families of infants and toddlers (10-33 months old) attending their routine well-child visits at three community pediatric locations. Acceptability of the screener was evaluated by recruitment rate. Usability was determined using five questions based on the After-Scenario Questionnaire (Lewis, 1991).

Results: 409 infants and toddlers were identified as potential participants based on their age. 132 (32.3%) families missed their well-child appointment. Of the 277 patients who attended their scheduled appointment, 56 (20.2%) were not approached to participate because of schedule conflicts or lack of sufficient English skills. Of the 221 families invited to participate, 187 enrolled in the study (84.6%). 78 (41.7%) children were African-American, 45 (24.1%) were mixed race, 23 (12.3%) were Caucasian, and 6 (3.2%) were Asian. 82 (43.9%) children were Hispanic/Latino. The average parent/guardian age was 30.42, ranging from 17.2 to 67.7 years. 51 (27.3%) were single parents. Education level for 113 (50.8%) parents was a high school degree or less. Five usability questions related to helpfulness of videos, satisfaction with the amount of time it took to complete, and ability to understand questions, rated on a Likert scale of 1-7, resulted in average parent feedback of 6.52, suggesting YAMS is a highly usable application.

Conclusions: This feasibility study suggests challenges and successes in the ability to reach a diverse inner-city population using an electronic multimedia screening tool. Through initial stages of deployment, results suggest some difficulty reaching participants based on their appointments, but among participants there was a high level of satisfaction in terms of the overall usability, the time it took to complete the application, as well as the helpfulness of the videos as a platform for illustrating screening questions. In addition to high levels of satisfaction with the app, our high participation rate will allow continuation of the development process by expanding the testing of YAMS in additional community settings as well as utilizing front-desk staff to more efficiently recruit participants.

16 **144.016** Development of Neural Responses to Hearing Own Name in Infants at Low and High Risk for ASD

***M. Arslan**, P. Warreyn, N. Dewaele, J. R. Wiersema, E. Demurie and H. Roeyers, Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background:

People attend to their own name even in noisy environments and use this as a signal to follow social conversations. Typically developing infants start to orient towards the sound of their own name already at 4-5 months of age, which was also observed by altered neural responses via event-related potentials (ERPs). A reduced attention to this ostensive cue was however detected in infants who are at high risk for autism spectrum disorder (ASD) and is considered to be an early sign of ASD. Enhanced attention to the own name may be important for language acquisition by functioning as a tool for speech segmentation, particularly in the beginning of the second year of life when language acquisition progresses very fast. Therefore, a reduction in this attention may result in weakened early social information processing, interfering with the development of social skills.

Objectives:

With this study, we aimed to identify the neural patterns of two infant groups at low-risk (LR) and high-risk for developing ASD (HR), longitudinally at the ages of 10 and 14 months, while they were hearing their own name versus a stranger's name.

Methods:

Data from 68 10-month-old infants and 72 14-month-old infants were collected. After excluding data from 32 infants due to excessive movement and artifacts, data from 25 LR and 28 HR at the age of 10 months and 25 LR and 30 HR at the age of 14 months were analyzed. ERPs were measured during an own name/stranger name task with both balanced auditory and visual stimuli (Parise et al, 2010).

Results:

The ERP components were investigated in three different time-windows. At the age of 10M the LR infants' neural responses to hearing their own name already differed from hearing a stranger's name in the early component (100-300ms post-stimuli), indicating an early involuntary attention to the own name. The HR group failed to show the same response. At the age of 14M, groups showed a different lateralization to hearing their own name versus a stranger name in the same early time-window. The groups particularly differed in their response to hearing their own name in the left frontal area. Likewise, in the later time-windows indicating attentional engagement, the atypical patterns in the ERPs of the HR group became apparent by the age of 14M.

Conclusions:

The preliminary results suggest that LR infants discriminated and paid more attention to their own name compared to a stranger name already by the age of 10 months; while HR infants did not show the same effects, implying that they may not pay special attention to their own name. In addition, differences between HR and LR infants were identified more clearly by the age of 14 months. These results imply that HR infants become differentiated from LR infants by their brain development around the age of 1 year with respect to paying attention to their own names. Associations of the ERPs to hearing one's own name with later social-communicative functioning will be presented at the conference.

17

144.017 Diminished Empathic and Social Responses in Infancy As Early Markers of ASD Diagnosis

***Y. Paz**[1], R. Roth-Hanania[2,3], L. V. Gabis[3], T. Orlitsky[1], C. Zahn-Waxler[4] and M. Davidov[1], (1)The Hebrew University of Jerusalem, Jerusalem, Israel, (2)Tel Aviv-Yaffo Academic College, Tel Aviv, Israel, (3)Pediatrics, Sheba Medical Centre, Tel-Hashomer, Ramat Gan, Israel, (4)Center for Healthy Minds, University of Wisconsin, Madison, Madison, WI*

Background: Empathy is an important socio-emotional capacity, which promotes adaptive social functioning. Children diagnosed with Autistic spectrum disorder (ASD) suffer from an impaired empathic ability and show lower emotional response to distressed others than typically-developing children (Sigman, Kasari, Kwon & Yirmiya, 1992). Those impaired abilities can be seen early in development, with prior work showing their presence from early in the second year of life (Hutman et al., 2010).

However, no study to date has examined empathic responding during the first year of life as a predictor of subsequent ASD diagnosis. This is likely because up until recently it has been assumed that empathic concern only emerges during the second year of life (Hoffman, 2001). But recent research shows that, contrary to this theoretical assumption, typically-developing infants can also express empathy for distressed others early in the first year of life (Roth-Hanania, Davidov, & Zahn-Waxler, 2011; Davidov et al., 2013). Reduced empathic responses during the first year should thus be studied as early markers of evolving ASD.

Objectives: The current study sought to investigate empathic abilities as early markers (prodromal signs) of ASD in a prospective longitudinal study of high risk infants. We predicted that empathic concern and social interest at 6-months would be negatively correlated with subsequent ASD diagnosis.

Methods: The sample consists of infants, siblings of children with ASD, assessed at age 6, 12 and 18-months. Here we present the results of the first 12 infants, who have completed the assessment so far, as an initial pilot sample of a larger cohort.

At 6-months, Infants' responses to two distress simulations (enacted by mother and experimenter) were assessed and blindly coded for empathic concern (on a 0-3 validated scale). Infants' social interest was also measured using an eye-tracking task examining preference for images of people vs. objects.

At 12-months, a clinical, neurological and developmental examination was performed including morphometric measurements and assessment of milestones.

At 18-months, diagnostic assessment of ASD was conducted (screeners- SACS, M-chat, Q-chat; ADOS-2). Two of the infants have been diagnosed with ASD, eight as typically-developing, and two with developmentally-delayed communicative abilities.

Results: Consistent with hypothesis, empathic concern at 6-months (for both simulations combined) was significantly negatively correlated with subsequent ASD diagnosis, $r=-.77$, $p=.003$. Moreover, at-risk infants later diagnosed had significantly lower empathic concern mean score compared to a large normative sample of typically-developing 6-month-olds that we have collected (N=155; respective means: 0.44 vs. 1.03, $t=-2.33$, $p=.05$). In contrast, the at-risk infants subsequently found to be typically-developing did not differ from the normative sample (1.12 vs. 1.03, $t=.55$, *ns*). Finally, in the people vs. objects task, there was a significant negative correlation between the tendency to prefer people (proportion of trials in which the infant first fixated on the person image) and subsequent ASD diagnosis, r=-.65, p=.044.

Conclusions: Empathic abilities and social interest in early infancy may be promising prodromal markers of subsequent ASD diagnosis in high risk infants. Additional research is needed to establish these early markers, which may promote early diagnosis and intervention.

18 **144.018** Distinct ERP Profiles for Auditory Processing in Infants at-Risk for Autism and Language Impairment

***V. Riva**[1], C. Cantiani[2], G. Mornati[1], M. Gallo[1], L. Villa[1], E. Mani[1], I. Saviozzi[1], C. Marino[3] and M. Molteni[4], (1)Child Psychopathology Unit, Scientific Institute, IRCCS Eugenio Medea, Bosisio Parini, Lecco, Italy, Italy, (2)Child Psychopathology Unit, IRCCS Eugenio Medea, Bosisio Parini, Italy, (3)Centre for Addiction and Mental Health (CAMH), University of Toronto, Toronto, ON, Canada, (4)Scientific Institute, IRCCS Eugenio Medea, Bosisio Parini, Italy*

Background:

Early identification of autism spectrum disorder (ASD) is crucial for the formulation of intervention programs to be applied at very young ages. There is a strong interest in identifying reliable brain-based predictors, which may constitute useful tools for early detection of at-risk cases. Deficits in language skills may be a hallmark feature of ASD and language delay observed in ASD shows striking similarities to that observed in children with language impairment (LI). Deficits in auditory processing are seen in both LI and ASD, however, auditory processing in the two at-risk populations has never been compared directly using Event-Related Potentials (ERPs) techniques.

Objectives:

The study aims to characterize infants at-risk for ASD at the electrophysiological level and to compare them with infants at-risk for LI and with typically developing infants, to find specific markers with predictive and prognostic value.

Methods:

At 12 months of age, auditory processing in infants at-risk for ASD (HR-ASD; n = 20), for LI (HR-LI, n = 19) and controls (TD, n = 22) was characterized via EEG/ERP using a passive double-deviant oddball paradigm. Pairs of complex tones were presented at a rapid rate (70ms inter-stimulus interval). For standard tone-pairs (STD), the same tone characterized by a fundamental frequency of 100Hz and a duration of 70ms was repeated twice. Stimuli with the second tone differing in either frequency (300Hz, DEVF) or duration (200ms, DEVD) served as deviants and were presented in a pseudo-random order. Furthermore, all infants were then evaluated at 20 months of age, to prospectively investigate developmental trajectories from early auditory processing to autism-related traits (M-CHAT questionnaire) and language skills (Language Development Survey, LDS).

Results:

The results are intriguing and unique as this is the first study that provides abnormalities in ERP auditory processing profiles in ASD compared to LI high-risk infants and controls.

In both ASD and LI at-risk groups, the latency of the mismatch response is delayed compared to controls ($F_{(1,58)} = 3.58$, $p = 0.008$). On the other hand, only the group at-risk for autism shows enhanced P3 mean amplitude compared to infants at-risk for LI and controls ($F_{(2,58)} = 3.65$, $p = 0.032$). Correlational analyses revealed that infants with enhanced P3 amplitude at 12 months were characterized by higher scores in the ASD screening test at 20 months (U = 99.00; $p = 0.021$), whereas infants with faster mismatch response at 12 months produced more words at 20 months ($r_{(54)} = -0.291$, $p = 0.036$).

Conclusions:

The results reveal that at 12 months of age the two at-risk groups can be compared and differentiated based on their electrophysiological abnormalities in auditory processing, showing distinct predictive value on later socio-communicative and linguistic skills. These results may support the use of objective measurement of auditory processing to delineate specific pathophysiological mechanisms in ASD, as compared to LI. These results can help identifying infants at-risk for ASD and possibly provide specific markers that help to distinguish ASD from more specific linguistic delays.

19 **144.019** Do Infants at Risk for ASD Attend More to the Mouth When Watching Dynamic Videos?

***K. H. Finch**[1], H. Tager-Flusberg[2] and C. A. Nelson[3], (1)Boston University, Boston, MA, (2)Psychological and Brain Sciences, Boston University, Boston, MA, (3)Boston Children's Hospital, Boston, MA*

Background:

Typically developing 4- to 12-month-olds attend more to the mouth when watching videos of a woman speaking directly to them which is thought to aid in understanding speech (Lewkowicz & Hansen-Tift, 2011). This process might be impaired in infants who develop ASD as they show different gaze patterns to speaking faces (Shic et al., 2014). Moreover, differences in gaze patterns to speaking faces have been found in 9-month-olds who are at familial risk for ASD but do not develop ASD (Guiraud et al., 2012). However, it is unclear if this difference extends to all infants at risk for ASD.

Objectives:

Our current study investigated differences in gaze patterns in infants at risk for developing ASD. We included infants at familial risk and infants who fail a 12-month screener as well as an age-matched group of infants at low-risk.

Methods:

Participants

67 English-speaking 12- to 14-month-olds were divided into two groups: 1) low-risk typically developing controls (LR; N=47) or 2) high-risk for ASD (HR N=20) defined as either having an older sibling with ASD (HRA; N=10) or failing the Communication and Symbolic Behavior Scales Checklist (Wetherby & Prizand, 2002) at 12 months (HRS; N=10).

Procedure

Infants watched dynamic videos of a woman speaking directly to them on a Tobii T60 eye-tracker. The current study utilized a McGurk paradigm by presenting four video types up to 30 times each: 1)congruent-ba (Visual /ba/, Audio /ba/ or VbaAba), 2)congruent-ga (VgaAga), 3)incongruent-impossible (VbaAga), and 4)incongruent-McGurk (VgaAba).

Analysis

There were two areas of interest (AOIs): eyes and mouth. We calculated proportions by dividing the total amount of time looking at each AOI by the total amount of time looking at any portion of the face. We performed ANOVAs with condition (VbaAba, VgaAga, VbaAga, VgaAba) and AOI (eyes, mouth) as within-subjects factors and group (LR, HR) as a between-subjects factor.

Results:

There was a main effect of condition (F(3,195)=25.40, *p*<.001) with infants looking more towards the face in the congruent-ga and incongruent-McGurk conditions. There was a main effect of region (F(1,65)=6.46, *p*=.013) with infants looking more towards the mouth than the eyes. There was a condition by region interaction (F(3,195)=17.38, *p*<.001) that was driven by infants looking more towards the mouth in the congruent-ga and incongruent-McGurk conditions. There were no significant group differences. Moreover, preliminary analysis comparing LR, HRA, and HRS groups yielded similar results, including no group differences (see Figure 1).

Conclusions:

We found that LR and HR infants showed similar gaze patterns when watching videos of a woman speaking directly to them. All infants looked more towards the mouth, especially when the visual articulatory cues were less clear (/ga/ versus /ba/). While this work focuses on group level analysis, the data do show individual variability with some infants looking more towards the eyes while others attend more to the mouth. With larger sample sizes, future work should continue to investigate individual variability as well as group differences including distinguishing between infants who later develop ASD from those who are simply at risk for ASD.

20 **144.020** Understanding the Link between Language Abilities, Broader Autism Phenotype, and Atypical ERPs to Words in Toddlers with and without ASD

K. H. Finch[1]*, H. Tager-Flusberg*[2] *and C. A. Nelson*[3]*, (1)Boston University, Boston, MA, (2)Psychological and Brain Sciences, Boston University, Boston, MA, (3)Boston Children's Hospital, Boston, MA*

Background:

Atypical neural responses to speech have been found in toddlers with ASD and in their unaffected siblings (Kuhl et al., 2013; Seery et al., 2013). However, given that language difficulties are often seen in these populations, it is difficult to interpret whether these neural differences are a result of the ASD diagnosis or impairments in their language abilities.

Objectives:

Our study investigated event-related potentials (ERPs) to words in 36-month-olds with and without ASD, including those at familial risk with and without the broader autism phenotype (BAP). We also controlled for language abilities in our analyses.

Methods:

Participants

74 monolingual, English-speaking 36-month-olds were divided into four groups: low-risk control (LRC; N=31), high-risk for ASD (HRA; older sibling with ASD) without ASD or BAP (HRA-Typ, N=16), HRA without ASD with BAP (HRA-Atyp, N=13) and HRA with ASD (ASD; N=14).

Procedure

EEG was recorded while toddlers passively listened to a stream of words. Forty nouns were presented up to three times across two categories: 1) words acquired 'early' (understood by 18-month-olds according to the MCDI normative data) and 2) words acquired 'late' (not included on the MCDI; Dale & Fenson, 1996).

Analysis

Analysis focused on the mean amplitude of the N200 (200-350ms post-stimulus onset) and N350 (350-500ms post-stimulus onset) as their distribution varies depending on word familiarity (Mills et al., 2005). Two regions of interest from each hemisphere were constructed: frontal and temporo-parietal. We performed ANOVAs with condition (early, late), time bin (200-350ms, 350-500ms), and hemisphere (left, right) as within-subjects factors and group (LRC-Typ, HRA-Typ, HRA-Atyp, ASD) as a between-subjects factor. Average amplitude of the frontal and temporo-parietal sites were the dependent variables. We controlled for language abilities using the verbal developmental quotient from the Mullen Scales of Early Learning (Table 1).

Results:

Within the frontal sites, there were no significant main or interaction effects.

Within the temporo-parietal sites, we found a significant hemisphere by group interaction (F(3,69)=3.52, *p*=0.020). This interaction was driven by group differences in the left hemisphere (*p*=0.041), but closer inspection within the left hemisphere revealed no differences between the groups (all *p*>0.070). We found a significant condition by time by group interaction (F(3, 69)=2.96, *p*=0.038). This was driven by the HRA-Atyp children showing a more negative response in the N200 for the late words compared to the LRC-Typ (*p*=0.046) and ASD children (*p*=0.004). There were no other significant main or interaction effects.

Conclusions:

When controlling for language abilities, the HRA-Atyp group showed a different timed response to late words compared to the ASD and LRC groups in the temporo-parietal sites. This difference may reflect a weaker lexical representation of words in the HRA-Atyp toddlers compared to the LRC toddlers. The difference between the HRA-Atyp and ASD groups is surprising, but perhaps this is due to the variability often seen in the language abilities of children with ASD, including in our own sample. Our results suggest that both language abilities and ASD symptoms are important to consider when interpreting neural differences in lexical processing

21 **144.021** Early Motor Signs As Biomarkers of Neurodevelopmental Disorders: Applying Recent Findings in Autism to Attention Deficit Hyperactivity Disorder

A. Athanasiadou[1]*, J. K. Buitelaar*[2]*, O. Chorna*[3]*, F. Fulceri*[4]*, M. L. Scattoni*[4] *and A. Guzzetta*[5]*, (1)Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (2)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University*

Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (3)IRCCS Stella Maris, Pisa, Italy, (4)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (5)IRCCS Stella Maris Foundation, Calambrone (Pisa), Italy

Background:

Increasing evidence suggests that specific motor behaviors observed during the first months of life may be a marker of autism spectrum disorders (ASD). Analogously, ADHD, which shows clinical and genetic overlap with ASD, is increasingly recognized as a neurodevelopmental disorder associated with atypical brain connectivity, likely resulting in abnormalities of neural function that are expressed through the quality of early movement patterns. However, the correlation between early motor signs and later diagnosis of ADHD is not yet understood, as research on the subject is scarce and the findings controversial. Some authors suggest that the activity level in infancy is an early sign of ADHD, while others argue that the quality of movements in infancy does not predict the outcome.

Objectives:

In order to shed light on early motor signs in ADHD we systematically reviewed the publications investigating motor behavior during the first year of life in infants that later develop ADHD symptoms or are diagnosed with the disorder.

Methods:

A literature search was performed on PubMed and PsycInfo databases. Our search included the following keywords: i) “ADHD” OR “Attention deficit hyperactivity disorder” OR “Attention deficit-hyperactivity disorder”; ii) AND “infant” OR “infancy” OR “neonatal” OR “newborn” OR “baby”; AND “movement” OR “motor” OR “sensory-motor” OR “sensori-motor” OR “motion”. In total, 170 articles were identified via database searching; 30 studies were selected for review of abstract or complete article.

Results:

Nine published reports were selected. The quality ratings of the included studies ranged between 11 and 14/14. Overall, the reports were of good quality. The review revealed conflicting evidence of the utility of infant motor activity as an indicator of ADHD. Some suggest that specific motor activity qualities in infancy may be utilized as early indicators of ADHD risk, while others state that infant motor activity does not predict the disorder.

Conclusions:

Early motor signs, if present, appear to be non-specific, and therefore not readily useful in clinical screening. Spontaneous motility seems to be a promising aspect of early ADHD detection, although further studies with large cohorts implementing quantitative and qualitative scoring systems are recommended to determine its clinical role in populations at risk for ADHD.

22 **144.022** Early Origins of Autism Comorbidity: Neuropsychiatric Traits Correlated in Childhood Are Independent in Infancy

***Z. Hawks**[1] and N. Marrus[2], (1)Department of Psychological & Brain Sciences, Washington University, St. Louis, MO, (2)Washington University School of Medicine, St. Louis, MO*

Background: Previous research has suggested that behavioral comorbidity is the rule rather than the exception in autism. This link between autistic and psychopathologic traits is reinforced by clinical studies indicating that autistic symptom severity is correlated with the severity of non-autistic behavioral impairments and, within families, some of the genetic influences on the causation of ASD have been shown to overlap with genetic influences on other psychiatric conditions of childhood. Critically, research into early developmental factors that contribute to the emergence of autism can guide therapies, as the condition is known to be strongly responsive to early intervention.

Objectives: Our primary aim was to evaluate shared genetic and environmental influences on quantitative autistic traits (QATs) and other early trait-based manifestations of general psychopathology to clarify the developmental origins of their overlap beginning in infancy. To this end, we prospectively examined previously uncharacterized relationships among early precursors of social communication, a core feature of QATs, and psychopathologic traits.

Methods: Social communicative traits (assessed using the *Social Communication and Interaction* scale from the Video-Referenced Ratings of Reciprocal Social Behavior and the *Competence* scale from the Brief Infant-Toddler Social and Emotional Assessment; vrRSB *SCI* and BITSEA *Competence*, respectively) and early liability for general psychopathology (assessed using the *Behavior Problems* composite from the BITSEA) were assessed at 18 months of age in 314 twins ascertained from the general population. 222 twins were re-evaluated at 36 months of age, at which point QATs were assessed using the Social Responsiveness Scale (SRS) and internalizing and externalizing behaviors were assessed using the Achenbach Scales of Empirically Based Assessment. Patterns of trait overlap at 18 months were evaluated using correlational analyses, exploratory factor analyses, and hierarchical linear modeling (HLM). HLM was also used to evaluate the predictive utility of 18-month on 36-month traits.

Results: Standardized ratings of variation in social communication (i.e., *SCI, Competence*) at 18 months were highly heritable and strongly predicted *QATs* at 36 months. These early indices of autistic liability were independent from contemporaneous ratings of *Behavior Problems* (Figure 1), which were predominantly environmentally-influenced. Autistic liability did not significantly, incrementally predict CBCL *Internalizing* or *Externalizing* scores at 36 months (Figure 2).

Conclusions: We observed that variation in social communication was independent from variation in other domains of general psychopathology and exhibited a distinct genetic structure. This suggests that the commonly-observed comorbidity of specific psychiatric syndromes with autism may arise from subsequent interactions between autistic liability and independent susceptibilities to other psychopathologic traits. Indeed, given that studies in older children have identified shared genetic variance for autistic impairment and symptoms of general psychopathology, these results are consistent with a model of causal overlap in which inherited liability for *non-specific* psychopathologic symptoms can amplify the severity of autistic syndromes over the course of development. This suggests opportunities for preventive amelioration of their interactions in infancy, perhaps via interventions to target developmentally-independent, behaviorally-modifiable traits that may conspire to exacerbate autistic severity over the course of development.

23 **144.023** Early Risk Markers of Social Anxiety in Infants with Fragile X Syndrome

***C. J. Black**[1], A. L. Hogan[1], J. E. Roberts[2] and N. Poupore[1], (1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Psychology, University of South Carolina, Columbia, SC*

Background: Fragile X syndrome (FXS) is a neurodevelopmental disorder that typically presents with intellectual disability and an increased prevalence of maladaptive behaviors (Cornish et al., 2013). FXS is the most common genetic cause of autism spectrum disorder (ASD) accounting for 2-6% of ASD cases (Cohen et al., 2005). Both FXS and ASD have high comorbidities with anxiety disorders which often are not diagnosed until later in development (Cordeiro et al., 2010; Kessler et al., 2005). Given that early features of social anxiety are present before formal diagnoses, prospective studies of infants with FXS provides a unique opportunity to study the earliest predictors of anxiety. In typically developing (TD) infants, elevated fear and atypical physiological regulation (e.g., respiratory sinus arrhythmia, RSA) have been identified as early markers of the later emergence of social anxiety. (Booker et al., 2013). No studies have examined behavioral fear or physiological regulation as risk markers of social anxiety in infants with FXS.

Objectives: The current study uses a bio-behavioral approach to investigate differences in social fear responses in 12-month-old infants. We hypothesized that physiological regulation during social interactions is disrupted in FXS, causing them to exhibit a dampened physiological response to a novel social situation. Additionally, we believed that FXS infants would have higher parent reported fear in comparison to TD.

Methods: Participants included 18 infants with FXS (Male: n =12, chronological age: M =13.01 months, SD=1.02) and 30 TD infants (Male: n = 23, chronological age M=12.41 months, SD=0.61). The fear subscale from the Infant Behavior Questionnaire-Revised (IBQ-R) reflects scores associated with both social and non-social fear. Physiological response to a novel social scenario was measured via heart activity monitor during a baseline period and during the Stranger Task of the LABTAB (Goldsmith & Rothbert, 1996). This task is designed to elicit a social fear response in young children. RSA reactivity was computed as the change in RSA from baseline to stranger task.

Results: The difference between groups on the IBQ-R was not significant, $t(33) = 0.37$, $p > 0.05$. Moreover, there was no difference between groups in RSA reactivity $F(1,36) = .14$, $p > 0.05$. Paired sample t-tests were conducted between baseline and stranger RSA for each group. The TD group showed a significant decrease from baseline ($M = 4.61$, $SD = 1.03$) to stranger task (M = 3.84, $SD = .0.76$), $t(22) = -3.80$, $p < .001$. The FXS group did not show a difference between baseline ($M = 4.49$, $SD = 1.41$) and stranger task ($M = 3.79.50$, $SD = 1.43$), $t(15) = 2.08$, $p > .05$.

Conclusions: These results provide intriguing insights into the early physiological risk markers of social fear. Despite the lack of elevated fear in the FXS group, the blunted RSA response to social fear shows a potential early biomarker of social anxiety. Having a physiological biomarker reflecting prodromal symptomology could be instrumental to early identification and treatment of social anxiety in FXS and other high risk populations like ASD. Future studies, should investigate infant's behavioral responses in tandem with RSA regulation.

24 **144.024** Effects of a Parent Mediated Intervention on Positive Social Behavior of Toddlers with Autism: A Randomized Controlled Trial

***K. Baggett**[1], B. Barger[2], H. Schertz[3] and S. Odom[4], (1)Mark Chaffin Center for Healthy Development, School of Public Health, Georgia State University, Atlanta, GA, (2)Georgia State University, Atlanta, GA, (3)Indiana University, Bloomington, IN, (4)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: The purpose of this presentation is to report the results of a randomized controlled trial in which we examined the effects of a parent mediated intervention on the social behavior of toddlers with autism spectrum disorder (ASD). The Joint Attention Mediated Learning (JAML) program is a parent-mediated, relationship-based, developmentally oriented intervention focused primarily on supporting joint attention learning. While prior research has demonstrated large effects of the JAML intervention on the important targeted outcome of child joint attention, no published studies have examined potential effects of the JAML program on child social behavior, in general, or on parent positive support behaviors as potential mediators of child change.

Objectives: Research objectives include (a) examination of JAML effects on toddler positive social behavior directed toward their parents and (b) exploratory examination of the effects of JAML on parent positive support behavior and its relationship to child positive social behavior.

Methods: Twenty-three toddlers with Autism Spectrum Disorder, age 15 to 30 months, and their parents in Colorado, Kansas, Missouri, and Indiana were randomized to the JAML intervention group or a control group. Eligibility screening with the Autism Diagnostic Observation Schedule (ADOS-2) was conducted to establish ASD for inclusion. Parent-child free-play interactions at home were video recorded at pre- and post-assessment. Trained observers, naïve to group assignment and time point, completed the Indicator of Parent-Child Interaction (IPCI-2) based on direct observation of parent-child interaction videos. Mean interobserver agreement for child and parent behaviors was .86 and .85 (R= .74-.98 and .76-.96), respectively.

Results: While there were no significant differences in observed child behaviors or parent positive support behaviors between the intervention and control group at pre-assessment, toddlers in the intervention group, in contrast to the control group, demonstrated significant pre-post gains in positive social behavior toward their parents ($t(10) = -4.05$, $p < .01$) and follow through behavior ($t(10) = -2.50$, $p < .05$) with large to medium effects (d=1.29, d=.72, respectively). Exploratory analysis revealed a medium effect (d=.58) on parent following child's lead from pre- to post-assessment for parents in the JAML intervention group as compared to parents in the control group. Parent following child's lead was positively correlated with child positive social behavior (r=.38) and child follow through (r=.60), p<.05.

Conclusions: These pilot and exploratory results build on prior published work and provide preliminary evidence of JAML effects beyond the primary targeted child outcome of joint attention. Specifically, effects extended more generally to parent-child interaction, including positive toddler social and engagement behavior toward their parents. The finding of medium effects of the JAML intervention on parent positive support behavior, in particular, following child's lead, which was significantly correlated with child positive engagement behavior, points to the need for conducting sufficiently powered controlled trials to determine JAML effects on parent positive support behaviors and their potentially mediating effects on child positive social behavior.

25 **144.025** Electroencephalographic Markers of Atypical Development in Infants with Tuberous Sclerosis Complex

***K. J. Varcin**[1], A. H. Dickinson[2], C. A. Nelson[3] and S. Jeste[2], (1)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (2)University of California, Los Angeles, Los Angeles, CA, (3)Boston Children's Hospital, Boston, MA*

Background: Tuberous sclerosis complex (TSC) is one of the most commonly-occurring single-gene disorders associated with ASD. Recent work from our group has demonstrated that at the behavioral level, infants with TSC/ASD can be distinguished from infants with TSC/noASD by 12 months, and that by 3 years, infants with TSC/ASD show striking phenotypic homology in the profile of social communication impairment to that

of toddlers with non-syndromic ASD. In animal models, mutations in the TSC1/2 gene (through downstream effects on the mTOR pathway) have been linked to alterations in synaptic development and neuronal connectivity, which likely exert effects from very early in development. There is currently limited understanding regarding developmental trajectories of brain function in human infants with TSC, and especially those that go on to develop ASD.
Objectives: We aimed to identify potential neural markers associated with the development of ASD in TSC. Specifically, we examined whether developmental trajectories of electroencephalographic (EEG) power (as a marker of neural synchrony) and coherence (as a measure of connectivity) distinguish infants with TSC/ASD from infants with TSC/noASD from very early in development.

Methods: These data were collected as part of a multisite, prospective study of infants with TSC (n=40) and typically developing (TD) infants (n=32) across the first three years of life. Baseline EEG was recorded from infants at 9, 12, 18, 24 and 36 months using a high-density system (EGI Inc.). ASD diagnosis at 24 and 36 months was determined using the Autism Diagnostic Observation Schedule and clinical best estimate. We assessed developmental functioning using the Mullen Scales of Early Learning and we collected clinical information regarding epilepsy and medication status across development.

Results: Mixed-effects models revealed differences in developmental trajectories of both EEG alpha power and alpha phase coherence between (i) TSC and TD infants, and (ii) TSC/ASD and TSC/noASD. TSC infants had reduced whole-brain alpha power across early development (from 9-36mo) compared to TD infants (p<.001). From 12 months, alpha power trajectories differentiated TSC/ASD infants from TSC/noASD, with TSC/ASD infants showing the lowest levels of whole-brain alpha power (p<.01). We also identified significant differences in alpha phase coherence across early development between TSC/ASD and TSC/noASD infants from 12 months (t(24)=2.07, p<.05). These differences were identified despite overall comparable rates of seizures and medication exposure between the TSC/ASD and TSC/noASD groups.

Conclusions: We identified differences in brain function between infants with TSC/ASD and TSC/noASD from 12 months of age, well before the age at which an ASD diagnosis may be established in this population. Our findings suggest that EEG may show promise in identifying patterns of brain function that may precede or underlie the development of ASD in TSC. In particular, group differences in alpha trajectories are suggestive of alterations in white matter development in TSC/ASD. These findings highlight the need for further prospective studies mapping early brain function in TSC from within the first year of life, to identify whether differences in developmental trajectories may precede even the earliest emerging behavioral signs of ASD.

26 **144.026** Emerging Divergence between Cognition and Adaptive Socialization Skills in Infants Who Develop ASD

C. A. Saulnier[1], *J. Bradshaw*[2] *and C. Klaiman*[1], *(1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Department of Psychology, University of South Carolina, Columbia, SC*

Background:

Individuals with ASD exhibit delays in adaptive skills in comparison to age and IQ, and this gap appears wider in older versus younger individuals of average intelligence (Klin et al., 2007; Kanne et al., 2010). Since the majority of individuals with ASD do not have cognitive impairment (CDC, 2016) but still fail to achieve levels of independence in adulthood (Howlin et al., 2004; 2013), it is imperative to determine when this divergence emerges.

Objectives:

This study investigates the discrepancies between adaptive socialization and cognitive skills from 12 to 36 months in infants who develop ASD.

Methods:

Participants included 171 infants (60.2% male; 90.1% White; 2.9% Black; 7% Other) participating in a longitudinal study on ASD from birth through age 3 with the following outcome diagnoses: ASD=21; Broader Autism Phenotype (BAP)=19; High Risk Unaffected (HR-UA)=29; and Low Risk Typical Development (LR-TD)=102. Infants were assessed at 12, 24, and 36 months (12 and 24m for LR) with the *Mullen Scales of Early Learning* and the *Vineland Adaptive Behavior Scales, Second Edition, Survey Form*. Mullen Visual Reception scores were used as a proxy for nonverbal cognition (See Table 1). Mixed effects linear growth regression models were conducted to compare linear trends between cognitive and socialization skills from 12-36 months across diagnostic groups. Linear trend estimates derived from these models were compared across groups using slopes with the associated 95% confidence intervals.

Results:

Regression slopes for adaptive socialization scores declined significantly from 12-36 months for the HR-ASD ($t(118)=-3.27$, $p=0.001$) and HR-BAP ($t(107)=-3.70$, $p<0.001$) infants (Figure 1). In contrast, socialization skills did not decline for HR-UA or LR-TD infants. Socialization scores for HR-ASD infants were significantly lower than LR-TD infants starting at 12-months, and lower than both LR-TD and HR-UA infants at starting at 24-months. In contrast, cognition for all groups remained stable from 12 to 24/36 months. Regarding the gap between adaptive socialization and cognitive skills, a significant interaction emerged for HR-ASD ($t(99.3) = 2.95$, $p=0.004$), HR-BAP ($t(89.4)=3.68$, $p<0.001$), and LR-TD ($t(301)=2.21$, $p=0.028$) infants, but slope trajectories for each domain for the LR-TD group did not differ significantly from zero (socialization $p=0.109$; cognitive $p=0.145$).

Conclusions:

Adaptive socialization skills decline between 12 and 36 months for infants with both ASD or shadow symptoms of the disorder in comparison to both unaffected HR and LR infants, with differences evident as early as 12 months between infants who develop ASD and their unaffected peers. Though our sample has unusually high nonverbal cognition (which accounts for the significant gaps between cognition and adaptive skills in the LR-TD group), the gap between adaptive socialization skills and cognition widens over time for infants with ASD symptomatology, whereas it remains stable for infants unaffected by ASD. Given the pronounced deficits in adaptive behavior that are observed in older individuals with ASD, these findings underscore the need to assess for adaptive behavior early and repeatedly for infants with and at risk for the disorder.

27 **144.027** Emotional Face Processing and Spatial Frequency in 10-Month-Old Infants at Risk for Autism.

R. Di Lorenzo[1], *N. Munsters*[1], *C. van den Boomen*[1], *C. Junge*[2], *E. Ward*[3] *and C. Kemner*[1], *(1)Utrecht University, Utrecht, Netherlands, (2)Department of Developmental and Experimental Psychology, Utrecht University, Utrecht, Netherlands, (3)Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands*

Background: People diagnosed with Autism Spectrum Disorder (ASD) frequently experience problems in rapidly processing emotions. Furthermore, they often focus more on local details than on coarse global information. According to previous research, these two visual abnormalities are related, at least in early childhood: toddlers with ASD can discriminate emotions only when a face contains just local (but not global) information, whereas control children show the opposite pattern (Vlamings et al., 2010). It remains unclear when the developmental trajectory of visual processing becomes atypical in ASD.
Objectives: The present research tests whether already at 10 months of age infants at risk of developing ASD (i.e., siblings of a child with ASD) differ from a control group of infants at low risk for ASD (i.e., siblings of a child without ASD). Specifically, we investigated group differences in electrophysiological activations evoked by fearful and neutral faces filtered to contain only local or global information (See Figure 1).

Methods: Forty participants (22 high-risk and 18 low-risk 10-month-olds) were included in the preliminary data-analyses (we are planning to test more infants). We recorded their EEG, while participants passively watched emotional expressions (fearful or neutral expression) of faces containing only detailed (higher spatial frequencies, HSF) or global information (lower spatial frequencies, LSF).

Results: Our analyses focused on typical infant ERP components associated with face processing: N290 and P400. Mean peak amplitudes for each component were entered in a 2 (fear; neutral) by 2 (detailed; global) ANOVA, with group-membership as a between-subjects variable. Preliminary results show that the groups differ significantly on the amplitudes for both ERP components ($p < .05$), with the high-risk group having smaller amplitudes compared to the low-risk group. No other significant effects were found (all $p > .10$).

Conclusions: Our preliminary results show no differences between high and low-risk 10-month-olds in emotion discrimination or in the processing of detailed vs. global information, which suggests that this visual processing starts to deviate later on in development. However, we found that overall the high-risk group has a reduced cortical response to facial stimuli compared to low-risk infants. This could indicate that atypical face perception is an endophenotype of ASD. Possibly, in infants later diagnosed with ASD this impairment develops into atypical emotion discrimination that was reported in toddlers.

28 **144.028** Emotional Response Coherence in Toddlers with ASD

A. Zakin[1], *S. Macari*[1], *F. E. Kane-Grade*[2], *K. Villarreal*[1], *H. Neiderman*[1], *M. Wilkinson*[1], *E. Hilton*[1], *A. Milgramm*[3], *P. Heymann*[1], *L. DiNicola*[4], *D. Macris*[1], *K. K. Powell*[1], *S. Fontenelle*[1], *M. Lyons*[1] *and K. Chawarska*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (3)Center for Autism and Related Disabilities, Albany, NY, (4)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: The theory of emotions as tripartite complexes postulates that emotions are conveyed by facial expressions, vocalizations, and body postures (Izard, 1977). Expressive incoherence is the mismatch in the expression of emotions across channels. There is very limited data regarding coherence across expressive channels in ASD. A recent study suggests that in response to in-vivo probes eliciting frustration, school-age children with ASD show a mismatch between their facial and bodily expressions, especially during negatively-valenced events (Costa et al., 2017). This limited coherence across emotion expression channels could lead to problems in the parent-child dyad, as caretakers may have difficulty accurately reading the emotional state of children with ASD. Little is known about the existence of emotional expressive incoherence at the earliest stages when ASD can be reliably diagnosed.
Objectives: To examine if toddlers with ASD exhibit expressive incoherence compared with age-matched peers with developmental delays (DD) and typical development (TD) in response to in-vivo probes aimed at eliciting anger, fear, and joy.

Methods: 83 toddlers (ASD, n=43; TD n=40) ages 13-30 months (M=21) completed nine episodes of the Laboratory-Based Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999). Episodes were designed to elicit Anger, Fear, and Joy. The assessments were videotaped and coded offline by blinded coders for intensity of emotional responses during Fear, Joy, and Anger probes separately in the facial, vocal, and musculoskeletal channels. Within each emotion, Pearson's r correlations were used to compare the strength of associations across pairs of channels (facial-bodily, vocal-bodily, and facial-vocal) and Fisher r-to-z transformations were used to test the significance of the difference between correlations.

Results: In general, the correlations between the channels within ASD and TD groups were statistically significant with the magnitude of the effect ranging from r=.313 to r=.863 in the ASD group and from r=.339 to r=.692 in the TD group (Figure 1). Comparison of the magnitude to coherence (Pearson's r) between the two groups identified only two differences, both in the Joy condition. Specifically, there were significant differences between the ASD and TD groups in two pairs: facial-vocal expression coherence (p=.02), and bodily-vocal expression coherence (p=.01). In both cases, the ASD toddlers evidenced higher emotional coherence than the TD toddlers.

Conclusions: Our results indicate that TD toddlers and toddlers with ASD largely evidence similar emotional coherence across the three channels of emotional expression during tasks designed to elicit anger, fear, and joy. Contrary to our hypotheses, the bodily-vocal channels and the facial-vocal channels appear more coherent among children with ASD than TD children in the Joy condition. Our data do not provide support for emotional response incoherence in ASD.

29 **144.029** Face Looking, Eye Contact, and Joint Attention during Naturalistic Toy Play: A Dual Head-Mounted Eye Tracking Study in Young Children with ASD.

D. P. Kennedy[1], *G. Lisandrelli*[1], *R. Shaffer*[2], *E. Pedapati*[3], *C. A. Erickson*[3] *and C. Yu*[1], *(1)Psychological and Brain Sciences, Indiana University, Bloomington, IN, (2)Division of Developmental and Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (3)Division of Child and Adolescent Psychiatry, Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Background: Although numerous studies have identified abnormalities in social attention and social coordination in children with ASD, evidence of such abnormalities comes almost exclusively from laboratory experiments involving discrete trials and/or highly simplified screen-based stimuli. Very little is known about whether and how young children with ASD allocate and coordinate visual social attention in everyday life, which is characterized by moving heads and eyes, changing views of faces, and multiple competing visual targets.
Objectives: Using dual head-mounted eye tracking during naturalistic parent-child toy play, we assessed whether young children with ASD ages 24 to 48 months exhibit abnormalities in three social behaviors that have previously distinguished children with ASD from typically developing children in traditional laboratory-based studies: (1) face looking, (2) mutual eye contact (i.e., moments in which both the parent and child look at

each others' faces), and (3) joint, or shared, attention on objects.

Methods: Twenty-three parent-child dyads (N = 7 ASD; N = 16 TD) provided usable eye tracking data (out of 39 dyads tested: 20 ASD, 19 TD). Parents and children were fitted with head-mounted eye trackers, and were free to play with 24 different toys for five minutes. Parents were instructed simply to play with their children as they typically would at home. Offline data processing was carried out using a manual coding procedure, in which the targets of gaze for both the parent and child were coded separately. Joint attention was objectively identified as moments where both the parent and child looked at the same object at the same time. See Figure 1.

Results: Both ASD and TD children spent remarkably little time looking at faces [ASD: 1.2% (±1.3%); TD: 1.4% (±1.8%); t(18)=-.34, p=0.74, d=0.15], amounting to approximately six seconds of face looking over the course of a five-minute interaction. Interestingly, parents of children with ASD tended to look more at their children's faces [23%(±4%)] than did parents of TD children [12% (±8%)] [t(18)=-3.1, p=0.006, d=1.7]. Mutual eye contact was an extremely rare event, [TD: 0.6% (±0.8%); ASD: 0.7% (±1.4%)], and rates did not differ between groups (t(18)=-0.14, p=0.89, d=0.06). Joint attention was quite common in both groups [TD: 48% (±17%); ASD: 45% (±15%)], but also did not differ between groups [t(18)=0.32, p=0.76, d=0.16]. Proportions of parent-led versus child-led joint attention bouts were not different between the groups [t(18)=-0.25, p=0.81, d=0.11)].

Conclusions: Our results suggest that findings from screen-based and highly constrained studies may not always translate to more naturalistic behavior. We found that children with and without ASD rarely looked at faces, in contrast to what would be predicted from screen-based eye-tracking studies. Furthermore, an important behavior reflecting coordinated social engagement — namely, joint attention — was present and occurred at typical levels among the ASD dyads, suggesting multiple routes beyond face looking to achieve coordination (Yu & Smith, 2013). Future studies will examine additional aspects of naturalistic parent-child dyadic interaction in ASD, including vocalizations, object exploration, and sustained attention.

30 **144.030** First Year Inventory Attention Constructs in Infants at Risk for Autism Spectrum Disorders

D. Macris, *S. Macari, K. K. Powell, S. Fontenelle, M. Lyons, A. Giguere Carney, K. Bailey and K. Chawarska, Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Atypical patterns of attention are thought to be early predictors of autism spectrum disorders (ASD; Chawarska et al., 2016; Keehn et al., 2013). Parent report of attentional patterns could provide crucial information in early identification of ASD. One screener, the First Year Inventory (FYI; Baranek et al., 2003) shows promise in identifying 12-month-olds at risk for later ASD diagnosis (Reznick et al., 2007; Rowberry et al., 2014). The FYI may also be valuable in evaluating early attentional behaviors. Stephens et al. (2017) developed three new scores for the FYI: Responding to Social Attention (RSA), Initiating Social Attention (ISA), and Nonsocial Sensory Attention (NSA). These attention constructs predicted general social responsiveness at 3 years, but it is unclear how well the constructs predict diagnostic status or other aspects of development.

Objectives: To investigate how the attention constructs of the FYI relate to developmental outcomes at 24 months in infants at high and low risk for ASD.

Methods: Parents of 102 infants with older siblings diagnosed with ASD (HR; 70 male) and 63 infants with no family history of ASD (LR; 32 male) completed the FYI around their child's first birthday. At 24 months, children completed the Mullen Scales of Early Learning (MSEL), ADOS-T, and Vineland-II. Based on outcome diagnoses at 24/36 months of age, participants were categorized as: ASD (n=18), LR typically-developing (LR-TYP; n=50), HR typically-developing (HR-TYP; n=37), and children with other developmental delays (ATYP; n=60).

Results: One-way ANOVAs revealed significant effects of diagnostic group in RSA, $F(3,161)=5.92$, $p<.01$, and ISA, $F(3,161)=5.79$, $p<.01$, but not in NSA scores. Post-hoc Tukey HSD tests revealed that for RSA, LR-TYP children scored lower than children with ASD or ATYP, both $p<.05$ (Figure 1). For ISA, LR-TYP children scored lower than ASD, ATYP, and HR-TYP children, all $p<.05$. Multiple regressions showed that attention constructs from the FYI at 12 months predicted the following at 24 months: MSEL Verbal Developmental Quotient (VDQ), $F(3,161)=6.46$, $p<.01$, $R^2=.11$; MSEL Nonverbal Developmental Quotient (NVDQ), $F(3,161)=2.77$, $p=.04$, $R^2=.05$; Vineland Communication SS, $F(3,151)=6.60$, $p<.01$, $R^2=.12$; Vineland Daily Living SS, $F(3,151)=3.67$, $p=.01$, $R^2=.07$; and Vineland Social SS, $F(3,151)=6.09$, $p<.01$, $R^2=.11$. RSA was a significant predictor in the Vineland-II Communication model; ISA was a significant predictor in the MSEL VDQ and Vineland-II Daily Living and Social models; and NSA was a significant predictor in the MSEL VDQ model, $p<.05$ and a marginally significant predictor in the MSEL NVDQ model, $p=.06$. The attention constructs did not predict ADOS-T total scores or Vineland-II Motor SS, $p>.28$.

Conclusions: Children later diagnosed with ASD and other developmental delays scored more atypically on two of the three FYI attentional constructs (RSA and ISA) than LR typically-developing children. Furthermore, the constructs differentially predicted the cognitive ability and adaptive behavior of the children one year later. This suggests that parent-reported information via the new attentional constructs of the FYI show promise not only in identifying children who are at risk for developing ASD, but also predicting later vulnerabilities in verbal and nonverbal development and adaptive behavior.

31 **144.031** Gaze Behavior of 9- and 13-Month-Old Infants during Live Face-to-Face Interactions: Joint Attention Observed with an Eye-Tracking System.

M. Asano[1], *N. Naoi*[2], *Y. Hakuno*[1], *J. Yamamoto*[1] *and Y. Minagawa*[1], *(1)Keio University, Tokyo, Japan, (2)International Christian University, Mitaka, Japan*

Background:
Initiating joint attention (IJA) using gaze shift is suggested to appear around 9–12 months (Bakeman & Adamson, 1984). Typically developing (TD) infants older than 12- month- old control their gaze shift without adult support. During development, children show various combinations of joint attention behaviors such as gaze shifting, pointing, and verbalizing (Oyabu, 2004; Seibert, Hogan, & Mundy, 1987; Tomasello, 1995)

Autism spectrum disorder (ASD) is characterized by deficits in social interaction and communication. Since joint attention seems to precede the onset of theory of mind, the ability to share attention with others plays an important role in the development of social cognition in infancy. However, little is known about infants' gaze behavior in the naturalistic context of joint attention.

Objectives:

We examined gaze behavior of 9- and 13-months-old typically developing infants and infants at-risk for ASD during live face-to-face interactions for IJA using an eye-tracking system.

Methods:

Data of 20 infants was analyzed in this preliminary study. They participated the sessions at their age of 9- and 10-months-old and 12-and 13-months-old. During the recording an infant sat on the parent's lap facing to a live female experimenter. The experimenter presented the infant a wind-up toy for 20 s to elicit shared attention between the experimenter's face and toy. The infant's gaze behavior was recorded during interactions using Tobii eye-tracker (Tobii x-2-60, Sampling rate: 60 Hz). We separated participants into two groups for each age: 9- and 10-months-old group consisted of 11 TD infants and 9 infants at-risk for ASD. 12- and 13-months-old group consisted of 8 TD infants and 8 infants at-risk for ASD. We conducted the t-test between each groups to analyze looking time for object (toy) and face.

Results:

Our results revealed that during IJA, the 9-and 10-months-old TD infants looked at the toy and experimenter's face longer than the infants at-risk for ASD (t (10) =1.95, p=0.07). For 12- and 13-months-olds, on the other hand, the infants at-risk for ASD looked at the toy longer than the TD infants. However, only marginal significance was observed for this difference (t (10) =1.95, p=0.07).

Conclusions:

Although this is very preliminary study with limited participants, we were able to show that we can capture the eye gaze during social interaction. This method could show the early signs of social deficits for the infants at-risk for ASD during naturalistic social interactions. We will collect more data to discuss about the group difference in the poster.

32 **144.032** Gender Differences during Toddlerhood in Autism Spectrum Disorder: A Community-Based Longitudinal Follow-up Study

L. P. Lawson[1,2], *R. Joshi*[3], *J. Barbaro*[4] *and C. Dissanayake*[4], *(1)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)Autism Spectrum Australia, Melbourne, Australia, (4)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background:

Due to the large disparity in prevalence of Autism Spectrum Disorder (ASD) between the genders (3-4 males for every female), differences between diagnosed males and females have long been of interest. The few studies that have investigated gender difference in infants and toddlers focus on differences at one point in time within clinically referred samples or high-risk infant cohorts. It is important to consider children's developmental trajectories when examining early gender differences in ASD. Further, it is important, where possible, to examine gender differences in samples not subject to the biases inherent in high-risk and clinical cohorts.

Objectives:

The aim in the current study was to examine gender differences in early autism manifestations and cognitive development in a low risk community-ascertained sample of children with ASD from 24 to 48 months of age.

Methods:

Participants were drawn from the Social Attention and Communication Study (SACS; Barbaro & Dissanayake, 2010), where trained Maternal and Child Health nurses undertook developmental surveillance of children in a low-risk community-based setting during their routine child checks. Following identification of early markers of ASD, children were referred for a behavioural and developmental assessment. Sixty-seven participants (46 males; 21 females) who received a diagnosis of ASD at 24-months of age and attended a follow-up assessment 2-years later comprised the study sample. Research reliable clinicians administered the Mullen Scales of Early Learning and Autism Diagnostic Observation Schedule at both time points.

Results:

No significant gender differences were observed on verbal, non-verbal, or overall cognitive ability at either time point. However, there was a significant main effect of time, such that both males and females with ASD improved in their verbal ability, and hence overall cognitive ability, from toddlerhood to preschool. In regards to autism manifestations, no significant differences were found between males and females on overall autism severity or restricted, repetitive behaviours. However, there was a significant gender difference within the social affect scale, such that females with ASD had more severe social-communication impairments compared to males at both time points. In addition, both genders improved significantly across time on overall autism severity, restricted repetitive behaviours, and social affect.

Conclusions:

The only gender difference in our very young community-based sample of children with ASD was in social communication, where females had more social-communication impairments than males. This finding may reflect that toddler females with fewer or different social attention and communication impairments may not be identified during routine developmental surveillance of social attention and communication behaviours, and thus not referred for an ASD assessment prior to 24 months of age. Further, the improvements observed in both genders on verbal ability and autism manifestations from toddlerhood to preschool age supports the rationale of early identification and intervention for children with ASD.

33 **144.033** Genetic and Environmental Contributions to a 2-Factor Model of Social Communication in Toddler Twins

N. Marrus[1], *J. Grant*[2], *A. Glowinski*[2], *A. Agrawal*[2], *T. Jacob*[3], *B. Harris-Olenak*[4], *A. C. Heath*[2], *J. N. Constantino*[1] *and J. T. Elison*[5], *(1)Washington University School of Medicine, St. Louis, MO, (2)Washington University in St. Louis, St. Louis, MO, (3)Veterans Affairs Palo Alto Health Care System, Palo Alto, CA, (4)Family Research Center/VA Palo Alto HCS, Menlo Park, CA, (5)University of Minnesota, Minneapolis, MN*

Background: Elucidating the early phenotypic and genetic architecture of autistic traits is critical for resolving developmental mechanisms underlying autism spectrum disorder (ASD), a highly heritable condition. Previously, we have shown that the video-referenced rating scale of reciprocal social behavior (vrRSB) quantifies continuous variation in autistic traits among toddlers in the general population and differentiates toddlers with ASD. Here we capitalize on the vrRSB to model the phenotypic and genetic structure of social communication, a core ASD symptom domain, during toddlerhood, when autistic symptoms commonly emerge.
Objectives: 1) To characterize the factor structure for social communication in toddlers. 2) To determine genetic and environmental contributions

to early social communication. 3) To examine continuity of these influences during toddlerhood.

Methods: Parental ratings on the vrRSB were collected in two toddler-aged populations: 1) an epidemiologic, longitudinal twin sample identified through birth records in Missouri and California (n=317 twin pairs) and 2) a research participant registry at the University of Minnesota (n=1870). Social communication was indexed using the 13 video-referenced items on the vrRSB, in which caregivers rate their child in comparison to a typically developing scoring anchor presented by video. An exploratory factor analysis (EFA) was performed for ages 18 and 24 months using the larger Minnesota sample, followed by confirmatory factor analysis (CFA) at both ages in the twin sample. A quadrivariate twin model assessed the degree of genetic and environmental influences on the factor structure for social communication at ages 18 and 24 months, as well as the covariance between genetic and environmental influences on latent factors within and across time points.

Results: EFA identified two factors at both 18 and 24 months, an “affective engagement factor” and a “functional communication factor” (Table 1). A CFA demonstrated good model fit for these 2 factors at both ages (legend, Table 1). Twin modeling revealed substantial genetic contributions (A) and modest shared environmental (C) and unique environmental (E) contributions to factor scores at both ages (Table 2). Genetic influences explained 58-80% of the variance in the factors, with C explaining an additional 6-18% and E explaining 15-25% of the variance. Genetic correlations between factor scores within and across age were all significant and substantial, ranging from 0.69-0.90. Shared environmental influence on all factors was entirely overlapping, with no evidence of factor-specific C. Unique environmental correlations were more modest: within-age correlations between factors were estimated at 0.66 at 18 and 24 months and moderate correlations were observed for 24-month Factor 1 and both 18-month factors (rE=0.31-0.44). No significant cross-age, unique environmental correlations were observed for Factor 2.

Conclusions: In keeping with the high heritability of ASD, variation in early social communication appears largely attributable to heritable capacities for affective engagement and functional communication. Genetic influences on these factors showed strong continuity in toddlers, suggesting a potential mechanism for known stability of autistic traits. Measurable environmental influences on social communication highlight the opportunity to enhance early interventions for ASD through research identifying elements of early experience which ameliorate deficits in social communication.

34 **144.034** Genetic-Independence of Key Early Contributors to Autistic Trait Severity

A. Pohl *and J. N. Constantino, Washington University School of Medicine, St. Louis, MO*

Background: Previously, in separate lines of research, we have shown that social visual engagement (Constantino et al., *Nature*, 2017) and quantitative autistic traits (QAT, see Constantino and Charman, *Lancet Neurology* 2016) constitute highly-heritable autism endophenotypes. Here, we examine the relationship between these and other highly- heritable predictors of autism recurrence in infancy and early childhood.
Objectives: In a prospective longitudinal study of epidemiologically-ascertained infant twins, we examined the extent to which variation in social visual engagement at 18-24 months, familial QAT background, inattention at 36 months, and variation in motor coordination at 36 months predicted quantitative autistic trait burden at 48 months.

Methods: Visual social engagement was measured using eye tracking methods as described in Constantino et al. (2017), involving infant viewing of social scenes on video, and deriving for each subject a total proportion of visual orientation to eyes, mouths, bodies, and objects. We obtained ratings of variation in attention and motor coordination by parent report using respectively Achenbach’s Child Behavior Checklist and the Developmental Coordination Disorders Checklist (DCDQ). We derived a quantitative index of parental QAT using the biparental mean of the adult SRS-2 completed by spouse report.

Results: Remarkably, despite the established relationship of each predictive phenotype to autism, none were correlated with one another in early childhood ($p>0.05$ with false discovery correction applied), overwhelmingly indicating that they constitute non-overlapping traits. Moreover, Bayesian regression revealed that visual social engagement—despite its strong association with categorically-defined autism—did not predict variation in QAT among normal 48 month olds in this population sample. In contrast, biparental mean QATs was a distinct positive predictor of child QAT and explained 6% of the variance in child QATs in hierarchical regression. Furthermore, two neurocognitive phenotypes non-specific to autism, attention and motor coordination, explained the largest amount of the variance (18% and 10% respectively) in hierarchical regression, and both were significant predictors of QATs at 48 months. All three phenotypes appeared heritable in female twin pairs, while there was a large overlap in the 95% confidence interval for ICC in male monozygotic and dizygotic twin pairs in males on CBCL attention scores, suggesting sex-specific differences in heritability for this phenotype. Finally, we observed genetic overlap only between motor coordination and QATs, suggesting that genes affecting motor coordination may also directly affect autistic traits.

Conclusions: Social visual engagement, familial background for quantitative autistic traits, variation in attention, and variation in motor coordination represent genetically-independent contributors to autistic symptom burden. Linking genetic variants to these underlying traits rather than to a diagnosis of “autism” may be more productive in devising personalized approaches to developmental intervention, especially if autism represents an epiphenomenon of earlier-interacting susceptibilities.

35 **144.035** Heart Rate during Sleep at 1 Month of Age Correlates with ASD Risk Scores at 30 Months

H. E. Reed[1]*, N. H. Brito*[2]*, L. C. Shuffrey*[3]*, W. P. Fifer*[3]*, J. D. Nugent*[3] *and A. J. Elliot*[4]*, (1)Columbia University Medical Center, New York, NY, (2)Department of Applied Psychology, New York University, New York, NY, (3)Division of Developmental Neuroscience, Columbia University Medical Center, New York, NY, (4)Sanford School of Medicine at the Unviersity of South Dakota, Sioux Falls, SD*

Background: Autism spectrum disorder has been associated with a range of atypical autonomic responses, from pupillary light reflex to cardiac arousal. Heart rate (HR), an easily obtainable biomarker of autonomic function, is frequently found to be elevated at baseline in children with autism (Klusek et al, 2015). Although a few studies in children reported no correlation, this may be attributable to variations in measurement contexts. Only two studies thus far have examined cardiac variables during sleep, with both reporting autonomic dysregulation during non-REM sleep, and one reporting elevated HR in ASD across both non-REM and REM sleep (Pace et al, 2016; Harder et al, 2016). No studies to date have examined autonomic dysregulation during sleep prior to symptom development, despite the evidence of atypical brain development in ASD during this time.
Objectives: To the best of our knowledge, this is the first study to investigate a relationship between autonomic function during sleep in newborns and later autism risk.

Methods: Data was collected from healthy term newborns enrolled in the Prenatal Alcohol and SIDS and Stillbirth Network in the Northern Plains region of South and North Dakota. This cohort includes 352 children (47% male, 53% female). This sample reflects general population risk for ASD. Average heart rates were obtained at a 1-month postnatal follow up visit and calculated across a 10-minute period of quiet sleep (QS) and a 10-minute period of active sleep (AS), reflecting the different autonomic arousal profiles associated with non-REM and REM sleep respectively. Brief Infant-Toddler Social and Emotional Assessments (BITSEA) were obtained between 24-36 months of age (mean age of 30 months) (Briggs-Gowan and Carter, 2006). The BITSEA ASD Total subscale is a validated measure with high sensitivity, specificity, and PPV as a screener for ASD risk (Kiss and Carter, 2017).

Results: There was a moderate positive correlation between average HR during quiet sleep at 1 month of age and BITSEA ASD Total score at 30 months, r=0.311 (p=0.021). During active sleep, there was small positive correlation which approached significance with r=0.138 at p=0.051. Results were calculated controlling for sex, gestational age at birth, and age at BITSEA assessment.

Conclusions: These preliminary results demonstrate a significant correlation between average HR during quiet sleep in newborns and later autism risk. A similar correlation that approached significance was noted during active sleep. These results mirror previous findings of autonomic differences during sleep in ASD and are the first to indicate that this phenomenon may occur prior to symptom development. Replication on an expanded sample with confirmed ASD diagnoses is needed. If this correlation is upheld, it may have important implications for early brain development in autism. Recent research has demonstrated increased extra-axial cerebrospinal fluid (CSF) at 6 months in children who later develop ASD (Shen et al 2017). Autonomic regulation plays a major role in CSF circulation, with enhanced sympathetic tone leading to increased CSF volume (Sakka, 2011). Further research is important to understand what role, if any, autonomic dysfunction may play in brain development in ASD.

36 **144.036** Identifying Prognostic Biomarkers in Toddlers with Autism Spectrum Disorder

***E. Bacon**[1], A. Moore[2], D. Cha[1], C. Barnes[1], E. Courchesne[3] and K. Pierce[4], (1)Neurosciences, University of California, San Diego, La Jolla, CA, (2)University of California, San Diego, La Jolla, CA, (3)Neurosciences, Univeristy of California, San Diego, La Jolla, CA, (4)Univeristy of California, San Diego, La Jolla, CA*

Background:

Although significant advances have been made in the early identification of ASD, once a diagnosis is made, little information is available regarding the prognosis for a particular child. This uncertainty creates anxiety for parents and limits the ability to develop treatments tailored for a specific ASD outcome profile. We have recently demonstrated that eye tracking is a powerful tool for detecting a subset of ASD toddlers with 98% specificity using a preferential looking task, the GeoPref Test, which compares fixation times for social versus geometric images. Our original studies (Pierce et al., 2011; 2016) showed that toddlers with ASD that fixated on geometric images >69% of the time, ASD “Geo Responders” were more likely to have poorer social, language, and overall intellectual aptitude than ASD “Social Responders” (i.e., fixated on social images >69%). However, it is currently unknown if performance on the Geo Pref Test would be associated with ability a year later. We hypothesized visual input and learning ability would be more abnormal for ASD Geo, than ASD Social Responders resulting in poorer outcomes.

Objectives:

We aimed to evaluate the prognostic utility of the GeoPref Test in toddlers with ASD.

Methods:

The sample included 71 toddlers with ASD recruited from the general population through community referrals and developmental screening using the One-Year Well-Baby Check-Up Approach (Pierce et al., 2011). All toddlers were evaluated longitudinally every 9-12 months using the Mullen Scales of Early Learning, Vineland Adaptive Behavior Scales, and Autism Diagnostic Observation Schedule, and diagnoses were confirmed at age 3 years. All toddlers participated in the GeoPref Test at their intake evaluation (mean age = 23 months). Performance on clinical measures at intake evaluations and at outcome approximately 1 year following eye tracking (mean age = 38 months) were compared between ASD Geo Responders (n=24) and ASD Social Responders (n=47).

Results:

As expected, Geo Responders demonstrated more impairments on the Social Affect Domain of the ADOS ($t = 4.26$, $p < .001$) and Receptive Language Domain of the Mullen ($t = -2.89$, $p < .01$) at their initial eye tracking age relative to Social Responders. Differences in Social Affect ($t = 4.85$, $p < .001$) and Receptive Language ($t = -2.79$, $p < .01$) persisted across a 1 year period. However, Expressive Language ability of Geo Responders worsened across this same time period ($t = -2.13$, $p < .05$).There were no group differences on the Vineland.

Conclusions:

The GeoPref Test identifies group differences in developmental functioning at intake and ~1 year following eye tracking. Geo Responders evidenced a poorer clinical profile with lower language ability and higher ratings of autism symptoms. These differences persisted over time, with differences in language ability becoming more pronounced. Therefore, the GeoPref Test shows utility as not only a biomarker for identifying ASD, but a prognostic indicator for newly-identified toddlers. Given that experience dependent mechanisms are foundational to brain development, we hypothesize Geo Responders are high-risk for poorer outcomes through adolescence. Follow-up is being conducted to examine if this phenomenon persists into school-age.

37 **144.037** Imaging Biomarkers for Early Detection of Autism in Tuberous Sclerosis Complex

***A. Prohl**[1], K. Kapur[2], B. Scherrer[1], X. Tomas-Fernandez[1], J. Peters[1,2], M. Bebin[3], D. A. Krueger[4], H. Northrup[5], J. Wu[6], M. Sahin[7] and S. K. Warfield[1], (1)Computational Radiology Laboratory, Department of Radiology, Boston Children's Hospital, Boston, MA, (2)Department of Neurology, Boston Children's Hospital, Boston, MA, (3)University of Alabama at Birmingham, Birmingham, AL, (4)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (5)McGovern Medical School, Univ. TX Health Sci Cntr-Houston, Houston, TX, (6)University of California Los Angeles, Los Angeles, CA, (7)Boston Children's Hospital/Harvard Medical School, Boston, MA*

Background: Tuberous Sclerosis Complex (TSC) is a monogenetic disorder with high penetrance of autism spectrum disorder (ASD). Our previous work has characterized imaging features associated with ASD in adult and pediatric TSC patients. We determined that there are underlying

microstructural integrity alterations in TSC patients with ASD that are not present in TSC patients without ASD, and that they exist throughout the brain, with varying degrees of severity, and are prevalent in the corpus callosum and arcuate fasciculus. There is an urgent unmet need for imaging biomarkers that can be used in the first year of life to identify and direct early intervention towards infants most likely to develop ASD.
Objectives: In light of our previous findings of abnormality in the corpus callosum and arcuate fasciculus, we set out to identify a biomarker of ASD in TSC through prospective and longitudinal study of microstructural development of the arcuate fasciculus, a fronto-temporal white matter (WM) fiber bundle implicated in language development, and in the corpus callosum, a large interhemispheric fiber bundle and collector of stochastically-distributed disease burden in TSC.

Methods: 40 participants with TSC underwent longitudinal 3T diffusion tensor imaging (DTI) within the first year of life and at 12, 24, and 36 months of age. Participants were assessed for early ASD symptoms at 12 months of age with the Autism Observation Scale for Infants (AOSI). Bilateral regions of interest were automatically defined along the arcuate fasciculi, located in the WM underlying Geschwind's Territory, Wernicke's Area, posterior to Broca's area and in the body of the corpus callosum at the midline [Figure 1]. Diffusion properties in each region were measured. The ability of diffusion properties in each region to predict high or low AOSI total score at 12 months of age was evaluated with ROC analysis of the longitudinal sample, and in a subsample of data, restricted to scans acquired before 12 months of age.

Results: From the longitudinal sample, prediction of high or low AOSI total score was best achieved with fractional anisotropy of WM underlying left Geschwind's territory (AUC=87.20, sensitivity=86.67, specificity=80.00) and left Wernicke's area (AUC=85.07, sensitivity=86.67, specificity=76.00), while radial diffusivity of WM underlying left Wernicke's area conferred a negative predictive value of 100% [Table 1a]. Prior to 12 months of age, WM microstructure underlying right Wernicke's area was most predictive of high or low AOSI total score (radial diffusivity, AUC=76.89 ; mean diffusivity, AUC=76.14) and left Wernicke's area (fractional anisotropy, AUC=75.76) [Table 1b]. AUC of corpus callosum diffusion properties did not exceed 75.00 in the longitudinal or 12 month sample, and therefore were not the best predictors of ASD symptoms at 12 months of age.

Conclusions: Temporoparietal white matter that supports language development within the first year of life is associated with later diagnosis of ASD in TSC. Although associated with ASD in adults, microstructure of the corpus callosum was not predictive of later diagnosis of ASD, suggesting its role as an accumulator of disease burden in TSC.

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144.038 Increased Rates of Comorbid Psychopathology in Preschool-Aged Females with Autism Spectrum Disorder

C. W. Nordahl[1], *A. M. Iosif*[2], *G. S. Young*[3], *A. L. Hechtman*[3], *B. Heath*[1], *V. P. Reinhardt*[3], *D. G. Amaral*[1], *S. Ozonoff*[3] *and M. Solomon*[3], *(1)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (2)Public Health Sciences, University of California Davis, Davis, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA*

Background: There is some evidence that females with autism spectrum disorder (ASD) have higher rates of comorbid psychopathology, particularly anxiety and depression, in older childhood and adolescence than males with ASD. Studies utilizing large samples of females with ASD are lacking, and little is known about sex differences in comorbid psychopathology in very young children with ASD.
Objectives: We evaluated sex differences in comorbid psychopathology in preschool-aged females and males with ASD. Age-matched typically developing (TD) controls were included to investigate whether differences related to ASD varied between males and females.

Methods: Participants include 229 children with ASD (76 females, 153 males) and 131 age-matched TD controls (54 females, 77 males), mean age of 36.2 (sd 7.2) months. ASD diagnoses were confirmed using ADOS and ADI-R. Psychopathology was evaluated using the DSM-oriented scales for affective, anxiety, attention deficit/hyperactivity (ADHD), and oppositional defiant problems from the Child Behavior Checklist. Sex by diagnosis interactions were examined with negative binomial regression models using T-scores from each scale. For scales with significant interactions, the proportion of males and females with ASD who scored in the clinical range (>69) was compared using chi-square tests. As a secondary analysis to explore generalized psychopathology within the ASD sample, t-scores for each DSM-oriented scale were categorized as clinical (>69), borderline clinical (65-69), and normal (< 65), and a data-driven latent class analysis (LCA) was utilized to identify subgroups with higher rates of psychopathology across DSM-oriented scales. The proportion of females and males in each of the derived subgroups was compared.

Results: Sex by diagnosis interactions were identified for ADHD (p = .01 corrected for multiple comparisons) and affective problems (p = .06 corrected). Pairwise comparisons revealed a greater difference between ASD and TD within females than males on both ADHD [Female ASD vs TD: estimate 5.7 (SE 1.2), Male ASD vs TD: estimate 2.7 (SE 0.4)] and affective scales [Female ASD vs TD: estimate 5.5 (SE 1.1), Male ASD vs TD: estimate 2.3 (SE 0.5)]. A higher proportion of females with ASD than males with ASD scored within the clinical range on both the ADHD and affective scales (ADHD: 20% females vs. 9% males, p = .04; affective: 37% females vs 22% of males, p = .03). Within the ASD group, LCA of clinical, borderline, and normal scores across DSM-oriented scales revealed three subgroups: elevated scores across all measures (35%), low scores on all measures (25%), and a group in the middle (40%). A higher proportion of females were in the group with elevated scores than males (43% vs. 31%, p = .03), suggesting a higher overall rate of psychopathology in females.

Conclusions: Comorbid psychopathology occurs at a higher rate in girls with ASD than in boys, even at the young ages tested in this study. This difference is not mirrored in typical development. Specifically, preschool-aged females exhibited higher rates of clinically significant ADHD and affective problems, suggesting a need for closer evaluation and earlier interventions to potentially improve outcomes for females with ASD.

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144.039 Infant Effortful Control Acts As a Protective Factor for Traits of ASD in Mid-Childhood.

R. Bedford[1], *T. Gliga*[2], *T. Charman*[3], *M. H. Johnson*[4] *and A. Pickles*[5], *(1)King's College London, London, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (5)Biostatistics and Health Informatics, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

Background: Executive function impairments are characteristic of children with developmental disorders such as autism spectrum disorder (ASD). Recently, the reverse has been proposed; that strong executive functions may act as a protective factor across developmental disorders (Johnson, 2012). In the current study we use infant effortful control (EC), a proxy measure of early infant executive function, to test the hypothesis that EC can have a protective effect on subsequent ASD traits, in children at high familial risk for ASD.

Objectives: Our aim is to test whether infant EC acts as a protective factor in relation to later ASD traits, by testing the moderating effect of EC on the association between infant Autism Observation Scale for Infants (AOSI) scores and later ASD symptoms at 7 years.

Methods: Participants were 104 infants at high and low familial risk (54 high risk, HR; 50 low risk, LR) seen at multiple visits from birth to 7 years. Data for the current study comes from the 14 month infant visit (AOSI and EC) and the 7 year visit (Social Responsiveness Scale, SRS).

Results: First we ran a simple linear regression to test the association between 14-month AOSI score and 7-year SRS, showing that increased AOSI scores were significantly associated with greater 7-year autism symptoms. Next, we included EC (high and low based on median split) and the interaction between AOSI and EC in addition to the AOSI in a multiple linear regression. Results showed a significant association between AOSI and the SRS ($\beta = 0.63$, $p < 0.001$) and a significant EC*AOSI interaction ($\beta = -0.62$, $p = 0.001$). Separate simple linear regressions indicated that the interaction was driven by a significant positive association between AOSI and ASD traits in those with low EC ($p < 0.001$), with no association for those with high EC ($p = 0.54$).

Conclusions: Results suggest that early autism-like behaviours as measured by the AOSI are only associated with subsequent symptoms of autism in those with low effortful control. This supports the hypothesis that EC may act as a protective factor in infants at-risk, perhaps allowing them to compensate for additional neural atypicalities. Future studies should investigate the potential for early executive function interventions in at-risk infants using methods such as contingent eye-tracking.

40 **144.040** Integration of Longitudinal Cross-Domain Measures of Symptoms, Developmental Level and Adaptive Functioning to Predict Autism at 3 Years in High-Risk Infants

***G. Bussu**[1], E. J. Jones[2], T. Charman[3], M. H. Johnson[4], J. K. Buitelaar[5] and &. The BASIS Team[6], (1)Donders Institute for Brain, Cognition and Behaviour, Radboudumc, Nijmegen, Netherlands, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (5)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (6)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom*

Background: Individual prediction of later development of Autism Spectrum Disorders (ASD) at pre-diagnostic age might be crucial to enable early targeted interventions aimed at improving long-term outcome. Previous studies used scores from the Autism Diagnostic Observation Schedule (ADOS) at 18 months to classify ASD development (Chawarska et al., 2014), while predictive power for ASD of other behavioural measures commonly used for clinical evaluation has not been tested. Additionally, the relevance of data integration for improving classification of ASD outcome has been previously reported in neuroimaging studies (Libero et al., 2015).

Objectives: To characterise early development of ASD, we integrated information across multiple behavioural and developmental domains and multiple time-points. Additionally, we used a machine learning approach to improve individual classification of ASD among high-risk siblings (HR) at an early age from different combinations of measures.

Methods: We used data of the Mullen Scales of Early Learning (MSEL), Vineland Adaptive Behavior Scales (VABS) and Autism Observation Scale for Infants (AOSI) between 8 and 36 months in a cohort of 71 low-risk controls (LR) and 161 HR siblings. Clinical outcome of HR siblings at 36 months (HR-Typical, HR-Atypical, HR-ASD) was established by expert clinical researchers. First, we examined whether LR and HR clinical outcome groups showed differences in cross-sectional measures at 8 and 14 months, and in developmental trajectories of behavioural and developmental measures between 8 and 36 months. Second, different combinations of the same measures at 8 and 14 months were integrated into a Least-Square Support Vector Machine (LS-SVM) classifier to discriminate between HR-ASD and both HR-Typical and HR-Atypical.

Results: We observed clear but small size group effects for Mullen and Vineland scores at 8 and 14 months, and larger group effects at 24 and 36 months (Figure 1). Group differentiation was found from 8 months, except for MSEL visual reception, receptive and expressive language scores, and VABS motor and social scores, showing increasing differentiation of groups over time. Overall, LR and HR-Typical showed higher developmental level and functioning, and lower ASD symptoms than HR-Atypical and HR-ASD. Individual classification of ASD clinical outcome was possible with moderate accuracy using VABS daily living scores at 14 months (Area Under the Curve, AUC: 71.3%; 95% Confidence Interval, CI: [55.6, 85.1]). The integration of measures from different domains did not significantly improve classification (Figure 2).

Conclusions: This study extends previous high-risk studies on early markers for ASD by integrating information from multiple measures and multiple time-points; testing models for the individual classification of ASD clinical outcome; and focusing on prediction at a younger age. Our results provide further evidence of the high inter-individual and intra-individual heterogeneity of ASD, which makes it difficult to predict the later development of the disorder from clinical manifestations at an early age. Further investigation is needed to understand the interplay of different domains in the first years of life leading to an ASD outcome, and the combination of measures from different domains can be extended to include more biological data to examine whether it would further improve predictive power.

41 **144.041** Longitudinal Sex Differences in ASD Symptoms and Diagnostic Stability in Early Childhood

***N. Ludwig**[1], G. Perez Liz[2], D. N. Abrams[3], L. B. Adamson[4], D. A. Fein[5] and D. L. Robins[2], (1)Confex - The Conference Exchange, Cumberland, RI, (2)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (3)Georgia State University, Atlanta, GA, (4)Psychology, Georgia State University, Atlanta, GA, (5)Psychological Sciences, University of Connecticut, Storrs, CT*

Background: Research has demonstrated sex differences in the early screening of Autism Spectrum Disorder (ASD) in toddlers; however, studies examining the early clinical presentation of ASD have shown minimal sex differences at this age. Given research showing sex differences later in life, it is important to understand the potential developmental trajectory of sex differences and how this may impact early detection and diagnosis.

Objectives: The current study examined the relationship between sex and the developmental trajectory of clinical features and diagnostic stability of ASD in a sample of children initially evaluated based on screen positive status (i.e., at risk) on the Modified Checklist for Autism in Toddlers(-Revised) with Follow-Up (M-CHAT(-R/F) and re-evaluated two years later.

Methods: The sample included 424 ($N_{\text{male}}=318$) children who were initially evaluated as toddlers ($M_{age}=26.31$ months, $SD=4.46$) and re-evaluated two years later ($M_{\text{age}}=49.88$ months, $SD=7.19$). Evaluations included autism diagnostic measures (ADOS-2), cognitive testing (Mullen Scales of Early

Learning), and parent report of history and adaptive behavior (Vineland Adaptive Behavior Scales(-II)). Notably, ADOS-2 Calibrated Severity Scores (CSS) for Overall Total, Social Affect and Restricted, Repetitive, Behavior (RRB), as well as algorithm domain scores were utilized for analyses given minimal research examining the domain-specific CSS as an adequate measure of longitudinal changes in symptoms.

Results: Sex differences emerged in diagnostic stability. Although a similar percentage of males (8%) and females (12%) who were not diagnosed with ASD at the initial evaluation gained a diagnosis at the time of re-evaluation ($X^2(1,N=238)=.562$, $p=.453$), girls initially diagnosed with ASD were almost twice as likely (38%) as males (20%) to lose their ASD diagnosis at re-evaluation ($X^2(1,N=270)=3.647$, $p=.05$). Subsequent analyses on the subsample of children who lost an ASD diagnosis at re-evaluation ($N=51$) indicated a significant interaction between time of evaluation and sex ($F(1,47)=4.38$, $p=.043$, partial $\eta^2=.085$) for RRB algorithm domain scores; males demonstrated higher scores ($M_{male}=3.09$, $SD=2.01$) compared to females ($M_{female}=1.50$, $SD=1.71$) at the initial evaluation, but similar levels at re-evaluation ($M_{male}=.85$, $SD=1.18$; $M_{female}=.63$, $SD=.81$;). Toddlers with stable ASD diagnosis– ASD confirmed at both time points ($N=219$; $N_{male}=177$) – did not evidence differential ASD symptoms, developmental skills, or adaptive skills based on sex across time (ps>.05).

Conclusions: Results are consistent with previous literature demonstrating minimal sex differences in young children with ASD and extend previous findings by showing no sex differences in the developmental trajectory of the clinical features of ASD from toddlerhood to the preschool years. Nevertheless, sex differences emerged in diagnostic stability such that females were more likely to lose an initial diagnosis of ASD from age 2 to 4. While females demonstrated low rates of RRBs at both time-points, males demonstrated a significant decline in RRBs over time. This suggests that in females diagnosed with ASD in toddlerhood, fewer RRBs may be predictive of losing a diagnosis at age 4. Results call for future research examining early compensatory factors in females that may facilitate symptom reduction that lead them to lose their initial ASD diagnosis by preschool.

42 **144.042** Social Evaluation Is Reduced in Toddlers with ASD and Other Developmental Delays Compared to Toddlers with Typical Development

N. Ludwig[1], *R. Williamson*[2], *R. K. Ramsey*[3], *L. B. Adamson*[4], *S. F. Brosnan*[4], *W. Jones*[5] *and D. L. Robins*[6], *(1)Confex - The Conference Exchange, Cumberland, RI, (2)Georgia State University, Atlanta, GA, (3)Georgia State University, Atlanta, OH, (4)Psychology, Georgia State University, Atlanta, GA, (5)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (6)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

Background: Studies utilizing a nonverbal social attribution paradigm show that typically developing infants make dispositional state attributions about ambiguous stimuli as young as ten months of age and make goal state attributions and social evaluations by three months of age (Hamlin, Wynn, & Bloom, 2007, 2010). Given that social attribution has shown to be reduced in older individuals with ASD, early disruptions in social attribution may serve as a behavioral marker for early detection.

Objectives: This study examined whether a puppet-based social attribution paradigm developed for use in preverbal infants is appropriate for use in toddlers with and without delays and whether performance differentiates toddlers with ASD from those with non-ASD delays (DD) and typical development (TD).

Methods: The sample included 57 toddlers ($N_{ASD}=15$, $N_{DD}=20$, $N_{TD}=22$; $M_{age}=21.61$ mo, $SD=2.98$) who were presented with a nonverbal puppet-based social attribution paradigm in which a shape tries to climb a hill and another shape either helps or hinders its climb (Hamlin et al.). Toddlers were habituated to alternating helping and hindering social scenes until habituated (max. 12 trials). Toddlers were then presented with a Looking Time Test (LTT), a violation of expectation-based measure of dispositional attribution; longer looking time towards an unexpected social event (i.e., novel scene of climber moving towards hinderer vs. helper) was considered evidence that children made dispositional attributions during habituation. Toddlers also completed a Preference Test (PT) to measure social evaluation; choosing helper helper over hinderer was interpreted as evidence that children made goal attributions during habituation and integrated that knowledge in their social evaluation.

Results: Children habituated to the social scenes at similar rates across diagnosis ($X^2(2,N=57)=1.966$, $p=.374$); however, toddlers within the TD group looked longer per habituation exposure ($M=10.39$s, $SD=5.85$) compared to the DD group only ($M=7.89$s, $SD=3.30$; $F(2,54)=.0368$, $p=.047$, partial $\eta^2=.107$). Toddlers in the ASD ($M_{exp=}$ 5.36s, $M_{unexp=}$5.88s) and DD (M_{exp} = 7.00s, $M_{unexp=}$8.29s) groups did not demonstrate increased looking time towards the unexpected event during the LLT, and in contrast to studies in infants, neither did those in the TD group (M_{exp}=5.84s, M_{unexp}=5.82s; $F(2,52)=0.564$, $p=.572$, partial $\eta^2=.021$). The TD group demonstrated preference for the helper shape during the PT (71.4%$_{helper}$), whereas the ASD (28.6%$_{helper}$) and DD groups (40%$_{helper}$) did not ($X^2(2,N=55)=7.213$, $p=.027$).

Conclusions: This is the first study utilizing a nonverbal social attribution paradigm in toddlers with and without developmental delays. Contrary to expectations, TD toddlers did not show looking time differences on the LLT bringing into question whether looking time is an appropriate measure of dispositional attribution at this age. Despite this, toddlers in the TD group demonstrated evidence of social evaluation on the PT, whereas toddlers within the ASD and DD groups did not. While all toddlers habituated at similar rates, TD toddlers looked longer towards each habituation exposure compared to the DD group, which suggest that other factors may have impeded success in the DD group. Future research is warranted to examine whether deficient social evaluation is specific to ASD or characterizes developmental delays more broadly.

43 **144.043** Looking Patterns Predict Expressive Language in Toddlers with ASD Only If First Words Are Acquired

L. A. Edwards[1], *S. I. Habayeb*[2], *T. Tsang*[3], *C. A. Saulnier*[1], *W. Jones*[1] *and A. Klin*[1], *(1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Catholic University of America, Washington, DC, (3)University of California, Los Angeles, Los Angeles, CA*

Background: Infants show shifting patterns of social visual engagement to faces over the first two years of life. Specifically, after an early period of predominant eye-looking, typically developing (TD) infants show increases in mouth-looking, which seem to accelerate around the developmental time-point at which first words are spoken. Past work has provided evidence for associations between this shift and the development of speech and language abilities: in observational studies, attention to visual speech facilitated phonetic learning and language discrimination in TD infants (Teinonen et al., 2008; Weikum et al., 2007), and TD infants were more likely to look to the eyes of a talking face when learning word referents (Lewkowicz et al., 2012). In contrast to TD patterns of social visual engagement, infants later diagnosed with autism spectrum disorder (ASD) show more rapid acceleration in mouth-looking, as well as very early declines in eye looking that persist until 24 months. How patterns of visual

fixation in infants with ASD relates to speech and language abilities is currently not well understood.
Objectives: The present study compares eye-tracking measures of social visual engagement with spoken language abilities in the second year of life, an important period in typical language acquisition characterized by marked inflection in word learning. We predicted fluctuation in preferential patterns of visual engagement during this period, with a significant correlation between mouth-looking and expressive language in TD children.

Methods: Chronological age-matched samples of 10-25-month-old ASD (n=56) and TD (n=28) children watched videos of actresses engaged in child-directed caregiving activities. Social visual engagement data were collected using eye-tracking technology and quantified as percentage of time spent visually fixated on regions of interest. Between-group comparisons measured levels of fixation in ASD and TD children. Within-group regression analyses tested for associations between visual fixation and concurrent expressive language levels (measured by the *Mullen Scales of Early Learning*), controlling for age.

Results: During the second year of life, greater mouth- than eye-looking is observed in both TD (*p*=0.0001) and ASD (*p*=0.018) children. However, the adaptive value of these looking patterns differs between groups: increased mouth-looking was positively associated with improved expressive and receptive language scores in TD children (*p*=0.003 and *p*=0.022, respectively) but was unrelated to language abilities in ASD children (both *p*>0.600). If analyses are constrained to ASD children for whom word-learning had begun, a weaker but positive association with expressive language is observed (*p* = 0.040). In ASD children who had not yet begun word acquisition, no relationship between visual fixations and expressive language was observed.

Conclusions: In the second year of life, increased visual engagement with the mouths of others is adaptive in TD children and positively predicts expressive and receptive language levels. For children with ASD however, only those children who have begun word learning show a positive association between mouth-looking and expressive language; for the remaining children, high levels of mouth-looking are unrelated to expressive or receptive language.

44 **144.044** Low Focused Attention Is Associated with Elevated ASD-Related Behaviours at 15 Months

A. Hendry[1], *E. J. Jones*[2], *T. Charman*[3], *M. H. Johnson*[4] *and &. The BASIS Team*[5], *(1)Department of Experimental Psychology, University of Oxford, Oxford, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (5)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom*

Background: Focused Attention (FA) is a filter through which environmental input is selected for learning, through orientation toward and sustained engagement with the external world. Higher FA spans in infancy are associated with enhanced language skills and general developmental ability, more complex play behaviour and better executive function. Genetically-influenced difficulties with attentional control have been identified as a likely developmental pathway to ASD (and co-occurring ADHD) and risk for poor control of attention appears to be distributed across individuals with a first-degree relative with ASD – yet little is currently known about early development of control of attention in ASD. Using FA as an index for early development of attentional control in infants with an older sibling with ASD ('infant-siblings') may yield insights into this potential causal mechanism.
Objectives: The first aim of this longitudinal study was to evaluate whether poor development of FA appears to be a characteristic of infant-siblings generally. The second aim was to evaluate whether poor development of FA appears to be specifically associated with levels of early-emerging ASD-related behaviours.

Methods: 112 infants were observed during free play with a set of blocks, at ages 10.5 (controls = 22, infant-siblings = 85) and 15 months (controls = 18, infant-siblings = 72). Coders rated infants' continuous looking and touching behaviour, from which the peak epoch of FA – longest epoch of simultaneous looking to the blocks whilst manipulating the blocks – was identified (ICC =.924). At 15 months, early behavioural markers of ASD were measured using the Autism Observation Scale for Infants (AOSI).

Results: A repeated measures ANOVA on peak FA, with group (controls, infant-siblings) as a between groups factor showed no main effect of time (*F*(1,75) = 0.546 *p* = .462, = .007) and no main effect of group (*F*(1,75) = 0.224 *p* = .638, partial-eta sq= .003). The interaction effect between time and group was marginal (*F*(1,75) = 3.145 *p* = .081, partial-eta sq = .040) but the generalised eta square value was small (.017). Across all infants, lower Peak FA scores at 15 months were associated with higher concurrent total AOSI scores, indicative of elevated ASD-related behaviours (*r*(61) = -.222, *p* = .043). No significant association was found from Peak FA at 10.5 months to AOSI scores at 15 months (*r*(65) = -.057, *p* = .327).

Conclusions: As predicted, poor FA at 15 months is concurrently associated with elevated ASD-related behaviours. An equivalent predicted association from FA at 10.5 months to ASD-related behaviours at 15 months was not observed thus it is not clear from these data whether ASD-related behaviours are primary or secondary to difficulties with FA in infancy. Contrary to expectations, no evidence was found to suggest that having an older sibling with ASD is linked with impairment in FA in this sample of infant-siblings. Further research is required to establish whether differences in FA are apparent amongst the minority of infant-siblings later diagnosed with ASD.

45 **144.045** Measuring the Reward Value of Various Social Signals in Toddlers with and without Autism: An Interactive Eye-Tracking Study

A. Vernetti[1,2], *T. Charman*[3], *M. H. Johnson*[4], *T. Gliga*[2], *A. Senju*[2] *and &. the BASIS Team*[2], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Several accounts have been suggested to describe the origins of social difficulties in autism spectrum disorder (ASD), including accounts arguing for atypical social orienting (Klin et al., 2002) and diminished social motivation (Chevallier et al., 2012). However, increasing evidence shows that individuals with ASD seek and enjoy social interactions within specific contexts but may struggle with processing the irregularities inherent to social interactions (Pellicano and Burr, 2012).
Objectives: 1) To develop a task measuring the reward value of social signals within different contexts in young toddlers with and without ASD; 2)

To test whether toddlers with ASD orient and smile towards social stimuli differently from their typically developing peers depending on the content and predictable nature of social stimuli.

Methods: 118 toddlers at high or low familial risk for ASD took part in the study at 27-month-old and were later characterised at 36-month-old as low risk controls (LR, N=26, age: M=25.6mo, SD=1.1), high-risk with no ASD diagnosis (HR-no ASD, N=78, age: M=26.8mo, SD=1.5), or high-risk with a diagnosis of ASD (HR-ASD, N=14, age: M=26.3mo, SD=1.9). During a gaze-contingent task (Figure1), toddlers could select and trigger one of two different videos through their gaze behaviour. In a first condition, toddlers could activate a video of a person greeting or a musical toy. A second condition contrasted two social stimuli that, when looked at, displayed a person turning either towards or away from the participant. Finally, a third condition contrasted an invariant interaction (a person constantly saying Hello) with a variable interaction (a person either saying Hello, Good job or smiling).

Results: Indexes of reward-seeking behaviour (proportion of first looks and looking time towards stimulus of focus) and an index of hedonic response (proportion of smiles showed in response to the stimulus selected) were analysed (Table1). When the social interaction was predictable, all groups, including the HR-ASD group (no effect of Diagnosis, p>.513), looked longer and smiled more towards a person greeting them compared to a mechanical toy (Condition1, all p<.001) and also smiled more towards a communicative over a non-communicative person (Condition2, p<.001). However, all groups (all p<.018), except the HR-ASD group (p=.507), selectively oriented towards a person addressing the child in different ways over an invariant social interaction (Condition3).

Conclusions: Typical reward-seeking orienting and hedonic response towards predictable social stimuli seem to be present in toddlers with ASD. These results go against accounts suggesting impaired social orienting or diminished motivation to engage with social stimuli. However, the lesser drive towards the variable social interaction observed in toddlers with ASD may reflect either a bias towards more predictable social information or the difficulty to process unpredictable social encounters. These findings suggest that social interaction is intrinsically rewarding for toddlers with ASD, but the specific variability of naturalistic social interactions may modulate the extent to which social exchanges are pursued.

46 **144.046** Moderate to Late Preterm Birth Has a Negative Impact on Cognitive Profile in Autism

F. Bonnet-Brilhault[1]*, M. Brayette*[2]*, R. Blanc*[3]*, S. Roux*[4] *and E. Saliba*[4]*, (1)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (2)Université François-Rabelais de Tours, Tours, France, (3)Université Paris Descartes, Boulogne Billancourt, France, (4)Université François-Rabelais de Tours, UMR INSERM U930, Tours, France*

Background: Despite the growing number of cohort studies examining the risk of autism based on prematurity, few studies have looked at neurodevelopmental profiles of children with autism born prematurely. Moreover, although data on the outcome of children born very preterm before 32 Weeks of Amenorrhea (WA) is now abundant, the later outcome of children born moderately to late preterm (MLPT, 32^{+0} and 36^{+6} WA) and those born early term (ET, 37^{+0} and 38^{+6} WA) remains uncertain - this population being less systematically followed.
Objectives: to characterize the neurodevelopmental profiles of children with autism born MLPT, ET and full term FT (over 39^{+0} WA), using validated tools which assess autistic behaviors and cognitive level.

Methods: 415 children with Autism Spectrum Disorder (ASD) were followed up in the University Child Psychiatry Center of Tours (France) in 2010-2016. 28 (6.8%) were MLPT, 104 (25%) ET and 283 FT (68.2%). They were diagnosed by a multidisciplinary team according to DSM-4-TR criteria; ADI-R and ADOS complemented the diagnosis of ASD.

Neurodevelopmental profiles including cognitive level and autistic behaviors were determined, at median age of 6 years 9 months using validated tools. Cognitive assessment (verbal and nonverbal developmental quotients) was carried out with age adapted neuropsychological tests. Behavioral assessment was carried out using the Childhood Autism Rating Scale (CARS, Schopler et al, 1980), the Revised Behavior Summarized Evaluation scale (BSE-R, Barthélémy et al, 1997) and the Repetitive and Restricted Behavior scale (RRB, Bourreau et al, 2009).

Results: Within the total sample, 209 patients (50.4%) had an Autistic Disorder, 21 (5%) an Asperger Syndrome and 185 (44.6%) a pervasive developmental disorder not otherwise specified (PDD-NOS). No significant difference was observed between the three groups MLPT, ET and FT (χ^2=4.42; df 4; p=0.35). The autistic profiles assessed by the CARS, BSE-R and RRB scales, did not differ between these three groups of patients. No significant difference was also found for the presence or absence of an intellectual disability ID (χ^2=3.91; df 2; p=0.14). However, ID was significantly deeper to severe in premature patients compared to those born ET and FT (χ^2=12.1; df 4; p=0.017). This cognitive effect was related to a significant lower nonverbal developmental quotient in the MLPT patients compared to those born FT (p=0.006 at post-hoc tests).

Conclusions: Moderately to late preterm birth does not modify autistic severity but exacerbates developmental deficiency and increases nonverbal difficulties in autism. These results highlight that, even moderate to late, preterm birth has a negative impact on cognitive profile in patients with neurodevelopmental vulnerability.

47 **144.047** Modifying Social Attention with Gaze-Contingent Eye Tracking for Toddlers and Children with ASD

Q. Wang[1]*, E. Barney*[2]*, C. A. Wall*[3]*, S. Macari*[1]*, K. Chawarska*[1] *and F. Shic*[2]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Department of Psychology, University of South Carolina, Columbia, SC*

Background: Toddlers with ASD, compared to typically developing (TD) and developmentally delayed (DD) peers, show diminished responses to dyadic engagement (Chawarska et al, 2012) and limited attention to the activities of others when viewing a naturalistic play scene (Shic et al, 2011). This decreased attention likely reflects not only the culmination of atypical experience-dependent knowledge regarding scenes and people, but also suggests that future access to observational learning may be limited.
Objectives: 1) To explore the feasibility of automated gaze-modification strategies for toddlers with ASD, 2) To assess short-term malleability of visual attentional patterns. 3) To identify whether measures of attentional redirection can be used in the direction of intervention.

Methods: In (1) Normative Data Collection phone, TD controls (n=41, age = 37.4±16.6 months) free-viewed scenes (of an actress emulating interactions with the viewer) while their gaze was eye tracked. This data was used as a normative reference to create a gaze-contingent (GC) adaptive cue system which redirected gaze upon deviation from TD looking patterns. Redirection was accomplished by highlighting TD controls looking locations. In the 2) Experimental phase, toddlers with ASD were randomly assigned to either the adaptive cue condition (cue, n=16, age = 32.3±8.7 months) or a control condition (no-cue, n = 19, age = 35.4±9.3 months).

Proportion of time looking at the screen (%valid) and proportion of time spent looking at the actress's face (%face) were analyzed in a group (3) x block (3) linear mixed model, covarying for Mullen nonverbal DQ. Pearson correlations were applied between change in %face after GC training and the Mullen verbal and nonverbal DQ.

Results: There was a main effect of group for %face (F(2,47)=6.42, p=.003) and a significant group*block interaction (F(4, 163)=3.06, p=0.018). At pre-training there was no difference between groups (ps>0.1). During training, TDs had higher %face than the ASD no-cue (p=0.001), and the ASD cue group was not different from the TDs (p=.062) or ASD no-cue group (p=.11). Post training, the TD group still had more %face than the ASD no-cue (p<0.001) and ASD cue (p = .009) groups, but the ASD cue group had higher %face than ASD no-cue (p=.015). Only the ASD no-cue group had a significant decrease of %face from baseline to training (p=0.028) and post-training (p=0.001), with no trend in the TD and ASD cue groups (ps>0.1). A negative correlation between the Mullen nonverbal DQ and the difference between pre- to post-training of %face was observed for the ASD cue group (r=-.64, p=.013), but not significant for the ASD no-cue (r=0.38, p=0.18) or TD (r=0.11, p=0.65) groups.

Conclusions: Compared with the ASD no-cue group, gaze-contingent training was effective at mitigating decreases of attention towards the face of the dyadic social partner in the ASD cue group. After adaptive training the attention towards the social partner was significantly higher in the ASD cue group than the no-cue group. The negative association with the Mullen nonverbal DQ implies that this approach may have particular relevance as an attentional training tool for more impaired toddlers with ASD.

48 **144.048** Non-Specific Inherited Background Susceptibilities for Autism Spectrum Disorder

S. E. Mous, *Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands*

Background: Previous studies have demonstrated that autism spectrum disorder (ASD) is highly heritable and may arise from the highly deleterious effects of genetic variants as occur in monogenic and oligogenic ASD syndromes. Besides the direct genetic effects, indirect background ASD susceptibilities may amplify the effects of these genetic mutations. For example, it has been shown that the risk for clinical-level ASD affectation in offspring is strengthened when parents exhibit subclinical ASD traits. Many previous studies have demonstrated the aggregation of non-ASD-specific neurodevelopmental impairments in individuals with ASD, such as attention-deficit/hyperactivity disorder (ADHD) symptoms and motor impairments. Although these problems are not part of the DSM5 diagnostic criteria for ASD, these impairments often co-occur in children affected by ASD. Studies strongly suggest genetic overlap between ASD and ADHD and between ASD and motor impairment, but findings from genetic studies are mixed and remain inconclusive. Supporting genetic overlap though, studies have revealed the highly pleiotropic effect of rare mutations in monogenic syndromes, such as the *FMR1*, *TSC1*/*TSC2* and *NF1* mutations, which have all three been associated with both ASD, ADHD and motor impairments.
Objectives: In this talk, both direct genetic effects as well as non-ASD-specific inherited background susceptibilities that amplify the level of ASD impairment will be discussed.

Methods: The first part of this talk describes a retrospective study in 114 males with a clinical diagnosis of ASD and 114 of their male siblings. In all children, quantitative autistic traits (QAT) were assessed, as well as ADHD symptoms and motor coordination. We examined the extent to which these two—non-ASD-specific—neurodevelopmental traits might contribute to ASD recurrence in the siblings. The second part of this talk portrays the direct genetic effect, and describes (preliminary) data on the neurodevelopmental profile (including ASD and ADHD traits) of children with rare monogenic syndromes, such as Fragile X syndrome, Tuberous Sclerosis Complex and Neurofibromatosis type I.

Results: In siblings of ASD-affected probands over 50% of the variation in autistic impairment—whether ascertained quantitatively or categorically—was predicted by sibling ADHD and motor problems. Preliminary data in children with rare monogenic syndromes demonstrates that neurodevelopmental difficulties such as ASD and ADHD are highly prevalent and often co-occur in these patients.

Conclusions: These studies suggest that background ASD susceptibilities that are inherited but non-specific ("BASINS") play a significant role in the development of ASD, and may contribute to additive genetic liability in the same manner that ASD-specific susceptibilities (such as deleterious mutations) engender ASD risk (Figure 1).

49 **144.049** Onset Patterns in ASD: Early Development, Later Outcomes and the Association with Mitochondrial Dysfunctions.

S. Boterberg[1], *E. Vantroys*[2], *R. Siugzdaite*[3], *R. Van Coster*[4] *and H. Roeyers*[1], *(1)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Department of Pediatric Neurology and Metabolism, Ghent University Hospital, Gent, Belgium, (3)Department of Experimental Psychology, University of Ghent, Ghent, Belgium, (4)Department of Pediatric Neurology and Metabolism, Ghent University Hospital, Ghent, Belgium*

Background: Behavioral signs of ASD emerge through different patterns: early onset, regression and plateau. Regression is assumed to be characterized by a 'typical' development, followed by a loss of previously acquired skills at a mean age of 21 months in 33% of the children with ASD. Recently, a meta-analysis on mitochondrial dysfunctions (MD) in ASD demonstrated an overall prevalence of 5%. Children with ASD+MD showed more seizures, motor delay, gastro-intestinal abnormalities and an elevated lactate (a biochemical marker of MD). Furthermore, in 52% of the cases, regression was noted.
More insight into the course, prevalence and pathogenesis of onset patterns in ASD would be of significant diagnostic and clinical value.
Objectives: The first purpose is to explore the trajectories of onset patterns in ASD and long-term outcomes. Second, we want to examine the presence of MD and their association with the severity of ASD-symptoms and regression.

Methods: Participants were 100 children with ASD (*M* age=7.48y,sd=1.98,range=3-11y;70% boys). Parent report was used to measure early ASD-symptoms and classification to onset group (EDQ,ADI-R,RSQ). Non-verbal intelligence was measured through the WNV and current severity of ASD-symptoms by the ADOS-2. Screening of MD included measurement of lactate in urine and near-infrared spectroscopy (fNIRS) in the brain.

Results: The results revealed an early onset (≤12m;38%), a later onset (>12m;34%) and an early onset+regression group (10%). Other children had a typical development followed by regression (13%) or plateau (5%). Regression (*M* onset=22m) involved in 78% of the children loss of language skills. Children with regression (ASD-R) showed significantly lower non-verbal intelligence scores (*M* IQ=81.50,sd=21.47) compared to children without regression (ASD-NR;*M*IQ=93.04,sd=20.18;*t*(94)=2.321,*p*<.05). Examination of current severity of ASD-symptoms showed significantly more symptoms in ASD-R (*U*(98)=1152.5,*p*<.05).
Based on the lactate results, the children were divided into three groups: low lactate (*n*= 20;*M*=2.05mg/dL,sd=.84), medium lactate (*n*=58;

M=5.45mg/dL,sd=1.75) and high lactate (*n*=20;*M*=11.52mg/dL,sd=2.55). Examination of early and current severity of ASD-symptoms showed no significant differences between the two extreme groups. Furthermore, no significant differences in non-verbal intelligence were found between the low (*M* IQ=87.37,sd=24.60) and the high lactate group (*M* IQ=90.75,sd=23.40; *t*(37)=.441;*p*=.662). The proportion of ASD-R did not differ between the high and the low lactate group ($\chi^2(1)=3.135; p=.08$). In addition, there was no significant difference between the lactate value of ASD-R (*M*=5.27mg/dL,sd=2.93) compared to ASD-NR (*M*=6.23mg/dL,sd=3.77;*U*(98)=757.5,*p*=.281). However, preliminary fNIRS results showed a significant difference between ASD-R and ASD-NR in the curves of the oxy-hemoglobin response in the temporal lobe of the right hemisphere (*z*=3.215;*p*<.05).

Conclusions: We found support for different onset patterns previously suggested in the literature. Further, ASD-R display more severe impairments later in life as measured by non-verbal IQ and ASD-symptomatology.
Based on lactate in urine as a biochemical marker of MD, no significant differences in the severity of ASD-symptoms and onset patterns were found. Still, there is a need for further examination since normal lactate levels have been reported in case studies of ASD+MD. Furthermore, preliminary analysis of fNIRS data showed a higher oxy-hemoglobin level in the brain of ASD-R. Final fNIRS results will be presented at the conference.

50 **144.050** Parent-Infant Interaction in Infants with Neurofibromatosis Type 1

M. W. Wan[1]*, S. Garg*[1]*, A. Kolesnik*[2]*, E. J. Jones*[3]*, J. Green*[1] *and M. H. Johnson*[4]*, (1)University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (2)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom of Great Britain and Northern Ireland, (3)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (4)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Neurofibromatosis Type 1 (NF1) is a single gene autosomal dominant syndromic model of autism with a prevalence of 1 in 3000 with well described neurobiology in animal models . Unlike ASD, NF1 can be diagnosed in infancy using cord blood testing for mutations in affected families .. A recent case series describes the first developmental profiles of infants with NF1 and reports delayed or impaired motor and communicative skills in all cases relative to infants at high familial risk who were subsequently diagnosed with ASD (as well as high-risk infants that were typically developing and low-risk controls). Since infants who are later diagnosed with ASD show parent-infant interactions that diverge from those seen in typical development from around 9-10 months of age, infants with NF1 may show further divergence in such interactions, with implications for their social and communicative development.
Objectives: As part of the prospective Early Development in Neurofibromatosis Type 1 (EDEN) project, we examined the interactions of 12 ten to 11-month-old infants with NF1 with their parents. The aims are: (1) to describe their parent-infant interactions, (2) to compare their interactions to those of high-risk infants with later ASD (from the British Autism Study of Infant Siblings; BASIS), high-risk infants with typical development, and low-risk infants; (3) to explore the associations between the parent-infant interactions of infants with NF1 and concurrent motor, communicative, social and cognitive functioning.

Methods: The validated Manchester Assessment of Caregiver-Infant Interaction (MACI) is a global measure used to evaluate seven areas of interaction. Evaluations of 6-min videotaped unstructured play interaction were made by two independent trained coders blind to all family information. The Mullen Scales of Early Development and Vineland Adaptive Behavior Scale (Parent Form) were completed as part of a battery of assessments.

Results: The parent-infant interactional styles of these infants will be described, highlighting how high object (toy) interest and low attentiveness to parent seem to have differential impacts on parental response that affect the infant's social experience. Aspects of parent-infant interaction were correlated with their concurrent motor and communicative scores, but not their social and cognitive scores. We will report on group differences in MACI (parent-infant interaction) ratings.

Conclusions: Our findings are consistent with the interpretation that the early emergence of motor and communicative difficulties in infants with NF1 impact social interactions with their parents in specific ways that may reduce the social opportunities, which are important for their communicative and social development. Furthermore, unlike infants at familial risk of ASD, who have at least one older sibling, these infants do not necessarily have a sibling. Thus, these early findings may be taken as support for altered parent-infant interaction being the result of the emergence of early neurodevelopmental markers rather than learned interactive styles (from interacting with the older child in the case of ASD).

51 **144.051** Predicting ADOS Scores Based on Behavioral Ratings from Parents and Pre-School Teachers

E. Nilsson Jobs[1]*, S. Bolte*[2] *and T. Falck-Ytter*[3]*, (1)Karolinska Institute, Stockholm, Sweden, (2)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (3)Karolinska Institutet & Uppsala University, Uppsala, Sweden*

Background:
Information from different informants such as parents and teachers is regarded as valuable as it can contribute to early detection of autism spectrum disorder (ASD; Dereu et al., 2012) and lead to a greater understanding of how the child is functioning in different environments. However, information can differ between informants (Rescorla et al., 2014; Stratis & Lecavalier, 2015). The ASEBA Preschool Forms Child Behavior Checklist (CBCL) and Teacher Report Form (C-TRF) 1.5 - 5 years (Achenbach & Rescorla, 2000) are often used as screening instruments for behavioral symptoms and psychiatric conditions in children. Among other scales, the forms include a total problem scale and a scale that is related to autism symptoms, i.e. Pervasive Developmental Problems (PDP). It is still rather unexplored how well these scales are correlated with clinical assessment of ASD symptoms.

Objectives:

The aim of the study was to investigate how much variance of the ADOS – 2 comparison scores (CS) can be explained by scores on the CBCL and C-TRF (total problem scale and the autism-related PDP scale). We expected that scores from both parents (CBCL) and pre-school teachers (C-TRF) would predict autism symptoms, measured by the ADOS-2 CS at 3 years of age. We also explored if any of the two informants contributed more than the other to the model.
Methods:

Fifty-seven 3-year-old children from an at-risk-for-ASD sibling study (33 (18 girls) high-risk-for-ASD with no diagnosis; 10 (5 girls) high-risk-for-ASD with ASD diagnosis and 14 (7 girls) controls) participated. Multiple linear regressions with CBCL and C-TRF entered as predictors were conducted separately for the total problems scale and the autism related PDP scale, with ADOS- 2 CS as the dependent variable throughout.

Results:

For the total problems scales, the model was significant (R^2 = .189, *P* =.004), and neither CBCL nor C-TRF contributed uniquely to the prediction of ADOS-scores (*Beta*s = .309 - .189, *P*s = .186 - .237). For the PDP-scale, the model was significant (R^2 = .298, *P* = < .001) and only the preschool teachers' ratings contributed uniquely to model fit (*Beta* = .538, *P* = .010, explained variance 23 %). This pattern of results was also replicated when excluding all low-risk participants from the analyses.

Conclusions:

Combined, behavioral ratings based on the CBCL and C-TRF explained a substantial proportion of the variance in the ADOS scores. Parents´ scores on the CBCL total and PDP subscales did not give a unique contribution to the prediction of ADOS scores over and above the contribution provided by preschool teachers' ratings. In contrast, the pre-school teachers' ratings on the PDP scales (but not total scores) made a unique contribution to the prediction of ADOS-2 CS- scores. This suggests that pre-school teachers' ratings may be particularly useful in the context of early diagnosis of autism.

52 **144.052** Predictors of Language Development in Young Children with Autism Spectrum Disorder: A Longitudinal Study

C. C. Wu[1] *and C. W. Shen*[2]*, (1)Department of Psychology, Kaohsiung Medical University , Kaohsiung, Taiwan (Province of China), (2)Kaohsiung Medical University, Kaohsiung, Taiwan*

Background: Previous studies have shown that early language ability is related to long-term outcomes and adaptive function in children with autism spectrum disorder (ASD). It is an important issue to explore predictors of language development in young children with ASD. Joint attention and imitation were supported that they could enhance language development in young children with ASD. However, there were few longitudinal studies to examine that both joint attention and imitation contribute to language development in young children with ASD under 36-months-old.

Objectives: The purpose of this longitudinal study was to examine that joint attention and imitation predict language development in young children with ASD less than 36 months.

Methods: The participants were 74 young children with ASD aged 17-35 months (*M* = 24.2, *SD* = 4.4) at initial assessment who were followed up 18 months after their initial assessment. The Screening Tool for Autism in Two-Year-Olds, Taiwan version (T-STAT; Chiang et al., 2013) was modified for measuring joint attention and imitation, including initiating joint attention, responding joint attention, object imitation and manual imitation. In addition, Mullen Scales of Early Learning (MSEL; Mullen, 1995) was used for assessing language abilities, including receptive language, expressive language and overall language. Joint attention and imitation were assessed at initial assessment and language abilities were assessed at two time points.

Results: Language abilities at 24 months, all of receptive language, expressive language and overall language were concurrent correlated with joint attention and imitation. The significant concurrent predictors of receptive language and overall language were responding joint attention and manual imitation. In addition, the significant concurrent predictor of expressive language was manual imitation. Language abilities at 42 months, all of receptive language, expressive language and overall language were longitudinal correlated with responding joint attention and imitation. The significant longitudinal predictors of receptive language and overall language were responding joint attention and manual imitation. In addition, the significant longitudinal predictor of expressive language was manual imitation.

Conclusions: Results of this longitudinal study showed that responding joint attention and imitation were concurrent and longitudinal correlated with language abilities in young children with ASD. However, initiating joint attention was only concurrent correlated with language abilities in young children with ASD. The results showed that manual imitation was the stronger predictors for receptive language, expressive language and overall language at 24 months and at 42 months in young children with

53 **144.053** Prospective Investigation of Early Clinical Predictors of Autism Spectrum Disorders in Infants with Tuberous Sclerosis Complex: First Analysis from the Epistop Project

A. Benvenuto[1]*, R. Moavero*[2]*, M. Siracusano*[3]*, L. Emberti Gialloreti*[3]*, E. Aronica*[4]*, A. Jansen*[5]*, F. E. Jansen*[6]*, S. Jozwiak*[7]*, K. Kotulska-Joswiak*[7]*, D. Kwiatkowski*[8]*, L. Lagae*[9] *and P. Curatolo*[1]*, (1)University of Rome Tor Vergata, Rome, Italy, (2)Systems Medicine, Division of Child Psychiatry, University of Rome Tor Vergata, Rome, Italy, (3)Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy, (4)Academisch Mediche Centrum, University of Amsterdam, Amsterdam, Netherlands, (5)Vrije Universiteit Brussel, Brussels, Belgium, (6)University Medical Center Utrecht, Utrecht, Netherlands, (7)Children's Memorial Health Institute, Warsaw, Poland, (8)Brigham and Women's Hospital, Harvard Medical School, Boston, MA, (9)University of Leuven, Leuven, Belgium*

Background: Tuberous sclerosis complex (TSC) is a genetic multisystem disorder that confers a high risk of early neurodevelopmental conditions. Little is known about early onset of developmental delay and of autism spectrum disorders (ASD) in this high risk population. The EPISTOP project is a multi-center prospective European study focused on evaluating clinical and molecular biomarkers of epileptogenesis and neurodevelopmental disorders in the genetic model of TSC.

Objectives: The objective of the work package 7 of EPISTOP is to identify early neurodevelopmental outcome in TSC patients in the first months of life. The main goal of this preliminary analysis is to identify early deviation in developmental trajectories and in specific skills potentially predictive of ASD onset.

Methods: 99 EPISTOP TSC subjects were prospectively followed from age of 6 months with Bayley Scales of Infant Development (BSID) for the evaluation of cognitive, language and motor level. Autism Diagnostic Observation Schedule (ADOS) was administrated from 12 months for the identification of ASD risk. All tests were repeated every 6 months up to 24 months of age. At this moment, data collection is still ongoing. We focused our analysis on the correlation with BSID sub-quotients at 6, 12 and 18 months and ASD risk based on ADOS total score at 24 months. ADOS and BSID changes over time were evaluated with paired samples t-test. Comparisons between groups were performed, as appropriate, with two-sample t test, ANOVA models, and Pearson's correlations. An alpha level of 0.05 was used for all statistical analyses, which were performed using SPSS v.23.0 (IBM Corp., Armonk, NY, USA).

Results: Data is available for 69 children at age 6 months and 46 at 24 months. At 6 months, 20% of children showed developmental delay in cognitive and language areas, and 53% had an impairment in the motor area of the BSID. At 24 months, an increased percentage of developmental delay (30%) could be observed in all the three developmental quotients. At 6 months, no significant correlations were found between development level of the three BSID areas and ADOS total score (p 0.15). At 12 months, children with lower scores in cognitive and language quotients presented higher risk of ASD calculated on ADOS total score at 24 months (p 0.02). At 18 months, the statistical significance of this correlation increases (p 0.01) and involves all BSID subquotients.

Conclusions: Our preliminary observations show an early deviation from a normal developmental trajectory in infants with TSC in the first 6 months of life, particularly in the motor area. Impairment in cognitive and language level at 12 months could be predictive of ASD at 24 months in these high-risk children. Prospective neurodevelopmental assessment associated with a close neurological and EEG follow-up could be useful to identify early correlation between clinical and neurobiological markers of ASD, to design individualized treatment strategies and to improve both short and long term outcomes for this population.

54 **144.054** Quality of Interaction between Very Preterm Infants and Their Mothers and Its Relationship with General Development and Autism Features

J. Vermeirsch[1], *E. Demurie*[1], *E. Bruyneel*[2], *L. Verhaeghe*[2] *and H. Roeyers*[1], *(1)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Gent, Belgium*

Background: Previous research has indicated that preterm born children have an increased risk for impairments across different domains (e.g., cognition, language) and for neurodevelopmental disorders such as Autism Spectrum Disorder (ASD; e.g., Dudova et al., 2014). Apart from the biological vulnerability, environmental factors such as early parent-child interactions (PCI) also seem to be important to understand differences in developmental outcome associated with ASD (e.g., Wai Wan et al., 2012). It is surprising that, although these early PCI can have a profound impact on the development of preterm infants (PI), to date still little prospective research has been conducted on these interactions and their relationship with later outcome in infants at risk for ASD.

Objectives: This study aimed to compare the early PCI of PI with the PCI of their term born counterparts (TI) and to investigate if the developmental trajectories of PCI are similar in both groups. Among PI, this study also examined whether characteristics of such early interactions can predict the emergence of ASD symptomatology and general development at 36 months.

Methods: Drawing on the model of prospective studies of infant siblings, a longitudinal follow-up study was set up to identify early developmental trajectories. Global aspects of PCI were assessed at 5, 10, 18, 24 and 36 months of age during unstructured play interactions in 67 PI (<30 gestational weeks) and 38 TI and coded with the Coding Interactive Behaviour rating scales (Feldman, 1998). At 36 months, measures of developmental level (MSEL) and language (RDLS) were included and ASD features were observed with the ADOS-2.

Results: Results showed that PI were less involved in the interaction at 10 and 36 months, and their parents exhibited lower sensitive responding at 10 months. Moreover, the dyadic patterns between PI and their mothers were less reciprocal at 10, 24 and 36 months. Preliminary analyses showed that different maternal, child and dyadic factors of PCI in the first two years of life are related to developmental level at 36 months. Maternal sensitivity and intrusiveness at respectively 10 and 18 months and child involvement at 24 months were associated with language comprehension and production at 36 months. We also found significant associations between two child domains of interaction at 10 and 18 months and social affect scores on the ADOS-2 at 36 months. More detailed analyses will be provided at the meeting.

Conclusions: These results indicate that mother-preterm dyads experience more interactional difficulties than mother-full term dyads in the first years of life. This study also provides information on the association between the quality of PCI and different aspects of development in PI, an area that has been analysed in only a few studies. In the PI-group, different characteristics of the quality of PCI were significantly associated with later general development and ASD features. This finding may stress the importance of supporting different aspects of the early PCI in PI because it may lead to better general development and less severe ASD symptomatology later in life.

55 **144.055** Response to Distress in 12-Month-Old Infants with Familial Risk for ASD

L. P. Jackson[1], *N. M. McDonald*[2], *C. Ponting*[3], *S. Jeste*[3] *and M. Dapretto*[4], *(1)UCLA, Los Angeles, CA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)University of California, Los Angeles, Los Angeles, CA, (4)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: Autism spectrum disorder (ASD) is a highly heritable neurodevelopmental disorder characterized by core deficits in social communication skills. Infants with familial risk for ASD (i.e., younger siblings of children with ASD) have a recurrence rate of 18.7%, with infants from multiplex families (i.e., multiple affected siblings) carrying an additional twofold increase in risk compared to those from simplex families (i.e., one affected sibling; Ozonoff et al., 2011). Although several studies have demonstrated deficits in empathic response to others' distress in toddlers with familial risk at 2-3 years of age (Campbell et al., 2017; Hutman et al., 2010; McDonald et al., 2012), only one study has examined empathic responding in infants with familial risk at 12 months, when empathic behavior first begins to emerge in typical development. Here, we examined the response to distress at 12 months in infants at variable risk for ASD (both multiplex and simplex infants) and compared them to low-risk (LR) infants.

Objectives: (1) Compare infant responses to others’ distress at 12 months between risk groups. (2) Examine whether infant responses to others’ distress correlate with standardized measures of social communication skills. (3) Examine whether infant responses to others’ distress predict 18-month ASD symptoms.

Methods: Participants included 23 LR, 26 simplex, and 9 multiplex infants at 12 and 18 months of age. During the simulated distress paradigm, an examiner pretended to hit her finger with a toy mallet. *Attention to distress,* defined by the proportion of time infants paid attention to the person in distress, was coded. Other measures of 12-month social behavior included: Early Social Communication Scales (i*nitiation of joint attention [IJA], initiation of behavioral requests [IBR], response to joint attention [RJA]*) and Autism Observation Scale for Infants (*AOSI total score*). At 18 months, ASD symptoms were measured with the Autism Diagnostic Observation Schedule–Toddler Module (*ADOS-T*).

Results: (1) Attention to distress did not significantly differ based on risk group (table 1), although multiplex infants had lower scores than the other two groups. (2) Attention to distress was significantly positively correlated with IBR, but not IJA, RJA or AOSI at 12 months (table 2). (3) Attention to distress was negatively correlated with the ADOS-T Social Affect score at 18 months (table 2). A linear regression model with all 12-month variables significantly predicted ADOS-T total score (R^2=0.378, F(5,39)=4.731, p=0.002); RJA (b=-0.313) and AOSI (b=0.253) explained the most unique variance in 18-month ADOS-T score.

Conclusions: Findings are consistent with previous work indicating that a lack of response to distress during infancy and toddlerhood is an important early sign of atypical social development, which is specifically related to emerging ASD symptoms and not to familial risk. Results also suggest, however, that it is important to measure a range of social behaviors when assessing risk for ASD. This study highlights the need for early interventions to enhance empathic responses and social communication skills starting as early as 12 months of age. Next steps include examining other aspects of infants' responses to distress, including empathic concern and hypothesis testing.

56 **144.056** Sex Differences in Screening Profiles of Toddlers with Autism

S. James[1], *E. Bacon*[2], *C. J. Smith*[1] *and K. Pierce*[2], *(1)Southwest Autism Research & Resource Center, Phoenix, AZ, (2)Neurosciences, University of California, San Diego, La Jolla, CA*

Background: Research suggests that gender differences in behavior and development exist among typically developing children. For example, female toddlers tend to show more advanced language development and social reciprocity, whereas males demonstrate higher levels of physical activity (Riddoch et al., 2007; Zambrana et al., 2012). Although under-researched, gender-specific behaviors of toddlers with autism are starting to emerge in the literature. For instance, research has found differences in the manifestation of autism symptoms (e.g. females exhibiting fewer stereotypies), which may contribute to male bias in prevalence estimates (Werling & Geschwind, 2013). If sex differences in phenotypic presentations of autism exist, screening and diagnostic measures may need to be re-examined and amended.

Objectives: This study aimed to examine sex differences in screening profiles of toddlers with autism. Specifically, we examined if items on the Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (CSBS) varied between male and female toddlers with autism.

Methods: Data were collected as part of a larger study testing a model designed to detect, evaluate, and treat autism within the first 2 years of life. Analyses for this study focused on 265 toddlers (207 males and 58 females) who failed the CSBS and were found to have autism after receiving a developmental evaluation. Multinomial logistic regression was used to model the relationship between gender and individual CSBS items, controlling for age.

Results: Gender was found to make a significant contribution to predicting only two items of the CSBS (see Table 1): males were more likely than females to score higher on items that address stringing sounds together (OR = 2.39, $p < .05$) and number of words used meaningfully (OR = 2.82, $p < .05$). Approximately one-third (31.6%) of the females, compared to one-fifth (21.3%) of the males, were reported to not string any sounds together. Almost half (46.4%) of the females, compared to one-third (30.1%) of the males, were reported to not use any words meaningfully.

Conclusions: Among toddlers with autism, the only significant gender differences were observed in two facets of expressive language: a male advantage in stringing sounds together and number of words used meaningfully. Inconsistent with patterns observed among typically developing children, this suggests that females with autism identified by the CSBS had more impaired expressive language than their male counterparts. This sheds light on the possibility that the CSBS is better at detecting females with the classic presentation of autism characterized by expressive language delay, and less sensitive in detecting ASD females without expressive language impairment.

57 **144.057** Social Orienting and Joint Attention in 9 to 12 Month Old Children with ASD with and without Intelectual Disability: A Study with Family Home Movies

R. Palomo[1], *S. Ozonoff*[2], *G. S. Young*[2] *and M. Belinchon*[3], *(1)Department of Basic Psychology, Universidad Complutense de Madrid, Madrid, Spain, (2)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (3)Department of Basic Psychology, Universidad Autónoma de Madrid, Madrid, Spain*

Background: Studies analyzing family home movies of young children later diagnosed with autism spectrum disorder (ASD) indicate that social orienting behaviours (looking at faces/people and responding to name) are the earliest identifiable specific symptoms (Baranek, 1999; Osterling et al., 2002). The Social Motivation Model (Dawson et al., 2002, 2005a,b) considers the social orienting deficit observed in autism at the end of the first year as the earliest behavioural consequence of an alteration in the dopamine reward system balance. This model predicts that the imbalance in the social reward system has developmental consequences for social perception as well as for complex behaviours such as imitation, attention disengagement, intentional communication and especially, joint attention (Dawson, Toth, Abott et al., 2004).

Objectives: (1) To compare the early social and communicative development of children between 9 and 12 months old, later diagnosed with ASD, with and without intellectual disability (ID); (2) to test the predictions from the Social Motivation Model (Dawson et al., 2005a,b) that at the end of the first year of life all ASD groups will show social orienting deficits, which will contribute to joint attention impairment.

Methods: We coded family home movies from children with typical development (TD, n=16), ASD with ID (ASD-ID, n=17) and ASD with normal IQ (ASD-N, n= 12). First, we coded the general content from the videotapes (e.g., setting, contexts, type of social activity, number of people in the frame) using an adaptation of Baranek's (1999) code. Then, using Noldus, The Observer 5.0, we analysed several social orienting (social gaze and responding to name) and joint attention (gaze alternation and gestures) behaviours using a coding system based on Dawson's (Osterling et al., 2002).

Results: There were no significant differences in the general content of the tapes. There were no significant differences found in any of the social orienting behaviours coded or total time the children expressed positive or negative emotions. Children with TD used significantly more vowel vocalizations than both ASD groups. Compared with TD, the ASD-ID group showed significantly fewer initiations of joint attention (IJA). The ASD-N group tended to show the same pattern but differences from the TD group did not reach statistical significance. There were no significant differences in any behaviour between the two ASD groups. Social orienting behaviours were not significantly correlated with IJA gazes or gestures in either the total sample or within any of the groups. A discriminant analysis using a dichotomous classification (TD vs ASD) showed that the combination of IJA and orienting behaviours was the best predictor of diagnosis, correctly classifying 73.3% of the participants. Individually, IJA classified 71.1% of the participants, while orienting behaviours 62.2%.

Conclusions: We did not find social orienting difficulties between 9-12 month olds with TD and those who went on to develop ASD but we did find significant differences in IJA development. Thus, our results don't support the predictions of the Social Motivation Model, implying that IJA impairment in ASD is developmentally independent of and not preceded by social orienting deficits.

58 **144.058** Symptom Severity Trajectories from Infancy to Childhood in Siblings at Risk for Autism Spectrum Disorder: Social Affect and Restricted and Repetitive Behaviors.

M. Franchini[1]*, E. Duku*[2]*, V. Armstrong*[3]*, J. A. Brian*[4]*, S. E. Bryson*[5]*, N. Garon*[6]*, W. Roberts*[7]*, C. Roncadin*[8]*, L. Zwaigenbaum*[9] *and I. M. Smith*[10]*, (1)Dalhousie University / IWK Health Centre, Halifax, NS, Canada, (2)McMaster University, Hamilton, ON, Canada, (3)IWK Health Centre / Dalhousie University, Halifax, NS, Canada, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Dalhousie University, Halifax, NS, Canada, (6)Mount Allison University, Sackville, NB, Canada, (7)isand, Toronto, ON, Canada, (8)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, Canada, (9)University of Alberta, Edmonton, AB, Canada, (10)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA*

Background: Siblings of children with autism spectrum disorder (ASD) show an increased risk (up to 18.7%) of developing the same disorder and an additional 28% rate of sub-clinical manifestations, developmental delays or deficits in other areas of development/behavior. However, the distinctive patterns by which the early symptomatology emerges in these children remain unclear.
Objectives: Here, we aim to define distinct developmental trajectories for ASD symptom severity for the total score and social affect (SA) and restricted/repetitive behaviors (RRB) subdomains of the Autism Diagnostic Observation Schedule (ADOS). Trajectory groups were examined from 1.5 years to 5-7 years of age. Early clinical and cognitive predictors (before 1.5 years of age) will also be determined for each measure

Methods: We used Group Based Trajectory Models (GBTM) to derive early symptom severity trajectory groups for three diagnostic measures: Total, SA and RRB scores from the ADOS at 18, 24, 36-42, and 60-84 months of age. The sample was composed of 502 high-risk siblings (281 males), of whom 128 received an ASD diagnosis at 36 months. Clinical and cognitive measures were also collected before this period (at 6, 12 and 18 months), with respectively the Autism Observational Scale for Infants (AOSI) and the Mullen Scales of Early Learning (MSEL). Predictors and diagnostic membership were examined according to the derived trajectory groups of symptom severity for each of the three diagnostic measures.

Results: Analysis revealed three distinct trajectory groups for the symptom severity Total score and two for each subdomain (SA and RRB). Pairwise comparisons between trajectory groups for quadratic slope estimates revealed significant differences for all comparisons (all $p<.001$). No significant difference in the intercepts was evidenced between trajectories for the Total score (all $p>.24$), but there were differences for the two subdomains (all $p<0.01$). As expected, children with an ASD diagnosis were more likely to be in the trajectory groups with the highest scores on Total, SA and RRB measures. Finally, from 6 months of age, language-related cognitive measures at the MSEL were more predictive of SA trajectory membership, and motor skills at RRB trajectory membership. From 12 months of age, AOSI clinical scores were also highly predictive of severity score trajectory membership for all three diagnostic measures.

Conclusions: Our results confirm substantial heterogeneity in the early emergence of ASD symptomology in children at high risk for ASD. The results also suggest that ADOS SA and RRB subdomain severity scores yield distinctive trajectories with distinctive predictors. The current study has clinical implication in revealing developmental heterogeneity in the early emergence of ASD symptomology in each diagnostic criterion domain.

59 **144.059** Temperament As an Early Risk Marker for Autism Spectrum Disorders in a Cohort of the British Autism Study of Infant Siblings (BASIS)

M. K. J. Pijl[1,2]*, G. Bussu*[3]*, T. Charman*[4]*, M. H. Johnson*[5]*, E. J. Jones*[6]*, I. J. Oosterling*[2]*, N. N. J. Rommelse*[7]*, J. K. Buitelaar*[8,9] *and &. The BASIS Team*[10]*, (1)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Centre Nijmegen, Nijmegen, Netherlands, (2)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (3)Donders Institute for Brain, Cognition and Behaviour, Radboudumc, Nijmegen, Netherlands, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (6)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (7)Department of Psychiatry, Donders Institute for Brain, Cognition and Behaviour, Radboud university medical center, Nijmegen, Netherlands, (8)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (9)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (10)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom*

Background: Since temperamental traits can be linked to neurobiological systems and are already measurable at an early age, potentially before autistic symptoms emerge, temperament could be used as a potential early risk marker for autism spectrum disorders (ASD). Previous studies revealed that the known three temperamental constructs (i.e. surgency [SU], negative affect [NA], regulation/effortful control [EC]) are associated with ASD from infancy onwards. This study aims to investigate temperament as an early risk marker in a high-risk (HR) and low-risk (LR) infant sibling design.
Objectives: (1) Investigating group differences in early temperament *at* and *across* multiple time points between HR-ASD (HR siblings subsequently diagnosed with ASD), HR-Atypical (HR siblings not diagnosed with ASD, but following an atypical development), HR-Typical (HR siblings with a typical development), and LR siblings, and (2) Predicting ASD and atypical development at 36 months at an individual level based on temperament during the first two years of life.

Methods: As part of the British Autism Study of Infant Siblings (BASIS), 247 infants (170 HR, 77 LR) participated in a battery of assessments during their first three years of life. Parents completed the Infant Behavior Questionnaire-Revised (IBQ-R) at 8- and 14 month visits, and the Early Childhood Behavior Questionnaire (ECBQ) at the 24 month visit. (1) MANCOVAs were used to investigate whether a risk gradient was present in polynomial group contrasts (HR-ASD > HR- Atypical > HR-Typical > LR) at separate time points. In post-hoc analyses pair wise group contrasts were examined across time by performing two-way mixed ANCOVAs. (2) Machine learning algorithms were used to investigate how temperamental measures at 8, 14 and 24 months related to atypical development, and more specifically ASD, at an individual level. Sex and age at the first visit were included as covariates in all analyses.

Results: (1) Risk gradients were found for SU at 14 months (Contrast Estimate [CE] = 0.40, $p = 0.02$), NA at 8, 14 and 24 months (CE = -0.46, $p = 0.004$;

CE = -0.38, *p* = 0.02; CE = -0.69, *p* < 0.001, respectively), and EC at 14 and 24 months (CE = 0.69, *p* < 0.001; CE = 0.84, *p* < 0.001, respectively). Furthermore, differences were found between groups based on both early trajectories (as revealed by interaction effects between group and time) and levels (as shown by main group effects) of temperament. (2) None of the temperamental traits was able to accurately predict ASD at 36 months. For prediction of HR-ASD, the combination of all factors at 24 months provided the most promising classifier (AUC=72%, *p*=0.02). For prediction of atypical outcome (i.e., HR-ASD plus HR-Atypical), the integration of EC and NA at 24 months provided the most promising classifier, but performance was not significantly different from chance level (AUC=61%, *p*=0.056).

Conclusions: Our findings indicate that although differences on temperamental traits at a group level can be detected early in infancy, this does not necessarily translate into an acceptably accurate individual classification. Explanations for findings and recommendations for future research will be discussed.

60 **144.060** The Characteristics of F0 Contours in Speech Directed at Infants at-Risk for Autism

A. Woolard[1], *T. Benders*[2], *F. Karayanidis*[3], *V. Murphy*[4], *C. A. Mallise*[5], *O. Whalen*[1], *L. E. Campbell*[6] *and A. E. Lane*[7], *(1)University of Newcastle, Australia, Callaghan, Australia, (2)Linguistics, Macquarie University, Sydney, Australia, (3)Psychology, University of Newcastle, Australia, Callaghan, Australia, (4)Medicine and Public Health, University of Newcastle, Australia, Callaghan, Australia, (5)The University of Newcastle, Callaghan, Australia, (6)School of Psychology, University of Newcastle, Newcastle, Australia, (7)University of Newcastle, Callaghan, Australia*

Background: The mother-infant interaction mediates early development and sensory regulation, and these interactions largely comprise early sensory experiences for the infant. One way mothers interact with their baby is through infant-directed speech (IDS), which is a unique speech register used by adults when speaking to infants. In particular, IDS can facilitate socio-communicative and language development in infants. One salient aspect of IDS is the trajectory of pitch, known as F0 contours. Research shows F0 contours are associated with infant affect and attention, but less is known about how F0 contours vary across contexts. It is important to understand the role of IDS with infants who are at-risk for socio-communicative, sensory regulation or language delay. Infants later diagnosed with Autism Spectrum Disorder (ASD) display significant impairments in these areas, however there is currently no research investigating how maternal F0 contours are used with these infants. It was hypothesised that infants at-risk for ASD would be spoken to differently when compared to infants not at-risk.
Objectives: The aim of this study was to compare F0 contours used by mothers when interacting with infants at-risk for ASD, to those used by mothers interacting with infants not at-risk.

Methods: Six 12-month-old infants and their mothers participated in a 15-minute recorded interaction. Of the six infants in the study, three were clinically at-risk for ASD (high-risk), and three infants were not at-risk (low-risk). Infant risk for ASD was assessed using the parent-report First Year Inventory, which indicates two areas of risk; socio-communication and sensory regulation (Reznick, Baranek, Reavis, & Crais, 2007). 1039 maternal F0 contours were extracted from the audio recorded during the interaction, and classified into contour types (rising, bell, sinusoidal, u-shape, slowly-falling, rapidly-falling, and complex). Independent samples t-tests were performed to investigate differences in mean proportions of F0 contours used with high-risk and low-risk infants. Pearson product-moment correlations were conducted to determine any associations between ASD risk and the proportion of contours used.

Results: Mothers of high-risk infants spoke a total of 419 utterances during the interaction, compared to 620 spoken by mothers of low-risk infants. Preliminary analyses of contours used between mothers of high-risk infants compared to low-risk infants revealed a difference in frequency of slowly-falling contours, which was approaching significance (*t*=-2.714, df=4, *p*=.053). More complex contours (*r*=.824, *N*=6, *p*=.04) and less rising contours (*r*=-.811, *N*=6, *p*=.05) were associated with a high-risk for ASD. Higher sensory regulation risk was associated with less rising (*r*=-.853, *N*=6, *p*=.031), more complex (*r*=.858, *N*=6, *p*=.029), and more rapidly-falling contours (*r*=.829, *N*=6, *p*=.041).

Conclusions: Although the sample size is small, these preliminary results suggest that infant risk for ASD is related to the way mothers use F0 contours during interactions. This could provide evidence that infants at-risk for ASD, even as early as 12 months-old, are spoken to differently than infants not at-risk. Further research into how mothers use IDS with high-risk infants is recommended and will be presented at the conference, in order to inform early interventions that could improve outcomes for children diagnosed with ASD.

61 **144.061** The Short Quantitative Checklist for Autism in Toddlers (Q-CHAT-10) As an Early “Red Flag” Screen for Autism Spectrum Disorder: A High-Risk Sibling Cohort Study

S. Raza[1], *L. A. Sacrey*[2], *K. Reid*[1], *S. E. Bryson*[3], *J. A. Brian*[4], *I. M. Smith*[5], *W. Roberts*[6], *P. Szatmari*[7], *T. Vaillancourt*[8], *C. Roncadin*[9], *N. Garon*[10] *and L. Zwaigenbaum*[1], *(1)University of Alberta, Edmonton, AB, Canada, (2)Autism Research Centre, Edmonton, AB, CANADA, (3)Dalhousie University, Halifax, NS, Canada, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)isand, Toronto, ON, Canada, (7)The Hospital for Sick Children, Toronto, ON, Canada, (8)University of Ottawa, Ottawa, ON, Canada, (9)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, Canada, (10)Mount Allison University, Sackville, NB, Canada*

Background: Identifying early risk markers of Autism Spectrum Disorder (ASD) is crucial in order to facilitate earlier detection of ASD and implement targeted interventions to improve functional outcomes. To support utilization in community practice, the development of brief screening tools are warranted. One such screening tool is the Quantitative Checklist for Autism in Toddlers (Q-CHAT), which was developed as an adaptation of the original Checklist of Autism in Toddlers (CHAT). A recent abbreviated version (Q-CHAT-10; Allison et al., 2012) shows promise, but further evaluation of this screen is warranted.
Objectives: The objective of this study was to examine the classification properties of the short Quantitative Checklist for Autism in Toddlers (Q-CHAT-10) as a rapid screen for ASD in a high-risk (HR) sibling population.

Methods: Participants were drawn from an ongoing longitudinal study of early development of ASD, and included 90 high-risk (HR) infants with an older sibling with ASD. For the purpose of evaluating the Q-CHAT-10, the group was further stratified into three groups: (1) HR toddlers who received an ASD diagnosis at 36 months (HR-ASD; *n*=19); (2) HR toddlers who meet the criteria for the broader autism phenotype (HR-broader autism phenotype (HR-BAP); *n*=31) and; (3) HR toddlers that do not meet the criteria for the broader autism phenotype (HR-typically developing (HR-TD); *n*=40). Criteria for BAP were: (1) does not meet criteria for an ASD diagnosis; (2) two or more Mullen subtests at ≥ 1.5 standard deviations (SD) below the mean; and/or (2) one or more Mullen subtests at ≥ 2 SD below the mean; and/or (4) ADOS ≥ 3. *Parent-Report Questionnaire:* The

Q-CHAT-10 is a 10-item questionnaire shortened from the Q-CHAT that assesses a broad range of ASD symptomology. Primary caregivers of HR toddlers completed the Q-CHAT-10 at 18 and 24 months. *Statistical Analyses:* Performance on the Q-CHAT-10 was compared between groups (HR-ASD, HR-BAP, HR-TD) at 18 and 24 months using two one-way ANOVAs. Group effects were explored using Benjamini & Hochberg (1995) corrections for multiple comparisons. To assess predictive ability, the sensitivity and specificity of 18- and 24-month Q-CHAT-10 scores were examined relative to the 36-month ASD diagnoses, at an individual level using the suggested cut-point of 3 (Allison et al., 2012).

Results: Higher total score on the Q-CHAT-10 differentiated the HR-ASD group from HR-BAP and HR-TD groups at both 18 ($q \leq 0.009$) and 24 months of age ($q \leq 0.001$), indicating greater frequency of ASD symptoms at these time points. Estimates of sensitivity and specificity of the Q-CHAT-10 were 0.58 and 0.72 at 18 months, and 0.59 and 0.84 at 24 months, respectively.

Conclusions: While the Q-CHAT-10 was able to distinguish groups of children with ASD from other HR toddlers who are typically developing or who exhibit the broader autism phenotype, individual classification by the Q-CHAT-10 for ASD versus not ASD was relatively poor in this limited sample. Thus, while the Q-CHAT-10 was able to identify group differences, individual classification was not sufficient to support screening in this HR sibling cohort.

62 **144.062** The Utility of a Social Emotional Questionnaire in Identifying Autism Symptomatology in Toddlers with Autism Spectrum Disorder

C. Beacham[1]*, H. Grosman*[2]*, M. Lambha*[3]*, T. Jacobsen*[4]*, S. Richardson*[5] *and C. Klaiman*[6]*, (1)Marcus Autism Center, Children's Healthcare of Atlanta, and Emory University School of Medicine, Atlanta, GA, (2)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (3)Marcus Autism Center/Children's Healthcare of Atlanta, Atlanta, GA, (4)Emory University, Atlanta, GA, (5)Marcus Autism Center, Atlanta, GA, (6)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder that, among other things, can result in deficits in social emotional functioning (APA, 2013). The Ages and Stages Questionnaire: Social Emotional (ASQ:SE) is a social emotional screening instrument for children 1 through 72 months of age, but has rarely been used as a screener in children suspected of having ASD. Since the ASQ:SE screens for difficulties in self-regulation, compliance, communication, adaptive behaviors, autonomy, affect and interaction with people, it may be an ideal adjunct to more commonly used screening tools for ASD to ensure that we are comprehensively understanding the profiles of individual children with ASD.
Objectives: The current study seeks to examine the ability of the ASQ:SE to accurately screen for ASD symptomatology in toddlers 16-43 months who have been referred for an ASD evaluation.

Methods: Participants included 130 toddlers (103 males) who were participating in a larger research study examining the efficacy of eye-tracking technology in distinguishing children with ASD from those without. Of the 130 toddlers, 116 (93 males) received an ASD diagnosis and the others displayed no clinical concerns. Caregivers completed the ASQ:SE as well as the M-CHAT-R prior to their appointment. Each participant was also assessed with the Mullen Scales of Early Learning (Mullen) and the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2).

Results: The ASQ:SE was strongly correlated with scores on the M-CHAT-R ($r(128) = .479$, $p < .0001$). Total scores from the ASQ:SE were significantly negatively correlated with all assessed domains of the Mullen ($p < .05$). Additionally, on the ADOS-2, Social Affect, Restricted/Repetitive Behaviors, and total scores were all significantly positively correlated ($p < .05$). See Table 2. 91.4% of children who were identified as having ASD failed the ASQ:SE, whereas 85.3% failed the M-CHAT-R. Of the 17 children who did not fail the M-CHAT-R, the ASQ:SE identified 10 of them who ended up with the ASD diagnosis. No differences were found between the children who failed the ASQ:SE and the children that did not. Characteristics, including behavioral patterns, of toddlers who passed the screening tools despite having an ASD diagnosis will be examined.

Conclusions: Social emotional screening tools can be helpful additions to identifying children with ASD. In combination with ASD specific screening tools, such as the M-CHAT-R, almost 94% of children, who had an ASD diagnosis were identified. The ASQ:SE was able to identify an additional 8% of children that the M-CHAT-R would have missed if used in isolation. The children assessed in this study were those whose parents or other professionals already had a concern about ASD, and thus, it is interesting that screening tools did not identify all children. Children who did not fail the ASQ:SE did not differ in their presentation when compared to children who failed it. This study shows results that indicate that the ASQ:SE could be a useful complement to identifying children with ASD within a diagnostic work up. Limitations including age restrictions on the M-CHAT-R will be discussed.

63 **144.063** Trails Next – Tracking the Next Generation

J. S. Richards, ***A. M. Sluiter-Oerlemans****, A. J. Oldehinkel and C. A. Hartman, Department of Psychiatry, Interdisciplinary Center Psychopathology and Emotion Regulation (ICPE), University Medical Center Groningen, Groningen, Netherlands*

Background:
Parental characteristics (e.g., personality, social-cognitive ability, psychopathology) are important predictors of parenting, and their interaction with environmental (e.g., SES, social support, and chronic difficulties) and child (e.g., temperament, behavior) factors has been acknowledged theoretically. However, little empirical research has comprehensively examined this interplay using detailed information about young adults and their social contexts as predictors of variation in parenting. Additionally, literature has suggested long-lasting interactions between individual characteristics and contextual factors like stressful life events. Evidence has been increasing for such person-environment (PxE) transactions and their associations with mental (ill-)health.

Studying the transactions of parental characteristics and environmental circumstances allows us to understand in much greater detail than before under which conditions particular parenting styles are especially (mal-)adaptive. It also allows us to determine whether and how PxE transactions and their consequences for mental (ill-)health reach into next generations. Such a detailed understanding provides a solid knowledge base for developing personalized and contextualized prevention and treatment efforts.
Objectives:
TRAILS Next aims (a) to study parent and child development as early as possible and elucidate transgenerational mechanisms of child and adolescent development and psychopathology, as well as (b) to clarify the role of social context and of life events and long-term difficulties herein.

Methods:

TRAILS Next is nested within the longitudinal cohort study Tracking Adolescents' Individual Lives Survey (TRAILS), see Figure 1. The current add-on study focuses on the children of TRAILS participants and their partners. Development of cognitive ability, personality and mental (ill-) health as well as environmental conditions have been studied in the prospective parents since TRAILS began in 2000-2004 when participants were approximately 11 years old (N=2773). In TRAILS Next, parents are followed from pregnancy onwards. At T1, pre- and postnatal parental experiences are collected up to when the baby is 3 months old (T2). At T2, a home visit is planned, including a short observation (motor activity of the baby, parent child-interaction), and an interview asking about major life events. Questionnaire data on parental psychopathology (including ASD symptoms), personality, parenting, and child temperament, social competence, and mental health (including ASD symptoms) are also collected. At T3, when the child is 30 months, questionnaire data as well as observational data (parent child interactions, play and tasks) are collected. At T4, questionnaire data will be collected from parents and teachers when the child is 54 months, see Figure 2.

Results:

TRAILS Next started in February 2015 and over 80 children and their parents have been included in the study so far. During this poster presentation, we present the most recent numbers and provide an (preliminary) overview of the study cohort characteristics.

Conclusions:

Findings from this study will help us understand the complex interplay of determinants of parenting and to what extent and which specific parenting and parent-child relationship dimensions explain associations between parent characteristics and child developmental outcomes. In addition, results will expand our understanding of how PxE interactions and their associations with parental mental (ill-)health reach into the next generation and are predictive of child developmental outcomes.

64 **144.064** Trajectories of Attention, Regulation, and Motor Organization from Birth to 6-Months for Infants at Risk for ASD

J. Bradshaw[1,2], *C. McCracken*[3], *C. Klaiman*[3], *L. Evans*[4], *C. Hendrix*[5] *and C. A. Saulnier*[6], *(1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Marcus Autism Center, Atlanta, SC, (3)Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, (4)Marcus Autism Center, Atlanta, GA, (5)Emory University, Atlanta, GA, (6)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: Although autism is believed to be a congenital disorder, little is known about its course in the neonatal and early infancy period. Yet from the first days of life, rich social interactions are present, facilitated by requisite neonatal neurological and behavioral organization. While neonatal neurobehavior (e.g., attention, regulation, and motor organization) sets the stage for the earliest forms of social interaction, these measures have rarely been used to understand the emergence of social-communication and ASD. The very early period between birth and 6-months spans key neurodevelopmental transitions wherein disruptions may, in part, determine the emergence of social and communication impairments.

Objectives: This study aims to 1) quantify neonatal and early infant trajectories of attention in infants at risk for ASD, 2) quantify trajectories of self-regulation and motor control that may be associated with attention, and 3) determine whether early patterns of attention are associated with later social-communication skills.

Methods: Participants included 42 high-risk infant siblings of children with ASD and 38 low-risk infants with no family history of ASD. Infants were administered the NICU Network Neurobehavioral Scale (NNNS) monthly from 1-week to 6-months, and the Communication and Symbolic Behavior Scales (CSBS) at 12-months. The NNNS is a reliable, standardized, measure that uses direct assessment to quantify neurological integrity, which forms the requisite basis for social interactive capacities. The attention item of the NNNS captures the infant's ability to orient to animate (faces) and inanimate (objects) stimuli that are presented in auditory-only, visual-only, and combined auditory-visual modalities. Generalized linear mixed effect models were used to compare trajectories of attention, self-regulation, and motor control between high-risk and low-risk infants. Because the relationship between age and attention was non-linear, splines functions were used to model the effect of age. Spearman correlations were used to assess the association between very early attention and later social-communication.

Results: High-risk and low-risk infants exhibited significantly different trajectories of attention from birth to 6-months [$F(12,179)=25.88; p<0.001$], with pronounced significant differences occurring between 1½ to 3-months (see Fig. 1). Investigation of the six items that make up the attention score revealed that differences were driven by attention to inanimate stimuli. High-risk infants also scored significantly lower on items of self-regulation and head/trunk motor control during this same period between 1½-3 months. Finally, we observed significant associations between social-communication at 12-months and attention at 2-months ($r_s=0.36$, $p<0.05$) and 3-months ($r_s=0.45$, $p<0.01$).

Conclusions: Infants at high risk for ASD exhibit divergent trajectories of attention beginning as early as the second month of life. We hypothesize that these differences reflect deficits in attention shifting, decreased sensitivity to social cues, and/or delayed emergence of socially adaptive, cortically-mediated behavior. Further, differences in attention for high-risk infants were accompanied by less efficient self-regulation strategies and motor control. These results provide evidence for a potential cascade of attentional and neurological abnormalities that culminate in social-communication deficits. Understanding how these behaviors are interconnected can help to develop viable early detection methods and bridge the gap between neonatal neurobehavior and complex social development.

65 **144.065** Trajectories of Social Attention in Infants at High Risk for ASD

J. B. Wagner[1], *A. Ahilan*[2], *H. Tager-Flusberg*[3] *and C. A. Nelson*[4], *(1)College of Staten Island, City University of New York, Staten Island, NY, (2)Staten Island Technical High School, Staten Island, NY, (3)Psychological and Brain Sciences, Boston University, Boston, MA, (4)Boston Children's Hospital, Boston, MA*

Background: Work with infants at high risk for ASD (HRA) has found that attention to faces at 6 months is linked to later language ability (e.g., Wagner et al., in press) and that trajectories of change in social attention between 2 and 6 months can identify infants who later receive an ASD diagnosis (Jones & Klin, 2013). More research is needed to understand how trajectories of change in social attention could relate to more continuous measures of developmental outcome.

Objectives: The present study aimed to explore how trajectories of social attention in HRA could relate to individual differences in cognitive and language ability.

Methods: A Tobii eye-tracker assessed attention to faces at 6 and 18 months in low-risk controls (LRC) with no family history of ASD (*n*=25) and HRA (by virtue of an older sibling with ASD; *n*=36). HRA were further divided into two groups based on clinical judgment from the infant's final lab visit at 24 months or older: high-risk ASD-negative (HRA–, *n*=25) and high-risk ASD-positive (HRA+, *n*=11). At both ages, infants saw images of their mother and a stranger side-by-side, and analyses focused on the first two presentations (10s each, sides counterbalanced). Difference scores were calculated between the 6 and 18 month visit for percent time on eyes (%Eyes) and mouths (%Mouths) as a function of total time on faces. The Mullen Scales of Early Learning (MSEL; Mullen, 1995) was used at 36 months to examine language through receptive language (RL) and expressive language (EL) scores and cognitive outcome through the Early Learning Composite score (ELC).

Results: Between 6 and 18 months, infants showed a decrease in %Eyes (*M*=–12.6%) and an increase in %Mouths (*M*=+10.8%). One-way ANOVAs revealed no group difference for changes in attention across age (*p*s>.48). For each group, correlations were run between trajectories of change in %Eyes and %Mouths between 6 and 18 months and MSEL RL, EL, and ELC scores at 36 months. In HRA–, positive associations were found between change in %Eyes and 36mo RL, EL, and ELC (*r*s>.45, *p*s<.05), and a negative association was found between change in %Mouths and 36mo EL (*r*=–.533, *p*=.016). For HRA+, negative associations were found between change in %Eyes and 36mo EL and ELC (*r*s<–.70, *p*s<.025), and a positive association was found between change in %Mouths and 36mo ELC (*r*=.768, *p*=.016; see Figures 1 and 2). No significant associations were found for LRC.

Conclusions: Although groups did not differ in trajectories of change in social attention between 6 and 18 months, individual differences in these trajectories were associated with different language and cognitive outcomes at 36 months, depending on group. For HRA–, increasing attention to eyes and decreasing attention to mouths predicted better language and cognitive skills, while HRA+ showed the opposite pattern, with increasing attention to mouths and decreasing attention to eyes predicting better outcomes. Future work will be needed to ask why changes in social attention that might be adaptive for HRA– might not be adaptive for HRA+, and vice versa.

66 **144.066** Understanding at-Risk Infants: Heterogeneity in Child and Parental Characteristics in a Sample Referred to Early Intervention Research

A. Gulsrud[1], *J. R. Williams*[2], *L. Hughart*[3], *N. Tu*[4], *A. M. Herrera*[5] *and C. Kasari*[3], *(1)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (2)Biostatistics, UCLA, Los Angeles, CA, (3)University of California, Los Angeles, Los Angeles, CA, (4)UCLA Semel Institute, Los Angeles, CA, (5)Semel Institute, UCLA, Los Angeles, CA*

Background: Autism Spectrum Disorder (ASD) can be reliably diagnosed in children as young as two years of age, but behavioral signs of autism can be detected in children as young as 12 months of age. Growing awareness of the disorder and its earliest signs has led to an increased number of referrals for intervention in younger and younger populations and a need to better understand heterogeneity in child and parent factors at the outset of treatment.

Objectives: The goal of this study is to characterize a sample of young children at-risk for ASD referred for an early intervention study by 1) establishing subgroups of children defined by sibling status, 2) exploring the relationship between these established subgroups and measures of social-communication, RRBs, cognitive and language functioning and parental stress, and 3) examining how levels of autism symptomatology relate to parental stress by subgroup.

Methods: A total of 105 at-risk toddlers, 12 to 22 months old, were referred and screened for entry into a clinical trial. 80 of these at-risk toddlers qualified for entry into the trial by scoring with at least mild to moderate concern on the ADOS Toddler module. This population was broken down into three groups: toddlers with no siblings (41%), toddlers with siblings without autism (29%), and toddlers with at least one sibling with autism (30%). These subgroups will be referred to as: No Siblings, No Siblings with ASD, and Infant Siblings, respectively. There was no significant difference in rate of qualification into the study based on sibling status,, p=0.40, although fewer children who were Infant Siblings qualified compared to No Siblings with ASD and No Siblings (71% vs. 85% and 75%). The children were predominately male (81%) and White (47%) with an average age of 17.68 months and standard deviation of 3.10 months.

Results: On average, Infant Siblings presented with lower average levels of restricted and repetitive behaviors compared to No Siblings and No Siblings with ASD (2.46 vs. 2.70 and 3.65; F(2,77) = 4.42, p = 0.02). Infant Siblings also had statistically higher average expressive language age equivalence (12.23 months) compared to No Siblings (10.28 months) and No Siblings with ASD (8.48 months; F(2,72) = 4.33, p = 0.02). Conversely, parents of Infant Siblings reported statistically higher levels of stress on a parental daily hassle questionnaire (52%) compared to parents of No Sibling children (39%) and parents of No Sibling with ASD children (44%; F (2,49) = 3.37, p= 0.04). A positive correlation between ASD symptomatology and parental stress existed for the Infant Sibling group (r=0.28), but no other subgroup showed this association.

Conclusions: This study provides preliminary evidence for child and parent differences in subgroups of young children referred to an early intervention study. Prior to entering into treatment, Infant siblings displayed less RRBs and higher expressive language, yet still had parents with the highest levels of reported stress. Understanding variability in symptom profile and familial factors at the outset of treatment has the potential to assist in determining more tailored intervention approaches.

67 **144.067** Using Head-Mounted Eye Tracking to Examine Sticky Attention in Naturalistic Child-Parent Social Interaction

J. R. Yurkovic[1], *G. Lisandrelli*[2], *R. Shaffer*[3], *E. Pedapati*[4], *C. A. Erickson*[4], *D. P. Kennedy*[1] *and C. Yu*[1], *(1)Psychological and Brain Sciences, Indiana University, Bloomington, IN, (2)Indiana University, Bloomington, IN, (3)Division of Developmental and Behavioral Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (4)Division of Child and Adolescent Psychiatry, Cincinnati Children's Hospital Medical Center, Cincinnati, OH*

Background: Children with autism spectrum disorder (ASD) often display atypical profiles of attention in constrained laboratory tasks (Chita-Tegmark, 2016), but whether these differences manifest in more naturalistic situations remains largely unexplored. One such attentional difference concerns the ability to rapidly disengage attention from one stimulus to another. This "sticky attention" phenomenon has predominantly been studied using a highly constrained and screen-based experimental paradigm, known as the gap-overlap task. Although previous research has demonstrated an impaired ability to disengage in children with ASD and this ability has been associated with ASD severity (Elsabbagh et al., 2013), very little is known about "stickiness" in more naturalistic and real-world contexts – the contexts in which children interact with the environment and their social partners.

Objectives: To determine whether young children with ASD (24-48 months old) exhibit evidence for "sticky attention" -- as operationalized across a number of different quantitative metrics spanning various timescales (from seconds to minutes) -- by using head-mounted eye tracking to measure and quantify moment-by-moment visual attention during free-flowing parent-child toy play, as compared to age-matched typically developing (TD) children.

Methods: Child-caregiver dyads played with 24 novel toys in a toy room space while wearing head-mounted eye trackers (for this study, only child eye tracking was analyzed). Figure 1 shows the experimental set-up. Following eye-tracker set-up, each dyad was given the toys to freely play with, and encouraged to play as they would at home.

Results: Data was acquired from 9 child-caregiver dyads in the ASD group and 16 dyads in the TD group. Sticky attention was operationalized in four ways and spanning different timescales, shown in Figure 2: (a) duration of individual toy looks, (b) proportion of time spent on each object, (c), number of objects looked at throughout the session, and (d) number of returns to objects previously looked at throughout the session.

T-tests revealed that groups did not differ on average look duration or across quartiles of look durations (all *p*s > .10). There were no differences between the ASD group and the TD group on proportion of time spent on the most looked at object (p = 0.85). Groups did not differ on total number of objects looked at during the session (p = 0.30) or on total number of returns to previously looked at objects per session (p = 0.11). Examination of time courses or finer-grained investigations of these behaviors also revealed highly similar patterns of looking and interacting with toys (Figure 2).

Conclusions: Our initial results suggest that “sticky attention”, measured during naturalistic toy play and operationalized in different ways and across different timescales, is not present in 24- to 48-month old children with ASD. Although many researchers have observed abnormalities of attentional disengagement in ASD (but see Fischer et al., 2016) and have speculated on its real-world importance, it remains an open question how such behavioral differences measured using highly constrained laboratory tasks may manifest in real-world behavior. Future analyses will explore the role of the caregiver on the child’s visual looking patterns.

68 **144.068** Using Motion Capture Technology to Characterize Motor Atypicalities in Infants at Risk for Autism Spectrum Disorder

***S. Norin**[1], P. Nyström[1], G. Gredebäck[1], S. Bolte[2] and T. Falck-Ytter[3], (1)Uppsala University, Uppsala, Sweden, (2)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women’s and Children’s Health, Karolinska Institutet, Stockholm, Sweden, (3)Karolinska Institutet & Uppsala University, Uppsala, Sweden*

Background:

Atypical motor behaviors have been reported in infant siblings of children with autism spectrum disorder (ASD) (Leonard et al., 2014). However, studies reporting motor impairments in this population often rely on retrospective data or performance on unspecific standardized tests. In this study, we investigated movements in infants at risk for ASD using motion capture technology, which provides an objective measure of kinematic profiles with high spatiotemporal resolution.

Objectives:

The aim of the study was to investigate kinematic variables linked to motor planning and execution in infants at risk for ASD during an interceptive action task (catching a moving object).

Methods:

Our sample consisted of 58 ten-month-old infant siblings at high familial risk for ASD (HR group, n = 39) and low risk infants without familial history of ASD (LR group, n = 19), participating in an ongoing longitudinal study. Using a design by Ekberg et al. (2016), we assessed the ability to catch a ball, which was rolling towards the infant on a curvilinear path. Movements of the infant and the object were recorded with an eight-camera 3D motion-capture system (Qualisys) using passive reflexive markers. Statistical analysis was performed using linear mixed models.

Results:

The groups did not differ in terms of successful catches. However, using velocity profile analysis and dividing a movement into movement units (acceleration followed by deceleration), we found a group difference implicating atypical planning. The HR group initiated the reach (onset of transport unit, i.e. the movement’s largest subunit) later (M = 284.91 mm (distance to object), SE = 5.50) than the LR group (M = 296.16 mm, SE = 5.53), $F(1, 375) = 4.18$, p = .42. Regarding motor execution, peak velocity of the transport unit was significantly lower in the HR group (M = 1.77 mm/sample, SE = 0.08) than in the LR group (M = 1.94 mm/sample, SE = 0.08), $F(1, 392) = 5.19$, p = .023. Congruently, the distance traveled during the transport unit was significantly lower in the HR group (M = 177.89 mm, SE = 7.13) than in the LR group (M = 196.85 mm, SE = 7.15), $F(1, 392) = 7.06$, p = .008.

Conclusions:

Using detailed motion capture technology, this study was the first to investigate motor function in early development in infants at risk for ASD. Our findings reveal a complex pattern of both later initiation and differences in motor execution, but also intact ability to catch a moving object. The observed movement patterns highlight the importance of fine-grained measures of motor control in addition to more general measures from standardized scales.

69 **144.069** Vocal Imitation Skills Are Associated with Visual Attention to the Face Region in Children with Autism Spectrum Disorders.

***Y. Ishizuka**[1,2] and J. Yamamoto[3], (1)University of Tsukuba, Ibaraki, Japan, (2)Japan Society for the Promotion of Science, Tokyo, Japan, (3)Keio University, Tokyo, Japan*

Background:

In previous studies, imitation skills were classified into two types, motor imitation and object imitation and had been examining how each kind of imitation relates to other communication skills (e.g., Ingersoll & Meyer, 2011a; 2011b). On the other hand, few studies examined the relationship between vocal imitation and the other communication skills. Imitation can also serve two skills, to direct own attention to model stimulus and to do same gestures as model stimulus. However there were few studies to show the association between visual attention and vocal imitation precision (Vivanti, Nadig, Ozonoff, & Rogers, 2008).

Objectives:

The purpose of this study is to investigate the relationship between motor, object, and vocal imitation precision and other communication skills.

Methods:

13 children with autism (CA: 2-5years; DA; 1-3years) were included in this study. We plan to recruit more participants. The experiment was conducted in a testing room at a laboratory. All children participated in the imitation assessment task, eye-tracking assessment task, motor development task, and vocal communication task. They received a structured imitation assessment that included 14 object, 14 motor, and 11 vocal imitation tasks. Each child saw symmetric (e.g. touch own head with own hands) and asymmetric gesture (e.g. touch own head with a hand and touch own stomach with the other hand), self (e.g. touch own head with own hands) and other (touch other's head with own hands) directed gesture on object, and oral (e.g. make noise //a//) and face gestures (e.g. extend tongue). In eye-tracking assessment task, each child was seated in a chair at a table 30 inches from an 23.5 × 13.3 inch monitor and required to look at experimental stimulus. It was composed of object, motor, oral-facial video clips, which was same as imitation assessment task. In motor development task, we evaluate their gross motor and fine motor skills. In vocal communication task, we asked the parents the number of words that the child can understand and express in the social interaction.

Results:

We used Spearman's rank correlation coefficient to examine the associations between each imitation precision and the other communication scores. The result showed that vocal imitation precision was correlated with total time spent looking at face region and mouth region observing stimulus (face; r=.63, p=.03; mouth; r=.52, p=.08). The imitation precision wasn't associated with total time spent looking time at eye region observing stimulus (eye ： r=.14, p=.66). The result showed that vocal imitation precision was correlated with motor developmental scores and vocal communication scores (motor; r=96, p=.001; communication; r=88, p=.002).

Conclusions:

The result demonstrated that vocal imitation skills was correlated with multiple social communication skills. Our findings suggest that teaching vocal imitation is one of the most important for early intervention to increase visual attention to adult, motor development and vocal communication. This study is the first to specifically examine the relationship between vocal imitation precision and visual attention to face region. We plan to collect the data for typically developmental children and compare with these results.

70 **144.070** Vocal-Gesture Profiling at Age 2: Diminished Gesturing Is Associated with Greater Distress in Toddlers with ASD

S. Plate[1]*, N. Libster*[2]*, J. Brown*[1]*, A. Faggen*[1]*, R. F. Slomowitz*[3]*, J. Wood*[1]*, J. Maldarelli*[3]*, J. Pandey*[1]*, R. T. Schultz*[1]*, J. Parish-Morris*[1] *and .. The IBIS Network*[4]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)University of North Carolina, Chapel Hill, NC*

Background: Autism Spectrum Disorder is defined by early and persistent deficits in social communication, as well as restricted interests and repetitive behaviors. Previous research has shown that gesture and language are both atypical in infants who ultimately receive an ASD diagnosis (Colgan et al., 2006; Lazenby et al., 2016; Zwaigenbaum et al., 2005). In this study, we use a system of high-dimensional behavioral coding to explore 2-year-olds' relative use of vocalization and gesture during a structured clinical evaluation. Vocal-gesture profiles generated using this method could help identify homogeneous clusters of children that respond comparably to targeted treatments, or who follow similar developmental trajectories.

Objectives: Examine relative gesture and vocalization use in 2-year-olds at high- or low- risk of ASD that did or did not receive a diagnosis.

Methods: Forty-four 2-year-olds were administered the Communication and Symbolic Behavior Scales (CSBS, Wetherby & Prizant, 2003) as part of the Infant Brain Imaging Study (IBIS; Estes et al., 2015). Participants were classified as LR- (no family history of ASD; N=22, 6 female), HR-neg (high familial risk for ASD, no ASD themselves; N=11, 4 female), or HR-ASD (high familial risk for ASD, ASD themselves; N=11, 1 female). Videos of the CSBS were coded for vocalizations and communicative gestures. Vocalizations were categorized as speech (e.g., words, babbles) or non-speech (distress, delight, and atypical sounds like squealing or growling). To explore relative reliance on vocalization and gestures, we calculated the amount of time each child spent vocalizing and/or gesturing divided by their own total coded behavior duration.

Results: A linear mixed effects model with participant ID as a random effect revealed a significant interaction between group (LR-, HR-neg, and HR-ASD) and behavior type (speech, non-speech, gesture). Compared to the LR- group, the HR-ASD group produced a higher ratio of nonspeech vocalizations vs. communicative gestures (t=2.10, p=.04; Figure). Speech ratios did not differ by group. To determine what type of nonspeech vocalizations the HR-ASD group produced in lieu of gestures, an additional mixed effects model compared nonspeech categories in the HR-ASD and LR- groups. Results revealed that the HR-ASD group produced a significantly larger proportion of distress vocalizations (crying) vs. delight vocalizations (laughing) than the LR- group (t=2.56, p=.01).

Conclusions: Granular profiles of vocal and gestural behavior could help identify homogeneous subgroups of children that respond better to one treatment vs. another, or follow similar developmental pathways. The results of this preliminary study showed that reduced gesturing and increased nonspeech vocalization differentiated the HR-ASD and LR- groups, and that diminished gestural communication was associated with greater distress vocalizations despite similar relative amounts of speech. This suggests that when communicative gestures are diminished, children with ASD do not compensate by adding more communicative speech – rather, they produce more non-speech vocalizations that express distress. Our next steps include tracing the developmental trajectory of these vocal-gesture profiles by coding vocalizations and gestures in the same children at 6 and 12 months, and exploring ways that children use speech and gesture separately vs. in combination (Winder et al., 2013).

71 **144.071** What Is the Relationship between Motor and Language Development and Joint Attention in Infants at High and Low Risk for ASD?

E. Bruyneel[1]*, E. Demurie*[2]*, P. Warreyn*[2] *and H. Roeyers*[2]*, (1)Department of Experimental-Clinical and Health Psychology, Ghent University, Gent, Belgium, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background: Children with ASD and their younger brothers and sisters (high-risk (HR-)siblings) have a high risk of experiencing difficulties in language development. Research shows that both motor development and joint attention are important predictors for later language

development. Since both markers may also influence each other, for example being able to sit makes it possible to show objects, it is important to look into the relationship of these three developmental domains in HR-siblings and in younger siblings of typically developing children (low-risk (LR-)siblings).
Objectives: The aim of the current study was to systematically investigate the relationship of early motor skills and joint attention on expressive and receptive language in HR- and LR-siblings during the first years of life.

Methods: HR-siblings (n = 35) and LR-siblings (n = 37) were followed during the first three years of life as part of a larger longitudinal study. Gross (GM) and fine motor (FM) skills were assessed at 10 and 14 months using the Mullen Scales of Early Learning (MSEL). Joint attention was measured using items (showing, initiating joint attention (IJA), response to joint attention (RJA)) of the Autism Diagnostic Observation Schedule (ADOS-2) at 14 months. Expressive (EL) and receptive language (RL) were measured by the MSEL at 24 months.

Results: HR-siblings had significantly lower scores on GM skills at 10 months (U = 383.00, p = .011) and on FM skills at 14 months (U = 355.00, p = .022). With regard to joint attention, HR-siblings presented a significantly lower quantity and quality of showing behaviors at 14 months. At 24 months HR-siblings had significantly lower scores on EL (U = 338.50, p = .027) but not on RL. In *HR-siblings*, EL at 24 months was correlated with GM skills at 10 months (ρ = .631, p = .00) and FM skills at 14 months (ρ = .546, p = .00). RL was correlated with GM skills at 10 (ρ = .598, p = .00) and 14 months (ρ = .436, p = .01), FM skills at 14 months (ρ = .608, p = .00) and IJA at 14 months (ρ = -.394, p = .03). On its turn, IJA at 14 months is correlated with FM skills at 10 months (ρ = -.440, p = .02). In *LR-siblings*, EL was only correlated with GM skills at 14 months (ρ = .358, p = .04), no correlations were found for RL.

Conclusions: Clear group differences were found for all three developmental domains, with HR-siblings scoring lower than LR-siblings. Correlational analyses showed more associations between these domains in HR-siblings, revealing different patterns in both groups. This indicates that early motor skills and joint attention may be more important in HR-siblings than in LR-siblings with regard to later language development. Implications will be discussed at the conference.

Poster Session
145 - Miscellaneous
11:30 AM - 1:30 PM - Hall Grote Zaal

73 **145.073** Altered Cortical-Subcortical Functional Connectivity in Autism Spectrum Disorders

J. O. Maximo *and R. Kana, University of Alabama, Birmingham, Birmingham, AL*

Background: Studies examining functional brain networks in autism spectrum disorder (*ASD*) have risen exponentially over the last decade and have characterized it as a disorder of aberrant brain network connectivity. While a large number of these functional MRI studies have focused on cortico-cortical connectivity in ASD, limited attention has been paid to cortical-subcortical connectivity. Subcortical regions such as thalamus (*THAL*) and basal ganglia (*BG*) may play a vital role in ASD neuropathology considering their role in sensory processing and cognition.
Objectives: To assess patterns of cortical-basal ganglia and thalamocortical connectivity in individuals with ASD and to examine the relationship between connectivity and ASD phenotype, such as socio-communicative and repetitive behaviors.

Methods: Resting state fMRI data (*TD = 168; ASD = 138; 5-8 minute-long, eyes open scans*) from the Autism Brain Imaging Data Exchange (*ABIDE II*) were used and preprocessed using a standard resting state processing pipeline. Unimodal (*motor, auditory, lateral and medial visual*) and supramodal ROIs (*DMN, posterior DMN, salience, attention, and left and right executive*) were defined using MELODIC ICA. Partial correlation maps were obtained for functional connectivity between cortical ROIs with THAL and BG and mean Z' score obtained for each cortical seed for the ASD group were correlated with clinical measures (*ADOS, ADI-R, and RBS-R*).

Results: For unimodal connectivity, clusters of overconnectivity (*ASD > TD*) were found between THAL (*auditory and motor*) and BG (*auditory and lateral visual*) while clusters of underconnectivity (*ASD < TD*) were also found between THAL and BG with medial visual. Conversely, for supramodal connectivity, clusters of underconnectivity (*ASD < TD*) were found in THAL (*salience, left executive, and posterior DMN*) and BG (*salience and left executive*) while clusters of overconnectivity (*ASD > TD*) were also found in THAL (*DMN and posterior DMN*) and BG (*attention*). Positive correlations were found between medial visual-BG connectivity with ADOS-RRB scores and between auditory-BG connectivity with RBS-R stereotyped behavior. Negative correlations were found between DMN-THAL connectivity with ADI-R verbal scores and salience-THAL connectivity with ADOS-Social scores.

Conclusions: Our findings of altered cortical-BG and thalamocortical connectivity in ASD are consistent with previous studies. This study targeted specific brain networks responsible for key cognitive processes, where overconnectivity (*ASD > TD*) between unimodal and subcortical regions and underconnectivity (*ASD < TD*) between supramodal and subcortical regions were predominantly detected. These findings may suggest excess crosstalk within unimodal regions and subcortical regions that support basic sensory information based on previous activation fMRI studies of visual, auditory and somatosensory systems. On the other hand, supramodal regions may require increased communication for effective higher cognitive functioning with subcortical regions, which may be reduced in people with ASD. The findings of brain-behavior relationship suggest that connectivity profile of unimodal and supramodal networks in ASD may play a role in sensory sensitivity and social communication respectively.

Poster Session
146 - Brain Structure (MRI, neuropathology)
11:30 AM - 1:30 PM - Hall Grote Zaal

115 **146.115** Abnormalities of Local Gyrification in Autism Spectrum Disorders after Age 40 Years

J. S. Kohli[1,2]*, R. A. Carper*[1]*, F. Hassan*[3]*, M. Kinnear*[4]*, A. J. Lincoln*[5] *and R. A. Mueller*[4]*, (1)Brain Development Imaging Laboratories, Department of Psychology, San Diego State University, San Diego, CA, (2)Joint Doctoral Program in Clinical Psychology, SDSU / UC San Diego, San Diego, CA, (3)Psychology, Brain Development Imaging Laboratories, San Diego State University, San Diego, CA, (4)Brain Development Imaging Laboratories, San Diego State University, San Diego, CA, (5)Alliant International University, San Diego, CA*

Background: Although prenatal or early postnatal in onset, autism spectrum disorders (ASDs) are associated with behavioral problems throughout the lifespan. Neurodevelopmentally, evidence shows early cerebral overgrowth in the first years of life, reflected in cortical thickness (CT), surface area (SA), and the local gyrification index (lGI). However, abnormalities across later childhood and adolescence are less well understood, and little is known about adults with ASDs past the age of 40 years, including possible accelerated decline. A few studies extending into early to middle adulthood suggested increased rates of cortical thinning in ASDs in frontal, parietal, and temporal regions. One study reported increased frontal and parietal lGI in participants with ASDs aged 18-43 years, while another detected no differences in gray matter characteristics in individuals aged 30-75 years.
Objectives: The current investigated cortical morphology in adults with ASDs ages ≥40 years, in a comparison with age-matched typical controls (TC).

Methods: T1 weighted MRI sequences (0.8mm isotropic) were collected for 50 participants aged 40–61 years (27 ASD, 23 TC). Following quality assurance, 20 ASD and 21 TC, matched on age, were compared. lGI, CT, and SA were measured using FreeSurfer v.5.3.0. Statistical analyses employed a general linear model including age, non-verbal IQ, and total brain volume as covariates. Vertex-wise correlations between lGI and Social Responsiveness Scale (SRS) scores were calculated. All results were corrected for multiple comparisons using Monte Carlo null-z simulations.

Results: For lGI, significant main effects of group (ASD<TC) were observed bilaterally in insular and anterior cingulate (ACC) clusters, along with left postcentral and middle frontal, and right orbitofrontal and supramarginal clusters. lGI was also shown to decline with age in combined groups in bilateral precentral and right supramarginal clusters. No significant group, age, or group by age interaction effects were observed for CT or SA. lGI showed a significant correlation with SRS total scores in a right caudal ACC cluster (r=.68, p<.001) in the TC group only.

Conclusions: Reduced lGI may suggest accelerated tissue loss in ASDs, possibly consistent with some studies reporting increased cortical thinning in early adulthood. The finding of lGI differences in the absence of CT and SA effects indicates that lGI may be more sensitive to abnormalities of cortical macrostructure in ASDs. Clusters in the insula overlapped with a previous study of children and adolescents, in which lGI was increased in two independent samples of participants with ASDs in regions surrounding earlier developing sulci, and perisylvian regions in particular. This overlap may indicate that regions most affected by early over-gyrification are also more susceptible to subsequent decline in the disorder. Group differences in ACC are of interest given multiple post-mortem reports of its altered cellular density in ASDs and the importance of ACC in social and emotional function. Correlations between lGI and SRS scores in TC in the same region add additional support to the functional relevance of this morphometric measure.

116 **146.116** ADHD Symptomatology and White Matter Development in Autism Spectrum Disorder

A. K. Converse[1], *D. C. Dean*[1], *B. G. Travers*[1], *M. B. Prigge*[2], *E. Bigler*[3], *N. Lange*[4], *A. L. Alexander*[1] *and J. E. Lainhart*[1], *(1)University of Wisconsin - Madison, Madison, WI, (2)University of Utah, Salt Lake City, UT, (3)Brigham Young University, Provo, UT, (4)McLean Hospital, Cambridge, MA*

Background: The symptoms that characterize attention deficit hyperactivity disorder (ADHD) are often found in individuals with autism spectrum disorder (ASD). Abnormal brain white matter has been associated with both ASD and ADHD, however, greater knowledge of white matter abnormalities in comorbid ADHD in ASD may further illuminate the neurobiological substrates of these disorders. Such understanding may help to advance diagnosis and therapy in both of these developmental disorders. We therefore asked whether white matter development differs in ASD according to the degree of comorbid ADHD symptomatology.
Objectives: To examine the influence of comorbid ADHD and ASD symptomatology on developmental trajectories of white matter microstructure.

Methods: Diffusion tensor imaging (DTI) data from male participants (3-45 years, 220 time points) were acquired up to 4 times across 9 years using a 3 Tesla Siemens Tim Trio. ADHD symptom level was measured by the ADHD index and inattentive scores from the Conners' ADHD/DSMIV Scale. Following acquisition, imaging data were corrected for subject head motion and eddy-current distortions and quantitative parameter maps of fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD) and axial diffusivity (AD) were computed. Mean values of these parameters were then computed for a group of five regions of interest from a published meta-analysis of studies relating FA and symptom levels in individuals with ADHD (van Ewijk et al. 2012). Using a linear mixed effects model, DTI measures from these regions were described as a function of age and ADHD symptom level.

Results: In preliminary analyses, no relationships between ADHD symptom level and FA were observed in these regions. However, MD, RD, and AD were correlated with ADHD symptom level across these white matter locations.

Conclusions: Although published reports of reduced FA in the regions examined may partially reflect deficits in the general ADHD population, the present results suggest that it may not be responsible for ADHD symptoms in comorbid ASD. Future work will use voxelwise analysis to search for regions in which altered DTI parameters are associated with elevated ADHD symptomatology in individuals with ADHD. Further study would also be helpful to determine whether or not ADHD with comorbid ASD shares aspects of the neurobiological etiology of ADHD without comorbid ASD.

117 **146.117** Altered Measures of Diffusion at the Grey-White Matter Boundary in Autism Spectrum Disorder

A. Bletsch[1], *C. Mann*[1], *D. S. Andrews*[2], *E. Daly*[3], *M. Gudbrandsen*[3], *F. Dell`Acqua*[4], *A. N. Ruigrok*[5], *R. Romero-Garcia*[6], *S. Baron-Cohen*[5], *D. G. Murphy*[7] *and C. Ecker*[1,3], *(1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (3)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (6)Brain Mapping Unit, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (7)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:
Autism spectrum disorder (ASD) is a highly complex neurodevelopmental condition that is accompanied by neuroanatomical differences on the macroscopic and microscopic level (Ecker, 2016). For example, a recent histological investigation suggests that the grey-white matter boundary is

less well defined in ASD, potentially due to an abnormal cell patterning at the grey-white matter (GWM) transition zone (Avino & Hutsler, 2010). Consistent with this finding, it has also been shown *in vivo* that the GWM tissue contrast at the white matter boundary is significantly reduced in ASD, and in many brain regions that have previously been linked to autistic symptoms and traits (Andrews et al., 2017). However, nobody has yet characterized the GWM boundary based on measures of diffusion in ASD.

Objectives:

Thus, we examined differences in fractional anisotropy (FA) and mean diffusivity (MD) at the GWM boundary in ASD individuals relative to controls. Based on previous reports of a reduced tissue contrast, we also expected significant reductions in measures of diffusion.

Methods:

92 adults with ASD (53 males, 39 females; diagnosed using ADI-R (Lord et al., 1994)), and 92 matched healthy controls (51 males, 41 females) aged 18-52 years were recruited and assessed at the King`s College London, London, and the University of Cambridge. For all 184 participants, high-resolution structural T1-weighted volumetric images and Diffusion Tensor Imaging (DTI) data were acquired. Cortical surface reconstructions were produced using FreeSurfer v6.0 (http://surfer.nmr.mgh.harvard.edu/). FA and MD measures were derived by mapping the diffusion data onto the white matter surface. Parameter estimates for FA and MD were estimated by regression of a general linear model (GLM) at each vertex along the GWM boundary with (1) diagnostic group, gender, and site as categorical fixed-effects, (2) a group-by-gender interaction, and (3) age and full-scale IQ as continuous covariates. Corrections for multiple comparisons were performed using ´random field theory` (RFT)-based cluster analysis using a $p<0.05$ (2-tailed) cluster-significance threshold.

Results:

We found that MD was significantly decreased in ASD at the GWM boundary underneath the dorsolateral (DLPFC) and medial orbitofrontal cortices, the cingulate cortex (CC), and in the medial somatosensory cortex (SMA). An increase in MD was observed in the right fusiform gyrus. When examining measures of FA, we observed significant decreases in ASD in the right DLPFC, the fusiform gyrus and entorhinal cortex, and in the right occipital lobe. Measures of FA were significantly increased in ASD in the right medial prefrontal cortex, and the right medial and lateral orbitofrontal cortex. In addition, we also observed significant group-by-gender interactions for both FA and MD in many regions with a significant main effect of group.

Conclusions:

Our results confirm that the white matter microstructure at the GWM boundary is atypical in ASD, potentially as a result of an abnormal cell patterning at the GWM transition zone. Thus, neuroanatomical features measured at the GWM boundary might be particularly sensitive for identifying and characterizing ASD. Given the significant group-by-gender interactions, it is however likely, that this aspect of the neuropathology of ASD is modulated by biological sex.

118 **146.118** Comparison of White Matter Microstructure between Affected and Unaffected Siblings Accounting for the Typical Distribution of Difference between Siblings

Y. Aoki[1], *B. Yamagata*[2], *T. Itahashi*[3], *H. Ohta*[3], *C. Kanai*[4], *R. Hashimoto*[5] *and N. Kato*[3], *(1)Showa University, Tokyo, Japan, (2)Keio University, Tokyo, Japan, (3)Medical Institute of Developmental Disabilities Research, Showa University, Tokyo, Japan, (4)Showa University, Setagaya-ku, Japan, (5)Tokyo Metropolitan University, Tokyo, Japan*

Background:

Prior studies with diffusion tensor imaging (DTI) have demonstrated that unaffected siblings of people with ASD show similar white matter abnormalities as their affected siblings compared with typically developing controls (TDC), suggesting genetic vulnerability of unaffected siblings. However, these studies did not account for the typical distribution of difference in white matter structure between siblings.

Objectives:

In the current study, we examined differences in DTI parameters between individuals with ASD and their unaffected siblings accounting for the distribution of differences in DTI parameters between pairs of TD siblings.

Methods:

Participants

Fifteen male individuals with ASD (mean age: 28.3 yo) and their unaffected siblings (mean age: 28.0 yo) were recruited. To examine the typical distribution of differences in DTI parameters, fifteen pairs of siblings of male TDC were enrolled (mean age: 28.4 for the older siblings and 25.1 for the younger siblings). In total, we recruited 60 people.

Data acquisition

We obtained diffusion tensor imaging data at Showa University.

Preprocessing

All data were visually inspected for visible artifacts. Eddy current and head motion were corrected. Data with large head motion were excluded from the analyses. Based on the ICBM DTI-81 atlas, 48 region-of-interests (ROIs) that locate in the center of major tracts were defined. Mean fractional anisotropy (FA), mean, axial, and radial diffusivity (MD, AD, RD) were computed from 48 ROIs.

Analyses

Paired t-tests

We examined the difference in mean DTI parameters between individuals with ASD and their unaffected siblings using paired t-test. Statistically significance threshold was set at $P<0.001$ (=0.05/48: number of ROIs).

Bootstrapping

First, in each ROI, we computed distribution of mean DTI parameters differences between 15 pairs of unaffected TD siblings using bootstrapping with 5000 iterations. Then, mean DTI parameters differences between siblings discordance for ASD were overlayed onto the distribution of difference of DTI parameters among TD siblings to obtain quantile rank. Threshold for significance were set at either quantile above 99.95 percentile or below 0.05 percentile (equivalent to $P=0.025/48$: corrected for multiple comparisons).

Results:

Paired t-tests

None of the tracts showed significant difference in any DTI values between individuals with ASD and their unaffected siblings (t<1.51, P>0.153 for FA, t<2.92, P>0.011 for MD, t<2.56, P>0.023 for AD, t<2.20, P>0.045 for RD).

Bootstrapping

The analysis revealed that difference in mean AD in the left stria terminalis and right anterior corona radiata between individuals with ASD and their unaffected siblings were statistically significant (above 99.99 percentile). Difference in mean FA between siblings discordant for ASD was also marginally significantly large on typical distribution (99.16 percentile).

Conclusions:

Our novel approach accounting for the typical distribution of difference in DTI parameters captured the potential neural correlates of ASD diagnosis. Given that the stria terminalis is sexually dimorphic and the current project enrolled only males, the narrow distribution of difference of DTI parameter between TD siblings is reasonable. Large difference of the DTI parameters in this tract between individuals with ASD and their unaffected siblings may suggest atypical response to sex hormone of this tract among individuals with ASD.

119 **146.119** Disrupted Thalamic-Occipital Connectivity in Six-Week-Old Infants at High and Low Risk for ASD and Its Relation to Behavioral Phenotypes

R. Jalal[1]*, A. Nair*[2]*, J. Liu*[3]*, T. Tsang*[3]*, L. P. Jackson*[4]*, S. Jeste*[3]*, S. Y. Bookheimer*[5] *and M. Dapretto*[5]*, (1)Semel Institute, University of California Los Angeles, Los Angeles, CA, (2)University of California Los Angeles, Los Angeles, CA, (3)University of California, Los Angeles, Los Angeles, CA, (4)UCLA, Los Angeles, CA, (5)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background:

Specific patterns of impacted thalamocortical connectivity have been found in children and adolescents with ASD using both diffusion tensor imaging (DTI) and functional connectivity magnetic resonance imaging (fcMRI; Nair et al., 2013; Nair et al., 2015). In our previous work with infant siblings at high risk for ASD (Nair et al., under review), we demonstrated that at-risk infants show a pattern of functional thalamic-prefrontal underconnectivity and thalamic-occipital overconnectivity few weeks post-birth. In comparison, little is known about the anatomical connectivity between thalamus and cortical regions in at-risk infants.

Objectives:

The goal of the current study is to examine early anatomical connectivity of thalamocortical tracts using DTI in infants at high-risk for developing ASD compared to low-risk infants.

Methods:

DTI data were acquired during natural sleep on a 3T Siemens scanner for 17 high-risk infant siblings (6 weeks post-birth) of children with ASD (HR) and 15 infants at low risk (LR) for ASD. Data were preprocessed using FDT (FMRIB's Diffusion Toolbox). Six cortical seeds were selected from motor, occipital, parietal, prefrontal, somatosensory, and temporal regions of the UNC Infant 0-1-2 neonate atlas (Shi, 2011). Probabilistic tracking was performed to derive white matter tracts originating from each cortical seed and terminated at the thalamus. The diffusion tensor was calculated at each voxel and maps of fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD), axial diffusivity (AD) were generated for tracts between each cortical seed and thalamus. These indices were then entered into a multivariate analysis of variance to compare between groups, and correlated with fcMRI connectivity z' scores as well as behavior measures of visual processing (Infant/Toddler Sensory Profile (Dunn, 2002); "Charlie Brown" eye-tracking paradigm).

Results:

DTI results showed aberrant patterns of thalamic-occipital connectivity in the HR group consistent with our prior fcMRI findings. Specifically, the HR group demonstrated significantly higher MD (p=.02), AD (p=.01), and RD (p=.03) values for thalamic-occipital tracts. Correlations between fcMRI z' prime scores and DTI indices revealed a normative pattern of lower fcMRI connectivity associated with low MD scores for the LR group (p=.02). However, such a pattern was not observed in the HR group. Higher thalamic-occipital MD (p=.02), AD (p=.05), and RD (p=.02) were significantly correlated with lower Sensory Profile visual processing scores in the HR group. Additionally, we found that lower thalamic-occipital FA (p<.001) and higher RD (p=.02) in the HR group was significantly correlated with greater preference for focusing on low-level perceptual features (e.g., motion, high luminance, high saturation, edges) versus character faces within clips of Charlie Brown at age 3 months.

Conclusions:

Our findings suggest that thalamic-occipital connectivity may be disrupted in at-risk infants by six weeks of age. These disruptions may also underlie early preference for sensory aspects of visual stimuli over social stimuli. Visual processing abnormalities have been found in prior studies of older children and adolescents with ASD (Keehn et al., 2013, Klin et al., 2015). Thus, our findings of thalamic-occipital connectivity anomalies and its relation to behavior phenotypes could be an early marker of ASD risk.

120 **146.120** Modeling Developmental Trajectories of White Matter Microstructure in the Autistic and Typical Brain

J. Villaruz[1]*, D. C. Dean*[1]*, B. G. Travers*[1]*, A. Freeman*[1]*, M. B. Prigge*[2]*, B. A. Zielinski*[2]*, P. T. Fletcher*[2]*, J. S. Anderson*[3]*, E. Bigler*[4]*, N. Lange*[5]*, A. L. Alexander*[1] *and J. E. Lainhart*[1]*, (1)University of Wisconsin - Madison, Madison, WI, (2)University of Utah, Salt Lake City, UT, (3)Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, (4)Brigham Young University, Provo, UT, (5)McLean Hospital, Cambridge, MA*

Background: While neuroimaging studies have increasingly associated ASD with altered brain structure and connectivity, relatively little is understood about the development of the autistic brain. Longitudinal data to characterize the trajectories of white matter microstructure in both autism and a reference population, such as typically developing controls (TDC), may reveal which white matter tracts are most significantly influenced by ASD and provide a timeline for when such divergence occurs. A continuous and probabilistic model could give important insights into white matter development, but which growth models are most appropriate for its trajectory is unknown. Furthermore, it is uncertain whether the model that best characterizes ASD white matter development differs from that of typical development. Thus, studies examining growth

models to determine which models provide the most accurate representation of white matter microstructure maturation are needed.
Objectives: Using diffusion tensor imaging (DTI) data from an ongoing longitudinal study of ASD, we investigated growth models of longitudinal white matter microstructure development and assessed which models best represent the developmental trajectories of 48 white matter tracts in individuals with ASD and TDC.

Methods: Male participants (N = 154; 99 ASD) between the ages of 3 and 52-years-old were scanned at the University of Utah up to 4 times across 9 years. The 48 white matter tracts defined in the JHU ICBM-DTI-81 template were aligned to a population-specific template created after image processing then median diffusion parameters were extracted for each tract. We fit the regional DTI data (i.e. FA, MD, RD, AD) to longitudinal linear and quadratic growth models and assessed which model best represented each tract's development using the Bayesian Information Criterion parsimony metric. These best-fit models were compared between groups to examine whether white matter development in ASD and TDC follow different trajectories.

Results: The Bayesian Information Criterion revealed 80 instances across the 4-diffusion metrics (FA, MD, RD, AD) where the best-fit models differed between ASD and TDC. In particular, 18, 19, 19, and 24 of the 48 white matter tracts differed in their FA, MD, RD, and AD trajectories, respectively. In all but 3 of these cases, which included MD and RD in the fornix and AD in the left medial lemniscus, a linear growth model was found to better fit the TDC data while a quadratic model best fit the ASD population.

Conclusions: Quantitative analysis of white matter maturation may provide insight into processes that are altered during neurodevelopment in ASD. These preliminary findings suggest that the growth models used to represent the trajectory of white matter microstructure development differs between individuals with and without ASD. Notably, these differences appear to be regionally dependent as the trajectory differences were not observed in all investigated tracts. Further investigation into additional models, such as logistic or Gompertz growth models, is required to ascertain which model best characterizes the developmental trajectories of white matter. Future analyses will examine these additional models to assess whether they provide a more accurate representation of development and whether these models differ between ASD and TDC trajectories.

121 **146.121** Multimodal Imaging Features Associated with Autism Spectrum Disorder

***D. S. Andrews**[1], A. Llera[2], C. B. Beckmann[3,4], M. Gudbrandsen[1], E. Daly[1], A. Marquand[2,5], C. M. Murphy[1,6], M. C. Lai[7,8,9,10], M. V. Lombardo[11,12], A. N. Ruigrok[11], S. C. Williams[5], E. Bullmore[11], J. Suckling[13], S. Baron-Cohen[8], M. Craig[1,6], D. G. Murphy[6,14] and C. Ecker[1,15], (1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (3)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (4)Centre for Functional MRI of the Brain (FMRIB), University of Oxford, Oxford, United Kingdom, (5)Centre for Neuroimaging Sciences, King's College London, London, United Kingdom, (6)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (7)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (8)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (9)Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan, (10)Centre for Addiction and Mental Health, Toronto, ON, Canada, (11)University of Cambridge, Cambridge, United Kingdom, (12)University of Cyprus, Nicosia, Cyprus, (13)University of Cambridge, Cambridge, United Kingdom of Great Britain and Northern Ireland, (14)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (15)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany*

Background: Several neuroanatomical measures of brain structure have been associated with Autism Spectrum Disorder (ASD) and may represent different biological pathways underlying the condition. Often, these anatomical features are investigated in isolation. However, the identification of between-group differences that are shared across imaging features could aid the identification of underlying neural mechanisms common to different anatomical features in ASD.
Objectives: We aimed to (1) identify multimodal components representing the inter-relationship between different *in vivo* MRI measures of grey matter volumes, cortical morphology, and white matter diffusion metrics; and (2) relate these components to the ASD phenotype.

Methods: 98 adults with ASD (49 males and 49 females; diagnosed using the ADI-R and ADOS) and 98 matched typically developing controls (51 males and 47 females) aged 18-42 years received structural and diffusion MRI scans at the Institute of Psychiatry, Psychology and Neuroscience, London, and the Autism Research Centre, Cambridge. For each participant; voxel based morphometry (VBM) was used to segment whole brain grey matter volumes, FreeSurfer software was used to estimate five morphometric features; i.e. cortical thickness, surface area, sulcal depth, local gyrification index, and grey to white matter signal intensity ratios; and track based spatial statistics (TBSS) skeletons of white matter fractional anisotropy (FA) and mean diffusivity (MD) measures were calculated. A multimodal fusion technique 'linked independent components analysis' (linked ICA) (Groves et al. 2011, 2012), was used to identify components representing shared inter-subject variation between the different measures. Relationships between individual multi-modal components and ASD diagnosis and Autism Spectrum Quotient (AQ) scores were assessed through correlation analysis.

Results: We identified one component that had a significant negative correlation with diagnosis of ASD (p=0.002) and AQ scores (p=0.0019). This component represented a spatially distributed pattern of grey matter volumetric increases spanning the cerebellum, temporal and parietal regions, as well as a pattern of decreased volumes in the frontal lobe in addition to increased gyrification in the cingulate gyrus and temporal lobes. A second component representing a similar diffuse pattern of grey matter volumetric differences as well as increased signal contrast, cortical thickness, and gyrification across temporal regions, was significantly negatively correlated with AQ scores ($p=5.1^{e-4}$).

Conclusions: We found significant correlations between a diagnosis of ASD and multimodal components representing spatially-distributed patterns of volumetric differences as well as decreased grey-white matter boundary integrity, cortical thickness and gyrification. Our findings enrich our understanding of the relationship between different imaging features, and may aid the identification of neurobiological pathways that contribute to the cross-modal pattern of atypical brain structure observed in ASD.

122 **146.122** Receptor Density and Distribution of 5-HT2 Receptors in the Cingulate Cortex in Autism: A Multiple Concentration Saturation Binding Study in Children and Adults

***C. Brandenburg** and G. J. Blatt, Hussman Institute for Autism, Baltimore, MD*

Background: Selective serotonin reuptake inhibitors (SSRIs) are among the most commonly prescribed medications in autism, however, several studies show evidence of harm and variable outcomes of efficacy from SSRI use. Some of the variability may be a result of differential changes in serotonin (5-HT) receptor subtypes across individuals.

Objectives: In an effort to determine differences in 5-HT$_2$ receptor expression between autism and neurotypical individuals, a multiple concentration ligand binding assay was performed in two parts of the cingulate cortex. These areas are important in socioemotional behavior, reward anticipation and in the default network, among other functions, and have been shown to be impacted in autism.

Methods: Using a large cohort of postmortem brain tissue, a saturation binding assay was conducted on 20µm sections from the anterior cingulate cortex (ACC) and posterior cingulate cortex (PCC) (n=16-19 autism, n=18-19 controls) by incubation with ^{3}H ketanserin (Perkin Elmer) at concentrations of 120, 90, 30, 12, 6, 3 and 1.5 nM before being loaded into X-ray cassettes with tritium standards and apposed to tritium-sensitive hyperfilm. Non-specific binding was determined with a competitive displacer (Ritanserin 100µM). After exposure, films were developed and digitized to quantify measurements of binding in femtomoles per milligram of tissue in both superficial and deep layers of each region. A Welch's t-test was utilized for statistical analysis.

Results: 5HT$_2$ receptor density in superficial and deep layers of the ACC and PCC did not have statistically significant binding density differences between total autism and control cases. However, the variance in the PCC layers was significantly higher in autism cases (p=0.038 deep; p=0.0031 superficial) using an F test and 30nM ^{3}H ketanserin as a representative concentration. The groups were then split into children (≤16) (n=8-9) and adults (>16) (n=9), which resulted in an increased binding density in the PCC of autism cases in children only (363.4 ±26.38 fmol/mg PCC deep; 400.0 ±10.93 fmol/mg PCC superficial) compared to controls (290.2 ±11.98 fmol/mg PCC deep; 308.8 ±10.93 fmol/mg PCC superficial) [p=0.028 PCC deep; p=0.0403 PCC superficial] while the ACC had similar mean and variance between groups. Adult autism cases had similar binding density compared to neurotypical individuals.

Conclusions: Although the overall comparisons of autism and neurotypical cases did not reveal a mean binding density difference across regions and layers, the variance of autism cases was significantly higher in the PCC and in children when compared to adults. This is particularly interesting given the literature on SSRI use in autism. A Cochrane review concluded that SSRI use has variable outcomes of efficacy, with adverse effects negligible in adults but significant in children. It is possible that the variance of 5HT$_2$ density seen in child autism cases contributes to the variable reactions to SSRI use. Comparison of 5HT$_2$ expression to other 5HT receptors in these cases will provide useful insight into how the 5HT system may be differentially impacted.

123 **146.123** Reduced Diameter, Perimeter and Cross Sectional Area of Corpus Callosum Axons Are Markers of a Deficit of Long-Range Connectivity in Autism

J. Wegiel[1]*, W. Kaczmarski*[1]*, T. Wisniewski*[2]*, K. Nowicki*[3]*, I. Kuchna*[4]*, S. Y. Y. Ma*[5] *and J. Wegiel*[1]*, (1)NYS IBR, Staten Island, NY, (2)NYU School of Medicine, New York, NY, (3)Developmental Neurobiology, NYS IBR, Staten Island, NY, (4)Developmental Neurobiology, NYS Institute for Basic Research, Staten Island, NY, (5)Neurobiology, NYS IBR, Staten Island, NY*

Background:

Autism is associated with lack of coherence, deficits in complex information processing, and intense and narrowly focused interests with a tendency to concentrate on systems that operate repetitively such as computers, games, or machines. MRI and neuropathological studies suggest that these functional anomalies are caused by defects in connectivity with short-range overconnectivity and long-range underconnectivity. Our studies of the corpus callosum in idiopathic autism revealed CC agenesis selectively affecting segments III-V in 3 of 11 examined autistic subjects, hypoplasia with a 49% deficit of axonal connections and a 37% reduction in the numerical density of axons in all agenesis-free autistic subjects (Wegiel et al 2017).

Objectives:

The aim of this postmortem study was to test the hypothesis that focal lack of CC axons and diffuse deficit of axons, reported as agenesis and hypoplasia, are associated with a third marker of long-range connectivity - reduced CC axon diameter. This pathology may directly contribute to reduced volume and capacity of information transfer between hemispheres, and lack of coherence and deficits in complex information processing in autistic subjects.

Methods: To detect markers of the deficit of long-range connectivity, 4 parameters were estimated using electron microscopy: axon diameter, perimeter, cross section area and myelin thickness in the brains of 10 subjects diagnosed with idiopathic autism and 10 brains of age and sex-matched control subjects. The brain hemispheres were fixed with formalin, dehydrated, embedded in celloidin and cut into equidistant serial 50-µm thick sections. Ultrastructural study was focused on axons in the CC genu. Equidistant serial celloidin sections were fixed with osmium tetroxide, dehydrated and embedded in Epon 812. The sections were photographed using a Hitachi 7500 electron microscope at 12,000 magnification. For each case twelve electron micrographs were used for measurements of axonal diameter, perimeter, crossectional area and myelin thickness. On average 420 axons were evaluated per case.

Results: The ultrastructural study revealed a significant (p<0.01) reduction of axon diameter by 15%, axon area by 19%, and axon perimeter by 9%. The distribution curve revealed a prevalence of small axons (less than 0.5 µm diameter), a similar percentage of middle-size axons (0.5-0.7 µm) but a reduced percentage of thick axons (>7 µm) in autistic subjects. Measurements of myelin thickness were less consistent due to the variable contribution of clusters of axons with a small diameter, very little amount axoplasm but an unusually thick myelin sheath found in some autistic subjects. Despite of these interindividual differences, the myelin thickness was reduced by 7% on average.

Conclusions: The study reveals another feature of the developmental impairment of long distance connectivity with a significant reduction in the diameter, perimeter, and cross sectional area of axons in the genu of the corpus callosum of subjects diagnosed with idiopathic autism. This pattern of pathology is considered a sign of reduced capacity and reduced volume of information transferred by long distance interhemispheric connections. The results suggest that CC sporadic agenesis, common hypoplasia and axonal developmental defects are an integral component of brain pathology contributing to the clinical autism phenotype.

124 **146.124** Sex-Informed Neuroanatomy of Autism: Evaluating the Quantitative and Qualitative Models of Sex-Moderation in Cortical Anatomy Using Data from the Pond Network

C. Hammill[1]*, M. J. Taylor*[1,2]*, J. P. Lerch*[3]*, E. Anagnostou*[4]*, S. Ameis*[5,6]*, P. Szatmari*[1,5,6] *and* ***M. C. Lai***[1,5,6,7,8]*, (1)The Hospital for Sick Children, Toronto, ON,* *Canada, (2)University of Toronto, Toronto, ON, Canada, (3)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (6)Centre for Addiction and Mental Health, Toronto, ON, Canada, (7)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (8)Department of Psychiatry, National Taiwan University Hospital and College of Medicine, Taipei, Taiwan*

Background:

We proposed two testable models on sex-moderation that underlie the 'female-protective-effect' mechanisms contributing to autism etiologies, as a key first step to clarify the sex-differential liability related to the brain. The 'quantitative sex-moderating model' (QUAN-model) posits that mechanisms leading to autism are comparable but differ quantitatively across sexes, that females require more brain changes to develop autism. The 'qualitative sex-moderating model' (QUAL-model) posits that mechanisms leading to autism operate through different neurobiological/brain changes across sexes.

Objectives:

Testing the QUAN-model and QUAL-model against a null-model of no sex-moderation:

(1) The QUAN-model predicts that across the brain, autism-related changes in females involve similar regions but with larger effect sizes, and/or involve overlapping and additional regions, than those in males.

(2) The QUAL-model predicts that across the brain, autism-related brain changes differ by sex, involving different brain regions and/or with different patterns of changes.

Methods:

Sample includes 729 participants scanned at the Hospital for Sick Children, Toronto and via the Province of Ontario Neurodevelopmental Disorders (POND) network, using the same scanner: 249 autistic males (age mean=13.3 years, FIQ mean=96.9), 60 autistic females (age mean=14.2, FIQ mean=95.7), 210 neurotypical males (age mean=14.0, FIQ mean=112.7), 210 neurotypical females (age mean=14.2, FIQ mean=113.0). T1-weighted scans were processed with CIVET 2.1. Cortical thickness, area, volume and curvature were estimated across 75,284 vertices. To account for heterogeneity of covariates, data were pre-processed with nonparametric matching – neurotypical controls were matched to autism subjects with full-matching by weighted Euclidean matching for age and whole brain volume (weights 1 and 0.5 respectively), but IQ was *not used in matching* due to high co-occurrence between autism and intellectual disability (ID). For each metric, a whole-cortex-based model selection determined the best model by Akaike's Information Criterion.

Testing QUAN-model vs. null by Sign-Concordance: By setting 'sex' as male=0 and female=1, autism-effect in males is given as $\beta_{diagnosis}$ and autism-effect in females $\beta_{diagnosis}+\beta_{sex*diagnosis}$. The QUAN-model predicts that autism-effect is *stronger* in females than in males, therefore $\beta_{diagnosis}$ and $\beta_{sex*diagnosis}$ have the same sign (sign-concordance). This was tested against a randomization distribution of test-statistics from the model with sex-labels permuted.

Testing QUAL-model vs. null by Spatial-Correlation: Evidence for the QUAL-model will be if, across vertices, there is less spatial correlation between autism-effects in females vs. males than by chance. This was tested with the same permutation approach.

Results:

Model selection: Thickness, area, volume and smoothed absolute mean curvature were best modeled without sex-covariate interaction terms. Thickness and volume were best modelled by brain volume cubed and a quadratic age term; Area and thickness were best modelled by linear age, and brain volume to the 2/3 power.

QUAN-model: Increased sign-concordance was observed for smoothed absolute mean curvature (but not other metrics) at effect thresholds greater than 50% of maximum observed effect, supporting the QUAN-model; this result was insensitive to whether IQ was included as a covariate.

QUAL-model: All measures were within randomization intervals providing no evidence for the QUAL-model.

Conclusions:

These results suggest possible *quantitative* sex-moderation of cortical curvature in autism. How sex-moderation is associated with autism-ID co-occurrence requires further investigation.

125 **146.125** Structural Connectivity of the Amygdala in Young Adults with Autism Spectrum Disorder

C. R. Gibbard[1]*, D. H. Skuse*[2]*, J. D. Clayden*[1] *and C. A. Clark*[1]*, (1)Developmental Imaging and Biophysics Section, UCL Great Ormond Street Institute of Child Health, London, United Kingdom, (2)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background: Autism spectrum disorders (ASD) are characterised by impairments in social cognition. The amygdala is thought to be involved in abilities that directly impact on social engagement, such as emotion recognition and 'theory of mind'. Structural magnetic resonance imaging (MRI) studies report both amygdala enlargement and reduction in ASD, whilst functional MRI studies have shown reduced amygdala activation in ASD participants in response to social cues. Little is known about the structural connectivity of the amygdala in ASD. Subdivisions of the amygdala have been identified that show specificity of structure, connectivity, and function, and recent diffusion tensor imaging studies have segmented the healthy adult amygdala into sub-regions *in vivo* using white matter connectivity-based parcellation schemes.

Objectives: The aim of this study was to investigate the microstructural properties of amygdala–cortical structural connections and their association with ASD behaviours, and whether connectivity of specific amygdala sub-regions is associated with particular ASD traits.

Methods: 25 high-functioning ASD (mean age: 24.7yr) and 26 neurotypical (mean age:23.2yr) participants underwent whole-brain T_1-weighted ($1mm^3$) and diffusion-weighted ($2.5mm^3$; 60 directions at $b=1000s/mm^2$; 3 b=0) MRI on a 1.5T Siemens Avanto scanner. Diffusion data were pre-processed using FSL. FSL FIRST and SIENAX were used to delineate amygdala and whole brain regions of interest, respectively. Cortical regions of interest were generated using FreeSurfer, and these cortical targets were grouped into frontal, parietal, occipital, and temporal lobes, and the insula using FSL utilities. All regions of interest were registered to diffusion space using FSL FLIRT and FNIRT. TractoR was used to seed probabilistic tractography from each amygdala voxel to the five cortical targets. An iterative 'winner takes all' process was used to parcellate the amygdala based on its primary cortical connection, which resulted in clusters of amygdala voxels that were maximally connected to the same cortical target. Fractional anisotropy (FA) and mean diffusivity (MD) were measured in each cluster's white matter tracts. Group comparisons were made using ANCOVA and linear regression models. Correlations with the self-reported autism quotient (AQ), a measure of ASD symptom severity, were made within the ASD group using partial Spearman correlation. Age, gender and full-scale IQ were covariates.

Results: Amygdala volume was greater in ASD compared to controls (F(1,94)=4.19; p=0.04). In the ASD group, MD was elevated in white matter tracts connecting the right amygdala to the right cortex (t=2.35; p=0.05), which correlated with the severity of emotion recognition deficits (rho=-0.53; p=0.01). Amygdala parcellation resulted in four clusters that maximally connected to the frontal, parietal, temporal, and insula lobes, respectively. In ASD subjects, reduced FA in white matter connecting the left amygdala to the temporal cortex was associated with greater attention switching impairment, as measured by the AQ (rho=-0.61; p=0.02).

Conclusions: This study demonstrates that both amygdala volume and the microstructure of connections between the amygdala and the cortex are altered in ASD. Findings indicate that the microstructure of right amygdala white matter tracts are associated with overall ASD severity, but that investigation of amygdala sub-regions can identify more specific associations.

126 **146.126** Structural MRI Does Not Support the DSM-5 Unification of the DSM-IV-TR Autism Spectrum Diagnoses

*E. Ferrari[1], A. Giuliano[1], P. Bosco[1], P. Oliva[2], M. E. Fantacci[3], F. Muratori[4], **S. Calderoni**[5] and A. Retico[6], (1)National Institute for Nuclear Physics (INFN), Pisa, Italy, (2)University of Sassari and INFN, Physics Department, Sassari, Italy, (3)University of Pisa, Physics Department, Pisa, Italy, (4)IRCCS Stella Maris Foundation, Calambrone (Pisa), Italy, (5)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy, (6)Pisa Division, National Institute for Nuclear Physics, Pisa, Italy*

Background: Autism Spectrum Disorders (ASD) are a heterogeneous condition that affects individuals with various degrees of severity. Brain magnetic resonance imaging (MRI) represents a valuable non-invasive technique to study this condition. In literature, there is a great amount of studies based on supervised classification algorithms in order to distinguish subjects with ASD from controls through an analysis of their structural brain images. However, the results obtained are controversial and usually not reproduced on a sufficiently wide statistical sample. Recently, many studies focused on the importance of the stratification of the ASD population to improve classification performance.

Objectives: To evaluate the impact of stratification on supervised classification of subjects with Autism Spectrum Disorders. To this purpose both the diagnostic categories of the DSM-IV-TR and DSM-5 have been taken into account.

Methods: In this study, 420 morphological features extracted with Freesurfer 6.0 from 2156 subjects from the public databases ABIDE I and ABIDE II [http://fcon_1000.projects.nitrc.org/indi/abide/] were analyzed. In first place, an outlier analysis has been conducted to exclude the subjects for which the brain segmentation was unsuccessful. Then, six different supervised machine-learning algorithms have been used on different groups of subjects to study the effects of stratification; this has been repeated using different feature normalization methods. For each classifier the area under the receiver operating characteristic (AUC) has been computed. Finally, an analysis of the most relevant features for the decision-making process has been conducted.

Results: The great amount of train-test experiments we performed allowed us to obtain the following main results: 1) the feature normalization does not have a significant effect on the AUCs; 2) by contrast, the stratification and the type of classification algorithm used have a strong impact. Specifically, using a Logistic regression classifier, whilst the entire group of ASD subjects (according to DSM-5 classification) differed from controls with a modest AUC (about 0.60), once the subjects are sub-grouped according to the DSM-IV-TR separate subcategories of autism (AD), Asperger (AS) and Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), the AUC values achieved remain limited for AD vs. controls, AD vs. AS and AS vs. controls, whereas they are: 0.82 for AS vs. PDD-NOS, 0.80 for AD vs. PDD-NOS and 0.82 for PDD-NOS vs. controls.

Conclusions: We found out that the stratification of the ASD population in more homogeneous subgroups according to the DSM-IV-TR diagnoses leads to an improvement of the case vs. control classification performance. Despite the AUC values we obtained are still far away from allowing us to claim for the discovery of a neuroimaging-based biomarker for ASD, the identification of which brain regions are more responsible for the subgroup separations may provide new clues in the understanding of the neurobiology underling the ASD condition.

127 **146.127** Structural-Morphometric Examination of the Thalamus in Individuals with Autism Spectrum Disorder

***J. L. Sokoloff**[1], H. Peng[2] and S. E. Christ[1], (1)Department of Psychological Sciences, University of Missouri, Columbia, MO, (2)University of Missouri, Columbia, MO*

Background: The thalamus has been implicated as a potential location of neural disruption in autism spectrum disorder (ASD). This subcortical nuclear complex plays a critical role in sensory processing, an aspect of functioning which is affected in many individuals with ASD. Whereas previous studies reported atypical thalamic volume in this population (Hardan et al., 2006, 2008; Perich-Alsina et al., 2002; Tsatsanis et al., 2003), the pattern of results across studies remains inconsistent. Differences in methodologies (e.g., image resolution, analysis software, segmentation approach, anatomical boundary definitions) as well as sample characteristics (e.g., age, symptom severity) may have contributed to past disparate findings. Given these discrepancies and methodological constraints, the exact nature of thalamic abnormalities in ASD remains unclear.

Objectives: Potential ASD-related abnormalities in thalamic morphometry (e.g. shape and size) were examined via semi-automated MRI-based segmentation. The relationship between thalamic morphometry and autism symptomatology was also evaluated.

Methods: A sample of 57 individuals with ASD (mean age = 15.1 years) and a demographically-matched comparison group of 62 typically developing individuals without ASD (mean age = 15.6 years) participated. A 3T Siemens Trio MRI scanner with a standard 8-channel head coil was used to obtain high-resolution T1-weighted structural images of the brain. Following acquisition, the structural MRI data for each participant was rotated into AC-PC coordinates. Volumetric and vertex data were obtained via semi-automated MRI-based segmentation (FSL-FIRST) for the left and right thalamus. FSL-FIRST is a model-based vertex analysis software that provides localized estimates of subcortical shape and size. It provides parameterized volumetric data as surface meshes and then estimates the most probable shape based on a library of subcortical models constructed from manually segmented images (Dean et al., 2016; Opel et al., 2014).

Results: As anticipated, we found autism-related abnormalities in thalamic morphometry. The vertex analysis showed significant group differences in left thalamic shape. Compared to the non-ASD group, the ASD group was associated with significant surface depression in dorsal and anterior-ventral aspects of the left thalamus ($p < .05$ in aforementioned areas). Vertex results were supported by volumetric data, which showed a trend towards a group-difference in left thalamic volume [$F(1, 115) = 3.07$, $p = .08$, $\eta_p^2 = .03$]. In addition, we found that, within the ASD group, bilateral thalamic volume was significantly smaller in individuals with ASD who experienced sensory abnormalities (per parent report) as compared to those with ASD whom did not [$F(1, 31) = 4.50$, $p = .04$, $\eta_p^2 = .13$]. Lastly, we found a significant negative correlation between bilateral thalamic volume and ASD symptom severity as measured by the Social Responsiveness Scale (SRS; $r = -.37$, $p = .006$).

Conclusions: The current results are consistent with previous findings of thalamic abnormalities in autism and suggest a link between thalamic size and sensory symptoms as well as more general social communication difficulties. Also, the present vertex-based approach provides an additional metric for thalamic investigation and allows for the identification of specific thalamic regions that may be particularly relevant to ASD and its manifestation.

128 **146.128** The Neuroanatomy of Autism Spectrum Disorder in 22q11.2 Deletion Syndrome

M. Gudbrandsen[1], *E. Daly*[1], *R. H. Wichers*[1,2], *C. M. Murphy*[1,2], *V. Stoencheva*[1,2], *E. Perry*[1,2], *D. S. Andrews*[3], *D. G. Murphy*[4], *C. Ecker*[5], *L. Kushan*[6], *C. Bearden*[6] *and M. Craig*[1,2], *(1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Behavioural Genetics Clinic, Adult Autism Service, Behavioural and Developmental Psychiatry Clinical Academic Group, South London and Maudsley Foundation NHS Trust, London, United Kingdom, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (4)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (5)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (6)University of California, Los Angeles, CA*

Background: Individuals with syndromic forms of autism spectrum disorder (ASD) provide a unique opportunity to understand specific genetic risk mechanisms. For example, individuals with 22q11.2 Deletion Syndrome (22q11DS) have a 30-50% risk of developing ASD (Schneider et al., 2014). The neurobiological mechanisms contributing to this increased risk are unknown, but likely include genetically-determined differences in specific developmental pathways. We, and others, previously reported that individuals with ASD and 22q11DS both have significant differences in cortical volume(CV), surface area(SA) and cortical thickness(CT) (Ecker et al., 2013; Jalbrzikowski et al., 2013). In the present study, we examined the relationship between brain anatomy and ASD symptomatology in individuals with 22q11DS based on different diagnostic criteria, as it remains currently unknown to what extent the clinical ASD phenotype in the context of the 22q11.2 microdeletion resembles the clinical ASD phenotype in non-22q11DS individuals. For instance, clinical studies reliably report significant social/communication impairments in 22q11DS, while repetitive/stereotyped behaviours are less common (Wenger et al., 2016). We thus subdivided individuals based on ASD-symptoms in the social/communication and repetitive domains separately, in order to elucidate their respective neuroanatomical correlates.
Objectives: To establish whether 22q11DS individuals with ASD symptomatology are neuroanatomically distinct from those without.

Methods: We included 55 individuals with 22q11DS (27 male/28 female), age range 6-31 years (mean age=14+6 years). Of these, 10 (i.e. 18%) met strict diagnostic criteria based on the ADI-R cut-offs in all three domains (abbreviated as 22q11.**ASD**), and 30 (i.e. 55%) met the diagnostic cut-offs in the social/communication domain only (22q11.**SC**). Both ASD groups were matched on age and full-scale IQ to their respective controls. Participants underwent structural T1-weighted magnetic resonance imaging (MRI) at the Institute of Psychiatry, Psychology and Neuroscience, London and the Semel Institute for Neuroscience, UCLA. Vertex-wise measures of CV, CT and SA were derived using FreeSurfer v6.0.0 software (http://surfer.nmr.mgh.harvard.edu), and analysed by regression of a GLM including group, gender and IQ as categorical fixed effect factors. Corrections for multiple comparisons across the whole brain were performed using a random-field-based cluster-threshold($p<0.05$) (Worsley et al., 1999).

Results: There were no difference in brain anatomy when applying gold-standard diagnostic criteria for ASD in all three domains. However, when applying a more lenient cut-off in the restricted/repetitive behaviour domain, we found significantly increased CV in the left dorsolateral prefrontal & posterior cingulate cortex, in 22q11.**SC** compared to their respective controls, which was driven by a commensurate increase in SA. Furthermore, increased SA was found in the right temporo-parietal-junction, middle & superior temporal sulcus, and inferior temporal gyrus. Last, we found that individuals with 22q11.**SC** had significantly decreased CV and SA in the left entorhinal cortex. We did not observe any significant differences in CT.

Conclusions: Individuals with 22q11DS and ASD symptomatology, predominantly in the social/communication domains, are neuroanatomically distinct from those without. The spatially distributed network of volumetric differences associated with the autistic symptoms in 22q11DS has previously been linked to wider ASD symptoms and traits, and might provide useful information for patient stratification and predictions of clinical outcomes in the future.

129 **146.129** The White Matter Microstructure of Autism Spectrum Disorder (ASD) and Attention Hyperactivity Disorder (ADHD)

H. Ohta[1], *T. Itahashi*[1], *Y. Aoki*[2], *M. Nakamura*[1], *C. Kanai*[3], *A. Iwanami*[4], *N. Kato*[1], *J. Fujino*[1] *and R. Hashimoto*[5], *(1)Medical Institute of Developmental Disabilities Research, Showa University, Tokyo, Japan, (2)Showa University, Tokyo, Japan, (3)Showa University, Setagaya-ku, Japan, (4)Showa University, Setagayaku, Japan, (5)Tokyo Metropolitan University, Tokyo, Japan*

Background:
Previous researches have shown high rate of comorbidity (30-50%) between attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder (ASD) . Some researches reported that impaired structural brain connectivity was related to the core features of ASD and ADHD. However, only a few studies directly compared the white matter microstructure between ASD and ADHD.

Objectives:

The aim of the present study is to reveal the commonality and difference of white matter microstructure between adults with ASD and those with ADHD using Diffusion Tenor Imaging (DTI).

Methods:

A total of 196 adults participated in this study; 68 Normal Controls (NC), 83 ASD, 45 ADHD. Two medical specialists diagnosed ASD and ADHD according to DSM-5 criteria. ADOS-2 was conducted on 71 out of 83 ASDs. Individuals who have mental retardation were excluded from this study. MRI scans were conducted to all participants. DTI data were processed using programs in the FMRIB Software Library (FSL) version 5.0. TBSS (Tract-Based Spatial Statistics) was used for voxelwise statistical analysis. The statistical threshold was defined at $p < 0.05$ (corrected for multiple comparisons). Age and gender were included as covariates.

Results: Lower FA of corpus callosum, bilateral superior and middle cerebellar peduncle, bilateral cerebral peduncle, right superior temporal cortex was found in ASD compared to HC. Lower FA of bilateral superior and middle cerebellar peduncle and right superior temporal cortex was found in ADHD compared to HC. Although the differences were disappeared after controlling for multiple comparison, lower FA of genu of corpus callosum in ASD and right cingulum in ADHD comparing directly between the two disorders.

Conclusions: The present study specified common white matter alternations between ASD and ADHD in cerebellum peduncle and white matter under superior temporal cortex. ASD specific alterations were observed in corpus callosum and cerebral peduncle.In the direct comparison of ASD and ADHD, lower FA values were found in genu of corpus callosum in ASD and in right cingulum in ADHD. To reveal more complete picture of association between ASD and ADHD, further studies are needed by adopting not only the categorical but also dimensional approach.

130 **146.130** White Matter Abnormalities Support the Female Protective Effect in Autism: A Group-Matched, Quality-Controlled, Diffusion Tensor Imaging Study

E. K. Lecarie[1]*, J. Lei*[2]*, S. C. Boland*[1]*, D. Yang*[3]*, P. E. Ventola*[4]*, D. G. Sukhodolsky*[4]*, K. Pelphrey*[5] *and R. J. Jou*[6]*, (1)Yale Child Study Center, New Haven, CT, (2)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (3)The George Washington University, Ashburn, VA, (4)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (5)The George Washington University, Washington, DC, (6)Yale University, New Haven, CT*

Background: Many earlier diffusion tensor imaging (DTI) studies reported widespread and heterogeneous white matter (WM) abnormalities in autism spectrum disorder (ASD). However, these findings were not replicated in more recent studies which stringently controlled for MRI data quality. Moreover, there is growing awareness that ASD manifests differently in girls, specifically the Female Protective Effect, which posits that girls require a greater etiologic load to manifest significant symptoms of autism. Therefore, neuroimaging studies should also account for gender differences, as girls with ASD may be more severely affected and exhibit a neurophenotype unlike that of boys with ASD.
Objectives: To evaluate gender differences in WM between individuals with ASD and neurotypical (NT) peers, while stringently controlling for data quality and matching for confounding variables known to produce artefactual findings.

Methods: A total of 130 children were divided into four groups: 25 ASD girls (age = 9.30 years ±4.25), 65 ASD boys (age = 9.79 years ±4.16), 16 NT girls (age = 11.30 ±4.14) and 24 NT boys (age = 11.16 years ±4.52). Participants underwent clinical assessment and DTI on a 3T MRI scanner. All scans were pre-processed using FSL, including eddy current correction and estimation of the diffusion tensor, which enables calculation of fractional anisotropy (FA), an accepted measure of WM integrity. A multi-step procedure was used to ensure stringent quality control, which consisted of visual inspection by two independent raters for removing compromised data (intraclass correlation coefficient >0.90). Voxel-wise group comparisons were performed using Tract-Based Spatial Statistics. Areas of significant difference were identified ($p < 0.05$, corrected) using Threshold-free Cluster Enhancement. A tractography atlas was used to characterize fiber tract abnormalities.

Results: No main effects of group or gender were observed for age or full-scale IQ. For the Social Responsiveness Scale, there was no main effect of gender, though a main effect of group was noted. No main effect of group was observed for any motion parameters (displacement, rotation, and translation). There were widespread regions in both hemispheres where FA was significantly reduced in ASD girls. All fiber types were represented, including association, commissure, and projection fibers. Notably, there were no significant differences in FA between ASD and NT boys.

Conclusions: The presence of neither localized nor widespread WM abnormalities in ASD boys was supported in the current study. Combined with comparable SRS scores between genders, the widespread WM abnormalities detected only in ASD girls suggests that comparable symptoms of autism require substantial structural aberrations. These results support the Female Protective Effect and the continued importance of gender differences in autism.

Poster Session
147 - Family Issues and Stakeholder Experiences
11:30 AM - 1:30 PM - Hall Grote Zaal

131 **146.131** A Qualitative Exploration of the Female Phenotype and Experience of Autism Spectrum Disorder

V. L. Milner[1]*, H. R. McIntosh*[2]*, E. Colvert*[1] *and F. Happé*[1]*, (1)Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)SGDP, Institute of Psychiatry, Psychology and Neuroscience (King's College London), London, United Kingdom*

Background:
Autism spectrum disorder (ASD) is a neurodevelopmental condition characterised by persistent deficits in social interaction, social communication and restricted and repetitive patterns of behaviour, from a young age. One of the most striking features of ASD is the high male to female ratio, which varies across the spectrum with most studies quoting 4-5:1. Much ASD research involves males only, perhaps leading to a biased understanding of the full spectrum of ASD and its manifestations. If current ASD diagnostic measures and processes are largely based on data from males, these may not meet the needs of females on the autism spectrum.

Objectives:

This study aimed to explore qualitatively the female ASD phenotype and experience, as a step towards developing trait and diagnostic measures that better recognise autism in women and girls.

Methods:

Participants were 18 females with a clinical diagnosis of ASD(n=16) or self-diagnosed ASD (n=2) aged between 11-55 years, and 4 mothers of women with ASD. Participants were invited to attend focus groups, face-to-face interviews or telephone interviews, which were audio recorded and transcribed. A topic guide was used within the session and included three overarching topics; diagnostic pathway, impact of ASD, and resilience and coping. A semi-structured interview style was used allowing in-depth answers to be collected. Two members of the research team conducted a thematic analysis following guidelines by Braun & Clarke, 2006.

Results:

From an abundance of relevant transcript data, seven overarching themes comprising 21 subthemes were identified. The seven major themes were: (1) “fitting in with the norm” ,which encapsulates the attempts, both successful and unsuccessful, that women make to attempt to fit in with their peers and society; (2) “gender”, which considers the differences between genders as well as the concept of fitting into a gender stereotype; (3) “negative components of ASD” explores the difficulties faced by the women that are associated with having ASD; (4) “coping strategies” identifies techniques adopted by the women to cope with their condition; (5) “the perspective of others” considers how other people, including peers and family members, understand and are impacted by ASD; (6) “potential obstacles for woman with ASD” uncovers the barriers and difficulties faced by the women; and, finally, (7) “positive aspects of ASD” highlights some of the benefits of having ASD and ways women have learnt to understand their condition.

Conclusions:

By capturing qualitative accounts of women’s experiences of autism, we hope to improve understanding of the obstacles and challenges faced by those with and without a diagnosis. It is hoped that the data can inform the focus of and measures used in future research. Furthermore, it is hoped that the study highlights the importance of including female stakeholder voices within ASD research.

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146.132 A Virtual Resiliency Treatment for Parents of Children with Autism: A Randomized Pilot Trial

***K. Kuhlthau**[1], R. A. Millstein[2], C. M. Luberto[3], G. K. Perez[3], O. Lindly[3], L. Traeger[3], E. Chad-Friedman[3], J. Proszynski[3] and E. Park[3], (1)Massachusetts General Hospital, Newburyport, MA, (2)Masachusetts General Hospital, Boston, MA, (3)Massachusetts General Hospital, Boston, MA*

Background:

Parents of children with autism experience high levels of distress.Evidence-based resiliency treatments for parents of children with autism have not been developed or tested.

Objectives:

This pilot study examines a Stress Management And Resiliency Training-Relaxation Response Resiliency Program (SMART-3RP) program, a 9-session mind-body intervention that seeks to decrease distress and increase resiliency, stress coping, social support and mindfulness.

Methods:

We randomized 48 parents into immediate treatment vs. delayed intervention (control group). Assessments took place at baseline (T1) and three months later (T2) – post-intervention for immediate group and pre-intervention for the control group. For immediate treatment subjects, we examined feasibility and acceptability by examining attendance and responses to a feedback form. We examined pre-post change for the immediate treatment vs. control groups alone, controlling for relevant sociodemographic baseline characteristics. Outcomes include: distress (visual analog scale; primary [VAS]) resiliency (Current Experiences Scale [CES]), stress coping (Measure of Current Status part A [MOCS-A]), social support (Medical Outcome social support survey [MOS]) and mindfulness (Cognitive and Affective Mindfulness Scale – Revised [CAMS-R]).

Results:

The vast majority of participants were mothers (89%), white (78%), non-Latino (96%), married/partnered (76%), had at least a college degree (80%). In terms of feasibility, 65% of intervention participants completed ≥6 sessions. Among 72% of intervention group participants who completed the post-treatment survey, 83% reported practicing relaxation response exercises at least a few times a week. In response to the question, “How successfully do you think this treatment will reduce your stress-related symptoms” (1=not at all to 9=very), intervention participants responded on average 7.9. When comparing immediate treatment to control group participants for change in efficacy (see table 1), distress as measured by the VAS did not show a statistically significant change (p=.31). All secondary outcomes showed significant change in the expected direction. Immediate treatment participants showed improvements on the CES (M difference 6.17; p=.028), MOCS-A (M difference 7.66; p=.002), MOS (M difference 7.67; p=.036) and CAMS-R (M difference 2.55; p=032).

Conclusions:

Findings from our randomized pilot trial showed promising feasibility, acceptability, and efficacy. All between group differences were in the expected direction. The distress measure did not reach statistical significance although other measures did. Next steps include modifications to improve the intervention and a larger trial.

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146.133 Addressing Quality of Life Priorities in Children and Adolescents with Autism Spectrum Disorder

***L. Morán**[1], L. E. Gomez[2], M. Á. Alcedo[2], V. B. Arias[3] and M. A. Verdugo[4], (1)University of Oviedo, Oviedo, Spain, (2)University of Oviedo, Asturias, Spain, (3)University of Talca, Maule, Chile, (4)University of Salamanca, Salamanca, Spain*

Background:

In the past years, important progress has been made in assessing quality of life of persons with intellectual disability. However, individuals with autism spectrum disorder and comorbid intellectual disability are one of the groups which have had less benefits from these advances, especially in the childhood and youth stages.

Objectives:

The aim of this study is to assess quality of life-related personal outcomes in children and youth with autism spectrum disorders and a comorbid diagnosis of intellectual disability in order to identify needs and strengths in this construct’s various domains. It also responds to the demand of caregivers and practitioners for instruments with appropriate psychometric properties to facilitate evidence-based practices, evaluating progress and obstacles related to their children’s quality of life.

Methods:

Caregivers reported on the ASD KidsLife scale (Gómez et al., in press), which evaluates personal outcomes related to the quality of life in people with autism spectrum disorders and intellectual disabilities aged 4 to 21 years old. The scale comprises 96 items organized by eight dimensions proposed by Schalock and Verdugo (2002): emotional wellbeing, material wellbeing, physical wellbeing, personal development, rights, self-determination, social inclusion, and interpersonal relationships. The sample was composed of caregivers of 420 children and adolescents with autism spectrum disorders and comorbid intellectual disabilities, aged 4 to 21 years old (*M*=12; *SD*=4.7) who were enrolled in social, educative, or medical services in 78 Spanish centres.

Results:

The highest quality of life scores were obtained in the domains of material wellbeing and personal development, while the lowest results were observed in the domains of social inclusion, self-determination and interpersonal relationships. At the item-level, the majority of caregivers endorse that the confidentiality of the child's individual evaluation is protected, the child is treated with respect, his/her rights are defended, his/her belongings and right to property are respected and he/she has an adequate hygiene and personal image. In contrast, caregivers also express concerns. For example, more than half of the participants report that their child does not take part in the creation of individual support plans nor participate in natural groups in the communities. Almost half of those evaluated cannot make self-endorsed choices in life areas and have insufficient information about their rights. Quality of life-profiles will be further evaluated in relation to both child and caregiver demographic characteristics.

Conclusions:

The implications of the study are discussed and specific recommendations are made to guide and plan professional practices in order to enhance the quality of life of children and adolescents with autism and co-occurring intellectual disability.

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146.134 Adolescents with Autism Spectrum Disorder and Their Caregiver's Perspectives on the Adolescents' Sexuality and Relationships

N. C. Cheak-Zamora[1]*, M. Teti*[2] *and A. Maurer-Batjer*[2]*, (1)Health Sciences, University of Missouri, Columbia, MO, (2)University of Missouri, Columbia, MO*

Background: Previous research has shown that many adolescents with Autism Spectrum Disorder (ASD) are interested in pursuing sexual or romantic relationships and caregivers play a critical role in providing sex and relationships education. Unfortunately, we know little about the congruence of adolescent and caregiver narratives about the adolescent's sexual and romantic interests or effectiveness of the caregiver's education.

Objectives: The goal of this study was to fill the gap in existing research and better understand the needs of caregivers and adolescents in supporting the adolescent's sexual self-hood. To achieve this goal, this study explored and compared the perspectives of caregivers and adolescent dyads regarding sex and relationships via separate qualitative interviews.

Methods: Qualitative methodology was used to capture adolescent and caregiver in-depth thoughts and experiences. Eligibility criteria for adolescents included being between the ages of 16 and 25 years; having an ASD diagnosis; English speaking; and capable of engaging in study activities. Diagnosis of ASD and age were verified through clinical records. Caregivers were defined as primary care takers of the adolescent, age 16-25 years, with an ASD diagnosis.

Caregivers took part in 90-minute focus groups while adolescents participated in 30 to 60-minute semi-structured individual interviews. Interview guides for both groups centered on exploring transition experiences and independence needs. Data (40 pages for caregivers and 72 pages for adolescent transcripts) were entered into Atlas software and analyzed, by two coders separately, using methods of thematic analysis to capture and compare experiences and attitudes. Sex and relationships were central themes in both groups.

Results: Twenty-seven caregiver and adolescent dyads participated in the study. Most adolescents within our study had a diagnosis of Asperger's Syndrome (40.7%) or Autism/Autistic Disorder (33.3%) with 75% of adolescents rated their ASD symptoms as mild. Analysis of qualitative data revealed overarching themes about companionship, interest and experience, and access to relationship information across both groups. Caregivers (1) expressed more concerns (present and future) about companionship problems than adolescents; (2) seemed to underestimate adolescents' interests and experiences with sex/relationships; and (3) overestimated adolescents' comfort confiding in caregivers about sex/relationships. Adolescents (1) spent more time describing current friendships and romantic relationships; (2) exhibited less future-oriented thinking than their caregivers; and (3) describe multiple places to access sexual education and relationship advice but reported lacking real knowledge and practical advice.

Conclusions: Our study can inform interventions to better support adolescents' sexual development. Findings show that successful interventions need to include caregiver and adolescent curricula as well as knowledge checks for adolescents to insure engagement and information retention. The importance of sex and relationship research with adolescents with ASD cannot be overstated. Thus, understanding adolescent and caregiver perspectives on the adolescent's sexual and romantic relationship is critical to both caregiver and adolescent's holistic well-being and development.

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146.135 An Examination of the Parentification and Infantilization Experiences of Typically-Developing Siblings of Individuals with Autism Spectrum Disorder

A. K. Nuttall[1]*, W. J. Chopik*[2]*, F. M. Hasan*[3] *and P. R. Dery*[3]*, (1)Michigan State University, East Lansing, MI, (2)Psychology, Michigan State University, East Lansing, MI, (3)Human Development and Family Studies, Michigan State University, East Lansing, MI*

Background:

Children's caregiving roles occur on a spectrum where moderate levels are expected to be beneficial for children in contrast to low parental expectations which are expected to underestimated children's abilities and lead to underfunctioning (*infantilization*) and high parental expectations expected to overburden children (*parentification*) (Jurkovic, 1997). Parentification is a multi-dimensional construct recognizing that parentification roles differ with regards to providing caregiving for parents and siblings (Hooper et al., 2011) and instrumental and emotional caregiving (Jurkovic, 1997). Moreover, parentification is particularly burdensome when there is poor parental maintenance of boundaries (Kerig, 2005) or children perceive roles as unfair or of few personal benefits (Jurkovic, 1997).

Research has examined parentification adjustment outcomes among typically-developing siblings (TDS) of children with Autism Spectrum Disorder (ASD) (Tomeny et al., 2016; 2017). However, this literature has not yet examined infantilization, nor compared the experiences of TDS to the experiences of siblings who do not have a sibling or family member with a disability. Such work can identify whether TDS are at increased risk for parentification and/or infantilization. Moreover, in order to elucidate TDS' experiences it is critical to examine parentification as a multi-dimensional construct consistent with parentification theory.

Objectives: We compared role experiences of TDS of individuals with ASD with those of siblings who did not have a family member with a disability. Specifically, we examined each key dimension of parentification (parent-focused, sibling-focused, emotional, instrumental roles, parental maintenance of boundaries, perceptions of unfairness and benefits associated with roles) and the converse of parentification, infantilization. We hypothesized that TDS of children with ASD would experience more role violations than siblings from families without a disability.

Methods: Online surveys about roles were collected from participants who self-identified as TDS of individuals diagnosed with ASD (Autism, ASD, Asperger's, and Pervasive Developmental Disability) (n=108) and siblings from families in which no members had disabilities. We used propensity score 1-1 matching on family constellation and demographic variables to select the final comparison sample. Sample characteristics are reported in Table 1 (age 18-25; N=216).

Results: Results from independent sample t-tests indicated that TDS experienced greater mean levels of parent-focused and sibling-focused parentification and instrumental parentification. There were no significant group differences with regards to emotional parentification or infantilization. TDS reported higher mean levels of role unfairness and lower mean levels of parental boundary maintenance and benefits associated with parentification roles (See Table 2).

Conclusions: Findings indicate the importance of parentification theory for understanding the experiences of TDS. Parents of TDS of individuals with ASD expect more, but not less, of TDS in comparison to families who do not have a member with a disability. TDS engaged in greater levels of instrumental (but not emotional) caregiving and provided support for not only siblings with ASD but also parents, with parents providing poor maintenance of familial boundaries. TDS' reports reflected perceptions of their roles as unfair and not beneficial to the TDS, suggesting a burdensome experience for TDS.

136 **146.136** Barriers and Facilitators to Success Using High-Tech Augmentative and Alternative Communication (AAC) Devices with Children with Autism Spectrum Disorder (ASD): An Interview Study Examining Stakeholder Perspectives

N. Murphy[1]*, J. McMAHON*[2] *and C. A. Murphy*[3]*, (1)School of Education, University of Limerick, Limerick, Ireland, (2)University of Limerick, Limerick, Ireland, (3)Clinical Therapies, University of Limerick, Limerick, Ireland*

Background: Children with a diagnosis of ASD and limited speech often use high-tech AAC devices or applications as their primary mode of communication. A wide range of factors is associated with successful implementation of AAC across the home, school and community environments. In particular, stakeholders such as family and a range of supporting professionals play an integral role in the successful selection, training and implementation of AAC technology for children with ASD. Among the key players in the process are parents, AAC specialists, teachers, speech and language pathologists and behaviour analysts. These stakeholders approach AAC interventions with different aims, priorities and methods. This qualitative interview study employs a social constructivist perspective to examine the experiences and key factors associated with AAC success and failures among a unique range of stakeholders involved in supporting children with ASD.

Objectives: The objective of this study was the exploration of experiences, barriers, and facilitators to success across a range of supporting stakeholders involved in supporting children with ASD to use high-tech AAC devices.

Methods: Eleven parents and practitioners with extensive experience supporting children with ASD using high-tech AAC devices and applications participated in this study. Individual semi-structured interviews were carried out in order to access rich descriptions of barriers, and, facilitators to using high-tech AAC with this population. The interviews were recorded, transcribed verbatim and analysed thematically as per Braun and Clarke (2006). Double coding of the interviews was used to ensure rigour.

Results: Analysis revealed nine prominent themes providing insight into important features of AAC devices for this population, barriers to successful communication outcomes, and stakeholder perspectives on features of effective AAC training and implementation. Participants shared many common concerns, but the data also revealed some diversity of views. Themes and sub-themes are described with illustrative and representative quotes.

Conclusions: Findings illustrate the multitude and complexity of factors and perspectives involved in successful support and implementation of AAC device use for children with ASD. The participants in this study approach AAC interventions differently, however, they share many of the same aims, goals, and experiences. Awareness of these shared insights may be useful to focus family and practitioners when planning and implementing AAC interventions. This research lead to the development of a questionnaire used in a Delphi study identifying factors associated with successful AAC device and intervention selection and implementation for children with ASD

137 **146.137** Building Better Bridges for Critical School Transitions of Underserved Children with ASD

J. Smith*, University of California, Los Angeles, Los Angeles, CA*

Background: Ethnically diverse, foreign-born, low-income, and rural children have been found to receive autism diagnoses later than their white counterparts, as well as receive different combinations of autism-specific services than white children with ASD (Magaña et al., 2013, Mandell et al., 2009; Mandell et al., 2010; Thomas et al., 2007; Valicenti-McDermott et al., 2012). This requires the development of policies and practices to address the needs of these communities. Community partnered participatory research (CPPR; Jones et al., 2009) is a transformative framework with documented effects with ethnically diverse cultural groups in community health (Chung et al., 2010; Kim et al., 2005). Benefits of using CPPR as a framework include increases in knowledge, engagement, acceptability of intervention, and community support and trust (Powers, 2017).

Objectives: *Building Better Bridges* is a five-year collaborative study that investigates the transition experiences of under-served families of children with ASD. Goals include the development of an intervention that engages parents, students, and school personnel to create a seamless hand-off between school systems or grade levels, and focuses on the development of critical transition skills. This abstract identifies barriers and needs in critical school transitions (i.e., preschool to primary, and primary to secondary).

Methods: Collaborators developed a protocol for focus groups and interviews with parents and staff to identify current transition processes, supports that facilitate transition, challenges and successes, and recommendations. Data included 38 transcripts with school providers (n=75) and parents (n=44) of children with ASD who had undergone a critical K-12 transition within the past year, and who met federal low-income qualifications. Focus groups and interviews were conducted in English or Spanish to match the parent's primary language, audio recorded, and transcribed. Coders established reliability on two consecutive transcripts (d > 0.61; Council on Exceptional Children, 2014); twenty percent of transcripts were double coded. Raters reached consensus on emergent codes and final themes through the constant comparative method. Stakeholder involvement ensured themes reflective of our target population.

Results: Parents reported great variability at the transition into kindergarten due to the change in systems from preschool to kindergarten. Some parents reported being well-prepared by the preschool, while other parents and some providers reported limited support due to the sending school's inability to definitely discuss district placements or services. Supports included service providers (e.g., SLPs, paraeducators, etc.) and other parents who had gone through transition. In secondary, school practices were more structured with school tours and summer bridge programs organized by the sending or receiving school. Recommendations included training for parents, paraeducators, and general education teachers, better home-school communication systems, and improved communication from one school team to another.

Conclusions: Although transition planning must be individualized, school practices vary greatly from district to district, and from school to school. There is a need to develop standard transition practices including how under-served parents are informed about transition, and how one educational team communicates information to the new team. *Building Better Bridges* addresses this need, and over the next two years, will be tested in a randomized control trial.

138 **146.138** Can Theatre Increase Autism Acceptance? Evaluating a Performance Piece Developed from Stakeholder Stories and Delivered By Autistic and Non-Autistic Actors

***A. Massa**[1], D. DeNigris[2] and K. Gillespie-Lynch[3], (1)College of Staten Island, Staten Island, NY, (2)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (3)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: Autistic college students face challenges despite often high academic potential, including stigma toward autism (Matthews et al., 2015). Participation in an online fact-based autism training was associated with increased autism knowledge and decreased stigma among college students in the United States, Lebanon and Japan (Gillespie-Lynch et al., 2015; Obeid et al., 2015). However, factual knowledge about autism may be less consistently associated with attitudes toward autism than *high-quality contact with autism* is (Gardiner & Iarocci, 2014; Nevill & White, 2011; White et al., 2016). According to "contact theory," direct positive contact between two groups may result in reduced biases (Allport, 1954).
Objectives: By developing a participatory performance-based intervention from the stories of autistic people and people close to them, *Beyond Spectrums*, which autistic people acted in, we aimed to use high-quality contact to decrease autism stigma and increase autism knowledge.

Methods: We gathered stories from the NYC autism community via survey. Respondents (*N* = 34) were informed that their responses would be dramaturged to create a script and answered a question from a list of choices (e.g., "In what ways have you observed autism to empower or disempower individuals?") using any form of writing they desired (story, free verse, etc.). Two of the nine performers in *Beyond Spectrums* were autistic. Participants (*N*= 101) attended one of three performances and completed demographics questionnaires and pre-test/post-test evaluations (before and immediately following the performance, respectively) assessing autism knowledge and stigma (Gillespie-Lynch et al., 2015). Participants varied in age (*M* = 29.47), gender (53% female), ethnicity (47.9% minorities), and lived experience with autism (8.3% were autistic and 19.0% had an autistic nuclear relative). Participants' responses to open ended questions about the performance were qualitatively coded after reliability was obtained.

Results: A mixed-model ANOVA revealed that men reported higher stigma than women (p = .02), a reduction in stigma from pre-test to post-test (p < .001), and an interaction between gender and change in stigma (p = .025). Another mixed-model ANOVA indicated an increase in autism knowledge following the performance piece (p < .001) but no associations with gender.

Among participants who completed open-ended evaluations of the performance, 94% indicated they had learned something new, 98% indicated that it was effective, 83% indicated that it had an emotional impact on them (often referring to a relationship with autism), and 96% indicated that it could change society. However, they often qualified societal impact (e.g., "this is a first step"). When asked how to improve it, 36% of respondents indicated that it was great as it was, 7% suggested that it could be more interactive, 35% provided polishing suggestions and 14% indicated that more autistic actors and/or stories should be incorporated.

Conclusions: Findings indicate that theatre can reduce autism stigma. A key strength of this research is that it was guided by autistic voices. Future theatrical interventions should meld greater resources with opportunities for diverse autistic people to shape the piece in order to impact stigma on a larger scale.

139 **146.139** Caregiver Perceptions of Insurance Coverage As Both a Barrier and Facilitator to ASD Resources

***M. E. Villalobos**[1,2], L. DeLustro[3], M. R. Klinger[4], L. G. Klinger[5] and J. Stinson[6], (1)Psychiatry, UNC Chapel Hill, Asheville, NC, (2)psychiatry, UNC-Chapel Hill, asheville, NC, (3)ETSU, Johnson City, TN, (4)UNC TEACCH Autism Program, Chapel Hill, NC, (5)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC, (6)ETSU, johnson city, TN*

Background: The impact of healthcare coverage on access to autism-specific services and health related quality of life factors (HRQOL, WHOQOL-BREF) is largely unknown. Until recently, health insurance plans typically did not cover autism-specific treatment (Bouder, 2009 and Baller, 2015). Increased instability of healthcare coverage has reached a new high with the implementation of the Affordable Healthcare Act and its possible repeal, in addition to concerns around state-specific Medicaid funding. Many families are faced with difficult decisions and/or few options for healthcare. Autism insurance mandates have been implemented in 43 states and previous analyses suggest that the first few years of the mandate often result in low rates of utilization (Mandell 2016) largely due to system and services delivery challenges (Baller, 2016).
Objectives: This study aimed to 1) examine the relationship of insurance changes on HRQOL factors, and 2) explore caregiver's perceptions of the healthcare coverage changes in a state with an autism insurance mandate effective in the past year.

Methods: A mixed-methods approach was used beginning with a quantitative survey assessing HRQOL and insurance changes. The survey was disseminated online to parents of youth who were part of research registry through UNC Chapel Hill. 365 caregivers completed the survey. In order to determine whether insurance variables significantly predicted HRQOL subscales (physical, psychological, social and environmental), a linear regression was conducted. Insurance variables hypothesized to predict HRQOL included the following: (1) changes in health insurance in the past two years, 2) perceived quality of change and 3) perceived quality of current insurance. For the qualitative component, 8 participants were interviewed. Qualitative interview questions were created to examine the relationship parents see between HRQOL and their own daily experiences; explore barriers and facilitators towards seeking out services, resources, or support; and elicit parental responses to potential mechanisms of disseminating support and various types of supportive providers. Theoretical thematic analysis was used to help describe transcript data. NVivo-11, a qualitative analysis software package, was used in the thematic analysis process for organization of codes and creation of themes. The current study focused on the theme "Resources."

Results: First, a linear regression was conducted to examine whether a change in insurance predicted HRQOL subscales. Caregivers who reported changes in insurance coverage scored lower on overall psychological well-being (β =-.187, p =.025). Further, caregivers who rated the quality of their current coverage lower also reported poorer environmental conditions (β = 269, p =.000) and physical health (β = -.146, p = .05). Second, qualitative analyses examining the resource theme further explained caregiver's concerns around insurance change (see Table 1): caregivers expressed concerns around loss of insurance coverage or loss of state Medicaid funding, the rising cost of services and challenges with traveling to providers who would accept their insurance.

Conclusions: Caregivers are voicing concerns around the instability of healthcare coverage, which is impacting their psychological and physical health as well as environmental quality of life. Further studies should examine potential supports for caregivers as they navigate healthcare coverage.

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146.140 Mixed-Methods Approach to Understand Health-Related Quality of Life in Parents of Youth with ASD

M. E. Villalobos[1]*, L. DeLustro*[2]*, J. Stinson*[3]*, M. R. Klinger*[4] *and L. G. Klinger*[5]*, (1)Psychiatry, UNC Chapel Hill, Asheville, NC, (2)ETSU, Johnson City, TN, (3)ETSU, johnson city, TN, (4)UNC TEACCH Autism Program, Chapel Hill, NC, (5)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC*

Background: If we want to improve the lives of children with ASD we have to consider the health and overall well-being of parents and caregivers. Previous research has clearly shown that parents of children with ASD experience a higher level of stress (Eisenhower et al., 2005) and report increased psychopathology, including anxiety and depression, when compared to parents of normally developing children. The health of caregivers is irrevocably linked to a number of outcomes for the recipient of care including the effectiveness of child-focused interventions.
Objectives: This study sought out to identify psychological factors that predict health related quality of life (HRQOL, WHOQOL-BREF) in parents of youth with ASD as well as give voice to the daily lived experience of these individuals by using a mixed-methods approach. HRQOL captures a meaningful snapshot of the experience of a parent by integrating multiple dimensions of well-being including physical and psychological health along with the subjective experience of health reported by a parent.

Methods: A mixed-methods approach was used beginning with a quantitative survey. The survey was disseminated online to parents of youth who were part of research registry through UNC Chapel Hill. In order to identify variables that significantly predict HRQOL, a hierarchical regression was conducted. Independent variables hypothesized to predict HRQOL included the following: (1) perceived burden, (2) perceived positive aspects of caregiving, (3) coping strategies (adaptive, maladaptive, help-seeking, and avoidant), and (4) social support (belonging, tangible, and appraisal). For the qualitative component, 8 participants were interviewed. Qualitative interview questions were created to examine the relationship parents see between HRQOL and their own daily experiences; explore barriers and facilitators towards seeking out services, resources, or support; and elicit parental responses to potential mechanisms of disseminating support and various types of supportive providers. Theoretical thematic analysis was used to help describe transcript data. NVivo-11, a qualitative analysis software package, was used in the thematic analysis process for organization of codes and creation of themes.

Results: To test the effect of psychological variables on HRQOL, hierarchical regression was conducted. First, demographic variables, including household income, parent age, and child age were entered into the model, then social support, burden, and positive and maladaptive coping were entered. Perceived burden, tangible social support, and maladaptive coping were all significant, strong predictors (see Table 1). Themes identified through thematic analysis included social and community support, resources, lack of understanding about ASD demonstrated by others, experiences of the caregiver, caregiver coping strategies, and process of reaching a diagnosis of ASD (see Table 2).

Conclusions: Interventions aimed at improving parental health and well-being should focus on parents most at risk for lower HRQOL. This means reaching out to older parents, parents of young children, and families with fewer socio-economic resources. When deciding how to intervene with parents, providers should focus on assessing for coping strategies, perceived burden, and presence of tangible social support. It may be helpful to offer psycho-education about adaptive coping strategies and/or inform parents about local avenues of tangible social support.

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146.141 Combining Anecdotal Observation with Scientific Discovery to Improve Translational Genetics Research in Autism Spectrum Disorders

ABSTRACT WITHDRAWN

Background: There are hundreds of genes implicated in risk for autism spectrum disorders (ASD); however, the clinical utility of this knowledge to help inform treatment remains limited. Understanding how currently implicated mechanisms contribute to variable expressivity of core symptoms and comorbidities in ASD is crucial to using genetics to inform more effective treatments. Generating hypotheses testing anecdotal evidence that highlights potential connections between comorbidities and ASD offers the opportunity to reveal important clinical and biological relationships. Previous studies have used this approach to successfully decipher pleiotropic genetic effects of ASD candidate genes (e.g., *MET* variation and expression of gastrointestinal symptoms in ASD). Sleep problems are common in individuals with ASD. Sleep has strong, neuronal-specific effects on the function of molecular, cellular and network mechanisms of synaptic plasticity. Synaptic pruning is also observed to be disrupted in individuals with ASD. Considering sleep is important to synaptic pruning it is possible that short sleep duration exacerbates atypical synaptic pruning, leading to more severe symptoms of ASD. Notably, genes encoding proteins essential for synaptic function are recurrently implicated in ASD.
Objectives: Our goal is to determine if dysfunction in synaptic genes underlies the expression of more severe symptoms observed in relation to short sleep duration in ASD.

Methods: We analyzed medical histories and whole-exome sequence data from 2,714 children in the Simons Simplex Collection. Linear regression was conducted to test if parent-reported sleep duration was associated with ASD-related symptom severity. Symptoms were compared between children in the lower 5th (extremely short) and upper 95th (extremely long) percentiles of the sleep duration distribution. Gene-set enrichment analysis for biological processes defined in Gene Ontology was conducted on ASD candidate genes included in the Autism Informatics Portal using the TopGO package in R. Sequence Miner was used to identify variants in genes assigned to the synaptic signaling biological process. Genetic risk scores were calculated, reflecting the number of variants (weighted by the likelihood of being detrimental as defined by eleven prediction algorithms) per individual. Linear regression was conducted to test if genetic risk was associated with ASD-related symptom severity. Influence of risk scores on the relationship of symptom severity and sleep duration was assessed with interaction tests.

Results: Shorter sleep duration was associated with increased social impairment, severity for numerous challenging behaviors and attention deficit disorder, depressive disorder, and obsessive compulsive disorder. Symptoms were more severe in children sleeping ≤420 minutes/night compared to ≥660 minutes/night. Increased burden of deleterious variants in synaptic signaling genes significantly influenced the relationship of short sleep duration with expression of depressive disorder.

Conclusions:

Results show a clear relationship between shorter sleep and more severe ASD symptoms, demonstrating the importance of identifying sleep problems in this patient population. We are currently exploring pleiotropic genetic effects influencing sleep duration and ASD symptom severity. Characterizing pleiotropic effects may help refine the mechanisms underlying expression of sleep problems in ASD. This, in turn, may inform more effective treatment options.

142 **146.142** Depressive Symptoms in Siblings of Children with in African American and Caucasian Families

ABSTRACT WITHDRAWN

Background: In school children, Kistner (2003) found that African American (AA) boys reported more depressive symptoms than Caucasian (C) boys, while AA and C girls reported comparable levels of depressive symptoms. Elevated rates of depression have been reported in the siblings of a child with an autism spectrum disorder (ASD) (Gold, 1993; Lovell & Wetherell, 2016). Little attention has been given to the role that racial diversity may play in children and adolescents with a sibling with ASD self reporting depression or in their parents reporting symptoms of depression in their well children.
Objectives: This ongoing study investigates: (1) are there differences in the self-report of depressive symptoms between a neutrotypical ASD sib and parental reporting; (2) are there racial differences in reporting symptoms of depression; and (3) are there racial differences in parental reporting symptoms of depression in ASD sibs.

Methods: Participants were recruited from the SC Department of Disabilities and Special Needs Autism Division. Criteria for inclusion were (1) C or AA families with at least one child with ASD 8 to 17 years, and (2) at least one sib not diagnosed with ASD. The Childhood Depression Inventory (self-report and parent report) were used to measure depressive symptoms (Kovacs 1991).

Results: The preliminary sample 11 C families, and 12 AA families. While not statically significant, AA sibs (33.3%) were 4x more likely than C sibs (7.7%) to report CDI scores ≥13. In fact AA sibs (17%) reported severe clinical symptoms (CDI ≥ 19) whereas C sibs did not. Female sibs reported higher clinically significant CDI scores than male sibs: C female: male ratio = 2:1; AA female: male ratio 3:1. AA mothers were four times more likely than C mothers to rate depression symptoms of ASD sibs in the clinical range. Both AA mothers and C mothers indicated their sons had more depressive symptoms than their daughters. An item analysis indicated AA sibs reported significantly fewer friendships (t(1, 21) =2.11, p=0.046) and fewer opportunities for fun than their C counterparts (t(1, 21)=2.57, p=0.018). AA mothers also reported ASD sibs had significantly fewer friends than C mothers reported (t(1, 22)=2.23, p=0.036). Finally, parents reported fewer symptoms of depression in ASD sibs than the children self-reported. The discordant rates for C families and AA families were 50% and 33% respectively.

Conclusions: Preliminary results indicate AA sibs reported more depressive symptoms than C sibs. The preliminary findings are inconsistent with previous studies of childhood depression. In this small study, both females regardless of race reported more depressive symptoms than males. Consistent with previous studies, parent and child ratings of depression were discordant. These results may change as participants are added to the study. Future research should address the social support needs of AA ASD sibs.

143 **146.143** Examining the Social Validity and Outcomes of Clinically Replicated PEERS (R) for Young Adults, Adolescents, and Preschoolers Groups

R. M. Klinkel[1]*, G. Lyons*[2] *and J. Gong*[3]*, (1)STAR Center for ASD and NDDs, UCSF, San Francisco, CA, (2)Psychiatry, UCSF, San Francisco, CA, (3)UCSF, San Francisco, CA*

Background: PEERS® is an empirically supported, parent-assisted social skills group that delivers comprehensive, skills-based curricula to adolescents and young adults. PEERS® research suggests positive and durable effects on the social skills of teens and young adults with ASD and related disabilities (Laugeson et al., 2012; 2015). PEERS® Preschool curriculum is undergoing initial evaluation.
Few studies are devoted to evaluating the social validity (SV) of research-demonstrated interventions such as PEERS®, while fewer studies consider relationships between SV and outcomes. Despite this, stakeholder approval is paramount when considering intervention diffusion and refinement. Indeed, stakeholders are more likely to select interventions they deem acceptable, while discontinuing those viewed as too demanding or inappropriate (Kazdin, 2000). Capitalizing on the burgeoning PEERS® evidence-base, replications considering outcomes must pivot to empirical questions that integrate stakeholder experiences.

Objectives: We are surveying parent and patient participants across four SV domains: *acceptability*, *feasibility*, *perceived effectiveness*, and *satisfaction*, and then analyzing SV in relation to parent- and patient-informed outcome measures.

Methods: We are clinically replicating PEERS® under the supervision of a certified PEERS® clinician and licensed psychologist at a university-based clinic. We included data from 57 stakeholders (92% of potential participants consented/included) across two Adolescent, two Young Adult, and one Preschool group (*n* = 30 parents; *n* = 27 patients) and aim to enroll 78 more by May 2018. Our inclusion criteria were identical to those described in PEERS® research. Every group had at least one female patient and 78% had ASD. Attrition was minimal (two drops after the 1st session, one after the 6th). We obtained pre-outcome measures prior to the first session, and post-outcome and SV questionnaires on the final session. The SV questionnaire used a 5-point scale: *strongly agree* = 5 to *strongly disagree* = 1. Outcome measures mirrored those used in prior PEERS® research.

Results: Overall satisfaction across the groups was 4.1, with relatively high ratings by parents in the preschool group (4.6) and low ratings by patients in the teen group (3.6). Descriptively, patient teens and young adults consistently rated SV less favorably than parents. Young adult patients perceived a more neutral effect (3.6), whereas parents of preschoolers perceived larger effects (4.5). In terms of acceptability of weekly lesson topics, ratings across respondents and groups were high. For outcomes, clear gains were indicated by several measures (see Table 2), whereas many measure showed minimal improvement. Some outcome data showed discrepancies between patient and parent responses. Attendance was high (M = 87%; range: 62.5-100%) and not associated with SV/outcomes. Exploratory correlations suggest, at $p < .05$, that (a) teens and young adults with ASD rated PEERS® significantly less feasible than those without ASD, and (b) some outcomes, such as Empathy Quotient, are strongly and positively associated with SV (r = 0.74).

Conclusions: Preliminary results suggest mostly positive SV of PEERS®, inconsistent outcome data, and associations emerging between SV and outcome, as well as SV and diagnosis. Understanding the SV of PEERS® could help stakeholders improve successful contact with intervention and better understand the variation in outcomes.

144 **146.144** Factors Affecting the Global Health Status of Children with ASD: An Analysis of Promis Pediatric Global Health Parent-Proxy Data from the Interactive Autism Network

***A. R. Marvin**, P. H. Lipkin and J. K. Law, Medical Informatics, Kennedy Krieger Institute, Baltimore, MD*

Background:

The overall well-being or "global health" of children with autism is important. Identifying specific factors associated with poor global health may lead to improved treatment and care.

Objectives:

To determine factors associated with global health as measured by the Patient-Reported Outcomes Measurement Information System (PROMIS) Pediatric Global Health measure (PGH-7) parent-proxy report.

Methods:

- Parent participants in the Interactive Autism Network (IAN)—a large, validated and verified, internet-mediated, parent-report research registry—completed the PGH-7 on their children age 5-17 with ASD.
- PGH-7 is a validated 7-item question bank that assesses a parent's overall evaluations of the physical, mental, and social health of his or her child. Responses to each question range from 1(worst)-to-5(best). Raw total scores (=sum of the scores for each question with minimum =7 and maximum=35) are converted to standardized T-scores (Mean=50; SD= 10), e.g., total raw score=24->T-Score=39.7 (~1SD below mean); total raw score=29->T-Score=49.3 (~the mean).
- Parents also completed IAN's Birth and Diagnosis Questionnaire (BDQ), which collects baseline data relating to each child's birth, ASD diagnosis, and development. A rating of "significantly below age level" on the cognitive functioning question and/or IQ score <70 was used as a proxy for intellectual disability (ID). A rating of "meaningful, fluent speech" was used to determine whether the child had normal verbal ability. In addition, the BDQ asks about the degree to which the child has experienced 15 common conditions or difficulties associated with ASD during the past 30 days. The BDQ also includes questions on parent marital status and household income. Children with a BDQ completed before age 5 were excluded.
- Demographic data is collected during IAN registration; analysis was limited to children who resided in the US.
- All children had a professional diagnosis of ASD, with a confirmatory score on the Social Communication Questionnaire (SCQ) screener ≥12 and a Social Responsiveness Scale (SRS) T-score>=60T.
- Multiple linear regression was performed on the PGH-7 raw total score and ordered logistic regression on each of the PGH-7 questions. Included variables are listed in Table 1.

Results:

- Demographics: n=1,052; 79% male; 86% white; 10% Hispanic; mean (SD) age at completion of PGH-7 12.3 (3.36) years.
- Household: 80% of parents married or in committed relationship; median income $60,000-$69,999.
- T-Score Percentages: 52.7% >1SD below mean (with 8.3%>2SD below mean); 46.2% +/-1SD of mean; .01%>1SD above mean.
- Multiple linear regression of PGH-7 raw total scores: number predictors reduced to six, with global health inversely related to (i) age and (ii) SRS raw score, the presence of (iii) irritability/aggression and (iv) depression, and difficulties with (v) feeding and (vi) bowel movements. $R^{2=}$.21, F(6, 889)=38.56, p<.001, with no multicollinearity.
- Ordered logistic regression of PGH-7 item scores: See Table 1. The greatest areas of concern are mental health, "sadness", and socialization.

Conclusions:

Addressing key factors associated with poor global health—most notably depression/mood disorders, feeding and bowel movement difficulties, socialization, and challenging behaviors (e.g., irritability/aggression and self-injury)—are most likely to improve overall well-being for children with ASD.

145 **146.145** Factors Relating to Parent's Decision of Treatment for Their Children with Autism in Vietnam

***H. Vu**, Hung Dong center, Hanoi, Viet Nam*

Background: Vietnam has not officially considered autism spectrum disorder (ASD) as a disability and there has not been an official national guide for ASD treatment. Most Vietnamese parents have to make treatment decisions for their children with ASD own their own.
Objectives: This study aims to examine the status of Vietnamese parents' choices for treatment services for their children with ASD.

Methods: A questionnaire included items about informant's demographic information, information of their child(ren) with ASD, and possible factors that may relate to parents' choices of intervention was created based on literature review and some parents and professional interviews. One hundred and eighteen parents from 5 provinces in Northern Vietnam participated in the study.

Results: Parents' choices of treatment varies with evidence-based as well as non-evidenced treatments. Family economy status was negatively correlated with non-evidenced treatments (*r=-0.402, p<0.05*); characteristics of children with autism (e.g. severity, skill level) had positive correlations with evidence-based (*r=0,264; p = 0.01*); and child's general functional level had negative correlations with evidence-based (*r=-0.261; p=0.01*). Parents' frequencies of looking for information are related to autism and the treatment methods; time accessing information sources; intervention locations; and parents' emotions significantly predicted evidence-based versus non-evidence treatment choices. Finally, the younger children are, the more parents hesitate in selecting interventions for children.

Conclusions: This is one of the first studies in Vietnam looking at parents' selecting behaviors and the correlates, which implies multiple suggestions for practice and research. Suggestions for future research directions, as well as policy and practice was provided to better support Vietnamese parents.

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146.146 Family Meetings Increase Recruitment and Engagement of Genetically Defined Communities in Simons Variation in Individuals Project (Simons VIP)

__L. A. Cartner__, J. Tjernagel, A. Daniels, L. A. Green Snyder and W. K. Chung, Simons Foundation, New York, NY

Background:
The Simons Variation in Individuals Project (Simons VIP) was established in 2010 to study groups of individuals who share recurrent genetic variants known to increase the risk of autism spectrum disorder and other neurodevelopmental conditions. In 2014 Simons VIP launched an online registry, enabling longitudinal data collection. One way to enhance engagement is to collaborate with self-organized communities who share a genetic etiology ("family groups") to coordinate or attend family meetings, either in-person or virtually. Virtual meetings are interactive webinars that share study results, present on special interest topics, and include discussion time. Goals of family meetings include providing education on the genetic condition, returning findings from the registry, performing research, and family interaction time.

Objectives:
The aim of this study was to evaluate the impact of engagement with genetically defined communities, at both in-person and virtual family meetings, on the enrollment and participation in the Simons VIP online registry.

Methods:
The impact of engaging with family groups was evaluated in ten family meetings taking place between 2016 and early 2018. Six of these meetings occurred in person, while four were virtual meetings. Main outcomes assessed included study enrollment and measure completion. Measures included: medical history and Vineland Adaptive Behavior Scales Second Edition (phone interview), and standardized online behavioral questionnaires. The study period was four-months starting three months prior to and one month after the meeting date, which contains active preparation time with the family group and follow up after the event. An increase was calculated as the change in enrollment or measures completed compared to the number of enrollments or measures completed at the start of the study period. Changes in main outcome measures for groups with family meetings were compared to groups without family meetings during the same date-matched time frames.

Results:
Compared to genetic variant groups without family meetings, we found an increase in both enrollment and measure completion among those groups with whom Simons VIP actively engaged with over the study period. On average, there was a 44% increase in registry enrollment per group with engaged communities, compared to a 17% increase for groups without engagement. We also found a 192% average increase in measure completion with engaged communities, compared to a 16% increase for groups without engagement during the same time period. Note that the average increase in enrollment and measure completion is primarily driven by inaugural meetings for respective family groups.

Conclusions:
Based on findings from the initial ten family meetings, there is evidence of increased registry activity for genetically defined communities when Simons VIP engaged with those groups to participate in family meetings, irrespective of format (in-person or virtual). The virtual family meeting model is scalable to a broader range of genetically defined groups, and may be appropriate for groups just beginning to organize. The percentage increases in enrollment and measure completion varied across groups. Further research is necessary to demonstrate the impact of this type of engagement on cohort recruitment and retention.

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146.147 Financial Impact, Quality of Life and Stigma of the Families of People with ASD in Uruguay in the Framework of a New Mental Health Law

V. Besio[1], __G. Garrido__[1], A. Rattazzi[2], R. A. Garcia[3], C. S. de Paula[4], C. Montiel-Nava[5], D. Valdez[6], A. Rosoli[7], S. H. Cukier[2] and M. Irrazabal[8], (1)Universidad de la República, Montevideo, Uruguay, (2)PANAACEA, Buenos Aires, Argentina, (3)Universidad de Chile, Santiago, CHILE, (4)Developmental Disorder Program, Universidade Presbiteriana Mackenzie, São Paulo, Brazil, (5)La Universidad del Zulia, Gainesville, GA, (6)Universidad de Buenos Aires-FLACSO, Buenos Aires, Argentina, (7)Projects, Organizacion Estados Iberoamericanos, Santo Domingo, Dominican Republic, (8)Millennium Institute for Research in Depression and Personality, Santiago, Chile

Background: International studies have described the impact of having a family member with autism spectrum disorder (ASD). It depends on many variables including access to treatments, inclusion in the educational system, stigma and severity of symptoms. Few studies have been conducted in Latin America describing the impact on families.
Objectives: Evaluate perception of the caregivers of people diagnosed with ASD in Uruguay have of the economic impact, quality of life, stigma and the variables that determine it. Contribute inputs to the New National Mental Health Plan within the framework of the National Integrated

Health System and the Care System

Methods: Cross sectional study. During a period of 4 months (2015-2016) caregivers completed the Autism Speaks Caregiver Needs Survey. Adaptation and dissemination of the survey was carried out by professionals and parent's associative corporation. This study is part of an investigation based on the needs of caregivers of people with ASD that made in six Latin American countries (Argentina, Brazil, Chile, Uruguay, Panama, Dominican Republic) by the Red Espectro Autista Latinoamerica

Results: - 382 surveys were filled in Uruguay, with a response rate of 11.14 per 100,000 inhabitants. 53% of the respondents said their son's disorder had caused family financial problems. One family member stopped working in 35,5% and in 52% had to reduce their working hours to take care of the individual with ASD. Quality of life was assessed relating the satisfaction and importance of three variables (importance of having support in school, making friends and the relationship with professionals). Satisfaction is low if it is related to the importance given. 35% feel discriminated by others because they have a child with ASD. 34% described impotence generated by having a child with ASD

Conclusions: Financial impact may be consequence of the costs of the treatments and the reduction of the hours of work or even quit to take of care of the person with ASD. Aspects such as: educational inclusion, the quality of attention and the access to treatment might influence the perception of quality of life that families have. This data is relevant in the current national context. Recently a new Mental Health Law was passed from a Human Rights (perspective or point of view) in the framework of the National Health System. The collected data must be considered in the National Mental Care Health Plan, allowing a thorough analysis of people with TEA's health needs along their lives and their families. More extensive studies should be done to allow a better understanding of the social stigma perceived by parents and to approach the difficulties that limit the social inclusion of people with ASD and their families in Uruguay.

148 **146.148** How Autistic People Portray Autism on Youtube: Alternative Conceptions Trapped in a Digital Bubble

J. Pickens[1], *A. Arpaci*[2], *P. J. Brooks*[3] *and K. Gillespie-Lynch*[4], *(1)The Graduate Center, City University of New York (CUNY), New York City, NY, (2)Staten Island Technical High School, New York City, NY, (3)Psychology, College of Staten Island, Staten Island, NY, (4)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: Online communities can provide valuable supports for autistic individuals (Benford & Standen, 2009). Research on the video-sharing site YouTube suggests that the site may serve as a useful resource for parents of autistic individuals (Bokhari et al., 2014) and may serve as a forum for autistic individuals to challenge stigmatizing conceptions of autism. By posting YouTube content emphasizing neurodiversity, autistic individuals may counter mainstream media depictions of autism (Brownlow et al., 2013) and endorsements of the medical model that contribute to stigmatizing views about autism (Draaisma, 2009; Jones & Harwood, 2008; Sarrett, 2011), apparent worldwide (Gillespie-Lynch et al., 2017). However, YouTube may filter content to match users' preexisting views (e.g., a digital bubble; Pariser, 2011).
Objectives:

1. Use content analysis to discover how media creators on YouTube portray autism.
2. Investigate the merits of YouTube as a platform for the autistic community to challenge mainstream conceptions.

Methods: Four hundred YouTube videos about autism were collected using four related keywords: "Autism", "Autistic", "Aspergers", and "Aspie". The first 100 videos were collected for each query. We eliminated 32 duplicate videos, 14 that were irrelevant to autism, 58 in a foreign language, and 31 that were inaccessible. The remaining 265 videos were categorized in accordance with the content producer's relation to autism (autistic individual, family member of an autistic individual, autism organization, or TV news-media broadcast). Videos were coded for: demographics, attitude towards autism, and purported nature of autism. We aimed to collect the four newest responses from each of the 25 most highly ranked videos in each category. Due to disabled comment sections, we collected 360 comments. The identity of commenters was coded into the following four categories according to self-identification: autistic individual, family member of autistic individual, professional/specialist, and other. Two independent coders achieved reliability > 80% for all coding categories on 20% of the sample.

Results: Utilizing nonparametric statistics, we found striking differences in the content of videos produced by autistic people or family members (see Table 1). Videos produced by autistic people highlighted coping mechanisms, while critiquing available supports. In contrast, videos produced by family members highlighted challenges associated with autism and endorsed available supports. Videos produced by autistic individuals received fewer views, likes, and dislikes relative to videos produced by others (ps <0.001). Videos produced by autistic individuals also tended to have more comments from other autistic individuals (p=0.021). In contrast, videos by family members of autistic individuals received more views and dislikes (ps<0.001), yet fewer comments from autistic individuals (p=0.027).

Conclusions:

Autistic people were more likely to present an alternative conception of their diagnosis and feature a more diverse portrayal of autism, but fail to reach many viewers. Family members, in contrast, were likely to present a mainstream conception and garner more views despite accruing more dislikes. Despite YouTube's potential as a platform for autistic people to challenge misconceptions about autism (Brownlow et al., 2013), this study suggests that YouTube may create digital bubbles where autistic individuals challenge mainstream conceptions, yet struggle reaching viewers with different perspectives.

149 **146.149** How Does Temperamental Individuality Impact the Developmental Course of Symptoms and Maladjustment in Youth with Autism Spectrum Disorder? a 9-Year Longitudinal Study

L. De Clercq[1], *S. S. De Pauw*[1], *L. M. Dieleman*[2], *B. Soenens*[2] *and P. Prinzie*[3], *(1)Department of Special Needs Education, Ghent University, Ghent, Belgium, (2)Department of Developmental, Personality, and Social Psychology, Ghent University, Ghent, Belgium, (3)Erasmus University Rotterdam, Rotterdam, Netherlands*

Background:
Scholars increasingly suggest that the study of unique behavioural traits, as captured by temperament and personality models, may provide valuable keys to better grasp the wide behavioural variability demonstrated by individuals with autism spectrum disorders (ASD). Multiple cross-sectional studies have now identified salient temperament or personality differences associated with the autism spectrum condition, in

adulthood but also in childhood and adolescence. Surprisingly little research, however, has addressed the longitudinal impact of these temperamental variables on developmental outcomes. Two important research questions, particularly salient in childhood and adolescence, relate to the impact of this behavioural uniqueness (ideally comprehensively assessed using temperament as well as personality constructs) on the developmental course of autism symptoms on the one hand, and on the course of psychosocial problems on the other.

Objectives:

This study evaluates the dynamic interplay between unique child characteristics, as measured by temperament and personality, the course of autism-related symptoms, and the manifestation of psychosocial problems, in a 9-year longitudinal study of children and adolescents with autism. First, this study addresses stability and change in temperament/personality, dimensional ASD-symptoms, and internalizing/externalizing problems. Second, the study evaluates the impact of temperament and personality traits on the developmental course of symptoms and of psychosocial problems.

Methods:

Parents of 139 children with ASD reported on their perceptions of the child's temperament (Early Adolescent Temperament Questionnaire-Revised), personality (Hierarchical Personality Inventory for Children), dimensional autism symptoms (Social Responsiveness Scale) and psychosocial problems (Child Behavior Checklist) at three occasions. At Time 1 (T1), children were on average 10.2 years old (SD = 2.4). At Time 2 (T2), the mean age was 16.0 years and at Time 3 (T3), the mean age was 19.0 years.

Results:

Correlational and repeated measurement analyses indicate that all variables (temperament, personality, ASD-symptoms, and behavioural problems) demonstrate substantially high continuity across the nine-year interval. Nevertheless, some marked, yet limited, developmental changes can be noted: temperament and personality profiles tend to become slightly more adaptive and both ASD-symptoms and psychosocial problems linearly decrease across the measurement waves. Notably, we found that the impact of child temperament/personality on the course of SRS-symptoms was more modest than expected: higher scores on ASD-symptoms were moderately associated with higher temperamental Negative Affect and lower Effortful Control, and lower Benevolence in personality, both within- and across-time. By contrast, child temperament/personality had major, predictive validity for the presence as well as the developmental course of psychosocial problems. Externalizing problems were mainly predicted, both cross-sectionally and longitudinally, by perceived difficulties in temperamental Negative Affect, and in the personality traits Extraversion and Benevolence. Internalizing problems were mainly predicted by Negative Affect and lack of Emotional Stability in personality.

Conclusions:

This study documents that youth with ASD shows both substantial stability and change in the manifestation of temperament, personality, ASD-symptoms and psychosocial problems across childhood and adolescence. The relative impact of child temperament/personality on the developmental course of internalizing and externalizing problems appears to be much more pronounced than the impact of temperament/personality features on the developmental course of autism spectrum symptoms.

150 **146.150** Including Autistic Adults in Research to Develop and Evaluate Services Interventions: Lessons from a Long-Standing Academic-Community Partnership

C. Nicolaidis *and D. Raymaker, School of Social Work, Portland State University, Portland, OR*

Background: Though there is a growing appreciation for the value of participatory methods in other fields, autistic individuals are infrequently included as co-researchers in autism research.

Objectives: To use our team's experience conducting participatory, mixed-methods intervention research with and for autistic adults to inform future research.

Methods: The Academic Autism Spectrum Partnership in Research and Education (AASPIRE) has been conducting community based participatory research (CBPR) with autistic individuals and other stakeholders since 2006. During this time, we have successfully conducted ten research studies with autistic adults. We reviewed field notes and other materials from this body of work. We then confirmed and expanded our recollections via discussions with community and academic partners.

Results: AASPIRE was founded due to the Autistic community's frustration with research that did not meet their needs or priorities. Since its inception, AASPIRE has aimed to include autistic adults as equal partners though every phase of the research process. In theory, community partners are primarily responsible for keeping the research respectful, accessible, and socially relevant, while academic partners are primarily responsible for keeping the research scientifically rigorous and academically relevant.

In practice, authentically including autistic adults in research has required considerable attention to individualized accommodations, communication, power sharing, and trust-building. Though many team members have worked with AASPIRE since the beginning, some have left and others have joined over the years. We have had 6-10 autistic partners on the team at any time. We have tried to include partners with diverse lived experiences and to maintain a balance between autistic community leaders and other autistic adults. Since our founding, several autistic team members have obtained advanced degrees themselves.

Due to the dispersed nature of our team, much of our communication happens online. We have developed a structured email format to promote clarity. Group meetings are via text-based instant messenger chat, but partners may also provide input individually via email or telephone. We have developed a variety of facilitation strategies to keep meetings accessible, respectful, fun, and efficient. We have found that a formal consensus process helps ensure shared decision-making. Constant evaluation and adaptation of our collaboration processes has been essential to building a culture of trust.

Academic and community partners have worked together in every phase of the research, collaboratively choosing research topics, obtaining funding, creating materials, designing interventions, interpreting data, and disseminating results. We have found the CBPR process to be particularly helpful in creating accessible consent and data collection materials. The CBPR process has also been critical in designing effective interventions. We collaboratively created an online, interactive healthcare toolkit for autistic adults and their primary care providers, which we have found to decrease barriers to healthcare and improve patient-provider communication and patient self-efficacy. We have used our experiences to create a set of guidelines for the inclusion of autistic adults in research.

Conclusions: CBPR necessitates significant attention to collaboration processes, power-sharing, co-learning, and trust. Authentically including autistic adults as team members can greatly impact the quality of the research process and the resulting interventions.

151 ## **146.151** Join the Fann Club – Results from an Interdisciplinary Network for Professionals on ASD in Females

M. L. Bezemer[1], *A. J. Mol*[2], *A. A. Spek*[3], *P. van Wijngaarden-Cremers*[4] *and E. M. Blijd-Hoogewys*[1], *(1)INTER-PSY, Groningen, Netherlands, (2)Altrecht, Utrecht, Netherlands, (3)Autisme Expertisecentrum, Eemnes, Netherlands, (4)Dimence, Deventer, Netherlands*

Background:

The diagnosis for ASD seems based on the male phenotype. Consequently, ASD is diagnosed more frequently in males than in females (4.5:1; CDC, 2012). Women are often misdiagnosed or diagnosed much later in life (Shattuck et al., 2009). The different manifestation of ASD in females is not reflected in the current diagnostic DSM-criteria (van Wijngaarden et al., 2014; Zwaigenbaum et al., 2012). Despite the fact that the DSM-5 states that "girls without accompanying intellectual impairments or language delays may go unrecognized, perhaps because of subtler manifestation of social and communication difficulties", it lacks concrete criteria to diagnose these females with ASD. Our project group will develop and implement scientifically based knowledge to fill in this gap regarding women with ASD.

In order to do so, the FANN was initiated in March 2017. The FANN is a Dutch interdisciplinary network for professionals (psychologists, psychiatrists, researchers, etc.) who are committed to improve the diagnostic and treatment of females of all ages with autism. Also experienced experts (women with ASD) participate in this network. The members of FANN are all experts in the field of autism in girls and/or women.

Objectives:

The objectives of FANN are to encourage knowledge exchange, to promote collaboration in scientific research, and to prompt implementation of scientific knowledge in clinical practice.

Methods:

The FANN core group meets at least twice a year and consist of 48 registered members, from all parts of the Netherlands. The FANN friends group is a LinkedIn group and consists of 167 members. Statistics are constantly being tracked.

Results:

Based on an online questionnaire, the FANN core group indicates that the following subjects are important: being a knowledge network, providing a (digital) platform, unraveling woman-specific ASD diagnostic features, ameliorating the recognition of ASD in women (including case identification), improving quality of care for women with ASD (preventing misdiagnoses, promoting better and faster diagnosis, developing effective therapy), fostering destigmatization, focusing on acceptance of women with ASD in society, and promoting scientific research.

The FANN friends group - on LinkedIn - shares the following: information on ASD in females gathered from conferences (28%) and articles (22%), advised materials for females with ASD (16%, f.i. specialized ASD cooking recipes), advised therapists with an eye for ASD in females (16%, not only in the Netherlands, but also in Belgium), media attention (12%), research (3%) and miscellaneous (3%). The latter information expands every week. At the conference, the most current data will be presented.

Conclusions:

The FANN exists since March 2017, but already inspired many people. There is a great need for such a network, which also provides a unique angle on females with ASD.

152 ## **146.152** Latino Parents of Children with Autism: Understanding How Innovative Mobile Technology Can Increase Access to Care

I. Arriaga[1], *T. De los Santos*[1], *K. E. Guardado*[2], *A. Gulsrud*[1] *and D. Hayes-Bautista*[3], *(1)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (2)Pediatrics, Children's Hospital Los Angeles, Los Angeles, CA, (3)David Geffen School of Medicine at UCLA, Los Angeles, CA*

Background: Latino parents of children with autism spectrum disorder (ASD) face unique challenges obtaining diagnosis, treatment, and access to autism services. Current literature lacks evidence on how low socioeconomic status (SES) Latino parents navigate autism services and use mobile internet technology to seek such services (Hispanic Pew Research & Fryer 2002). Crilly et al., (2011) found that many under-resourced populations have lower access to the internet on a computer, but have a higher mobile internet usage. Latinos, in particular, use their phones to access the Internet at higher magnitudes compared to other race/ethnic groups including non-Latino Whites (NLW) (Lopez et al., 2013).

Objectives: To understand Latino parents' perceptions of barriers to a diagnosis and treatment of ASD in low SES Latino populations. Moreover, the study aims to explore how Latino parents use mobile technology to access autism-related care.

Methods: IRB approval was obtained to interview 21 self-identified English- and Spanish-speaking Latino parents of children with ASD and 3 key informants (community leaders). Criteria for study participation included residency in Los Angeles County, being of Latin American descent, of low SES, as defined by the U.S. Federal Poverty Guidelines, and a parent of a child between the ages of 2 and 10 years with a professional diagnosis of ASD. Key informants were eligible if they worked with low-income, Latino parents of children with autism. Focus groups and interviews were conducted utilizing open-ended prompts to elicit discussion. Interviews and focus groups were audio-recorded, transcribed verbatim, and independently coded for major conceptual models. Exploratory, qualitative analyses were conducted using a modified grounded theory approach. Six raters coded each transcript to ensure reliability. Data triangulation and methodology triangulation were employed to ensure validity and reliability of data interpretation.

Results: Lack of information and language barriers emerged as major barriers in accessing autism-related services in low-income Latino families. Participants reported a need for culturally sensitive delivery of information. Heavy use of cellular phones to access Facebook and Google in order to connect with other parents and find autism-related information emerged as major solutions that these parents found to be feasible. Participants also expressed disappointment over the *lack of support from institutions* to access school-based and health services for their children. Despite these challenges, parents reported *accessing the internet* to inform themselves about broad topics related to autism (e.g., understanding autism, laws protecting children with disabilities). Cell phones and tablets were the primary source of online access. Lastly, English and Spanish speaking parents differed in their methods of evaluating the validity of online information. Such as verifying the information with other parents versus confirming the author's credentials. *Learning how to trust online* sources was also a major concern for parents.

Conclusions: These findings suggested that more parents are using their phones to inform themselves about their child's diagnosis and access resources. Understanding how Latino parents navigate autism services for their children may facilitate the creation of novel tools to make information and services more accessible to this population.

153 **146.153** Lessons from Recruitment and Engagement of over 4,000 Independent Adults with Autism into SPARK, an Online Research Cohort

***L. Grosvenor**[1], S. Ganesan[2], A. Daniels[1], P. Feliciano[1] and W. K. Chung[1], (1)Simons Foundation, New York, NY, (2)Simons Foundation - SPARK, New York, NY*

Background:

The heterogeneity within autism spectrum disorders (ASD) presents considerable challenges for autism research. ASD research has historically been more focused on children than adults, but as individuals with ASD transition into adulthood, new challenges may emerge. More effective strategies for recruiting and engaging adults with ASD will help researchers improve our understanding of ASD as a lifelong disorder.

Objectives:

We sought to understand how independent adult participants with ASD use and engage with SPARK's digital platform to inform future recruitment strategies for ASD research.

Methods:

All participants were recruited to join SPARK online (https://sparkforautism.org). During registration, independent adults with ASD consent to participate, share basic demographic and diagnostic information, and have the option to invite their biological parents and one non-ASD sibling to the study. They are presented with online surveys and sent saliva collection kits if they choose to participate in genetic studies. Participants are sent gift cards for participation and are enrolled in a lottery for an iPad if saliva samples are returned in a timely manner. We analyzed each step in the registration process as well as survey and saliva sample return for all independent adults in SPARK, and separated participants by age and referral source to understand how these factors relate to participation.

Results:

A total of 4,057 independent adults (44% male) created profiles on the SPARK website, which means they began the process, but did not yet complete informed consent. Of those, 2,029 (50%) consented to share their data with SPARK, and 2,001 (49%) consented to participate in genetic analyses. For comparison, 61% of all SPARK account holders consent to both aspects of the study. Consenting to participate in research varied by age: 28% of ages 18-24, 66% of ages 25-32, 59% of ages 33-44, 41% of ages 45-64, and 44% of 65 and older. Age was similarly associated with survey completion, saliva sample return, and the average length of time for task completion. There is a significant main effect of age group on the time to saliva sample return [$F(4,1316) = 2.48$, $p < 0.05$]. While the majority of independent adults were referred to SPARK by clinical sites (54%), this is a lower percentage compared to independent adults without ASD who enrolled dependent children in SPARK (65%).

Conclusions:

As a large-scale, online, longitudinal autism research cohort, SPARK is well-situated to recruit and engage thousands of independent adults with ASD. Surprisingly, the majority of independent adults in SPARK are female, in contrast to only 20% in the child ASD cohort, but this may reflect gender differences in research participation. Young adults who join SPARK are less likely than older adults to complete the registration process. On average, the older adults are more likely to complete their research tasks, and do so more quickly than younger adults. These are important lessons for informing recruitment and engagement of this under-studied group, and SPARK will focus on developing strategies to ensure that more adults, specifically young adults, fully participate by completing registration and research tasks.

154 **146.154** Leveraging Pediatric Primary Care Systems to Address Disparities in Autism Diagnosis and Engagement in Services: Implementation of a Family Navigation Intervention

***E. Feinberg**[1], A. Bennett[2], C. Weitzman[3], M. Augustyn[4], S. broder-Fingert[5], A. Chu[1], J. Eilenberg[6], Y. Diaz-Linhart[4], I. Fernandez-Pastrana[4] and N. Blum[7], (1)Boston University School of Public Health, Boston, MA, (2)Children's Hospital of Philadelphia, Philadelphia, PA, (3)Yale University, New Haven, CT, (4)Boston Medical Center, Boston, MA, (5)Pediatrics, Boston University, Boston, MA, (6)Boston University, Boston, MA, (7)The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Although evidence that interventions for very young children can impact the core deficits of ASD continues to grow, systems changes supporting screening, evaluation, and timely access to services have not kept pace with advances in diagnosis and treatment. Feasible, systemic interventions with broad scale-up potential are necessary. Leveraging pediatric primary care systems creates opportunity to decrease racial and ethnic disparities in identifying children with autism and providing them timely, quality services by expanding reach and supporting maintenance of effective interventions. Patient Navigation is a primary care-based care management approach that focuses on overcoming logistical hurdles to care during a defined episode.

Objectives: To use the RE-AIM framework to evaluate Family Navigation's (FN) external validity and potential for broad scale-up

Methods: We developed FN, a version of Patient Navigation designed for low-income, urban families of children with suspected ASD. Pilot data provided evidence of FN's efficacy to reduce time to ASD diagnosis. We are now conducting a multi-site randomized comparative effectiveness trial (n=250) of our systemic, lay-delivered FN protocol, which begins at a child's 18 or 24-month health supervision visit. The trial takes place in three urban, integrated pediatric care networks. The basic structure of both arms is a collaborative care system. The conventional care management arm (CCM) is consistent with the type of care provided within a traditional - but high quality – medical home. The FN arm provides more intensive, individually tailored, care coordination and theory-based family support. The navigators are bicultural, bilingual, and trained in motivational interviewing and collaborative decision making. Children are followed by their navigator for 100 days after diagnosis, and for 12 months by our study team. We report findings related to intervention reach and implementation.

Results: Regarding intervention reach, we conducted telephone confirmatory screening in the family's primary language using the M-CHAT-R/F with 448 of 496 eligible children 18- 27 months who had a positive primary-care administered M-CHAT. Autism risk was not confirmed in 22%; 16% declined participation; 56% were enrolled. Enrolled children were 22 months (mean), 31% were Hispanic, 55% Black, and 82% low-income. Regarding intervention implementation, mean time to confirmatory screening was 5 days; mean time to diagnostic resolution 109 days; 69% of

children have completed diagnostic assessment, of whom 59% received an autism diagnosis. Among families randomized to receive FN, 80% completed the 3 core in-person visits (pre diagnostic assessment; post diagnostic resolution; wrap-up/termination of navigation); only 2% did not engage with the navigator. Follow-up rates over 12 months were 85%.

Conclusions: Findings regarding intervention reach and implementation support the generalizability of FN. The study successfully enrolled children representative of those receiving primary care services at participating sites. Key elements of the FN protocol were successfully implemented, improved efficiency of primary care screening, and provided clinically relevant information. Further analyses will provide real world primary care practices with a replicable model of care and determine FN's role in increasing access to and engagement in timely diagnostic and early intervention services for a vulnerable population of urban families.

155 **146.155** Maltreatment and Autism: The Most Vulnerable of the Vulnerable?

M. H. Fisher[1], *R. Urbano*[2], *A. Vehorn*[2], *R. Epstein*[3] *and Z. Warren*[4], *(1)Counseling, Educational Psychology, and Special Education, Michigan State University, East Lansing, MI, (2)Vanderbilt University, Nashville, TN, (3)University of Chicago, Chicago, IL, (4)Vanderbilt University Medical Center, Nashville, TN*

Background: Compared to children without disabilities, children with autism spectrum disorder (ASD) may be at increased risk of experiencing child abuse or neglect. Despite this potential increased risk, few well-controlled population-based studies have examined the prevalence of child maltreatment for clearly defined subtypes of disability, such as ASD. Given growing numbers of children with ASD and the need for systems of care that can adequately serve them, it is important to understand the nature and scale of maltreatment of children with ASD.

Objectives: We examined the prevalence of maltreatment among a large, population-level sample of children meeting well-defined and established criteria for ASD to answer two research questions: 1) Are children with ASD more likely to be referred for a maltreatment assessment or investigation from the TNDCS hotline than comparison children? and, 2) Are children with ASD more likely than those without ASD to be classified as maltreatment?

Methods: Data were obtained from the Tennessee Autism and Developmental Disabilities Monitoring (TN-ADDM) Network, Tennessee Department of Children's Services (TNDCS) between 2006 and 2014, and the 2006 Tennessee Department of Health (TDH) birth vital records. Using deterministic linkage of common identifiers (e.g., name, address, birthday, gender), a single population-based dataset was created with information on ASD diagnosis, allegations of maltreatment (referrals to the hotline), processing of the allegations by TNDCS (triaged out or further action for either assessment or investigation), and the TNDCS determined maltreatments status. The final sample consisted all children from the 11 county TN-ADDM catchment area born in 2006, and included 387 children with ASD (cases) and 23,921 children without ASD (controls). These records were linked to all cases in the TNDCS database of children born in 2006 (N=4,385).

Results: At the time of submission, initial results indicate that twice as many children with ASD compared to control children (14.47% vs. 6.0%, $X^2 = 45.9$, $p < .001$) required 'further action' after their referral to the TNDCS hotline. Among those children referred for 'further action', slightly more children with ASD referred for Assessments had a decision of maltreatment (3.62% vs. 2.24%, $X^2 = 2.69$, $p = .101$). In contrast, there were no significant differences in findings of maltreatment between the ASD and Control groups for those children referred for Investigation (2.07% vs. 2.56%) or those with combined Assessments-Investigations (3.88% vs. 4.09%).

Conclusions: In summary, children with ASD, compared to children without ASD, are more likely to be referred for 'further action' from the TNDCS hotline. When examining the processing of referrals, the results are mixed. Children with ASD are slightly more likely than controls to have a disposition of maltreatment after receiving an Assessment. In contrast, children with ASD are equally as likely to have a disposition of maltreatment after receiving an Investigation or Assessment-Investigation. These findings highlight the complexity of examining child maltreatment rates and additional analyses will examine the differences in the number of referrals children receive, the age at which maltreatment occurs, and the difference in rates of substantiated maltreatment for those who received further assessments-investigations.

156 **146.156** Multi-Stage Screening Process: A Clinical Psychology Perspective

A. S. Carter[1], *A. Eisenhower*[2], *F. Martinez-Pedraza*[3], *A. Fettig*[4] *and E. Frenette*[1], *(1)University of Massachusetts Boston, Boston, MA, (2)Psychology, University of Massachusetts Boston, Boston, MA, (3)Psychology, Florida International University, Miami, FL, (4)University of Washington, Seattle, WA*

Background:

Despite knowledge that universal screening can reduce health disparities, screening for ASD is not routine in Early Intervention (EI) settings. The dissemination and implementation of ASD screening in EI may aid in reducing health disparities by (a) increasing rates and reducing ages at ASD diagnosis, and (b) increasing receipt of post-diagnostic intervention. In line with these goals, we have been disseminating a multi-stage, screening and assessment program for 14-36 month-old toddlers, implemented in partnership with EI agencies.

Objectives:

This paper evaluates screening dissemination outcomes using the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework, specifically regarding the *adoption* and *reach* components of our multi-stage screening protocol.

Methods:

Participants were children receiving services from partnering EI agencies, and their parents. Children with previous ASD diagnoses, significant sensory, or medical challenges were ineligible to participate. Our team offered training and support to EIPs to implement a multi-stage ASD screening process as part of their routine clinical practice. Stage 1 screening involved parent report measures, parent concern and provider concern. Stage 2 screening involved an EI administered observational screener. Families who screened positive were offered a free diagnostic evaluation, conducted by clinical psychologists on the research team. Screening and diagnostic assessment were offered in Spanish and English. We collected screening implementation data for each stage, including screening completion rates and referrals following positive screens. Additionally, we gathered administrative data, including demographics of screening eligible participating children and previously diagnosed EI-enrolled children.

Results:

Regarding screening *adoption*, 2,984 Stage 1 screening packets were distributed to EIPs, of which 473 (16%) were returned, indicating child ineligibility for screening, and 1571 (62.6% of the 2511 eligible) were completed. Of the 1571 Stage 1 questionnaires completed, 39.6% (n=622) scored positive and 64.8% (n=403) of children eligible for Stage 2 (based on Stage 1 positive screening) went on to complete Stage 2. Of those screened at Stage 2, 80.4% (n=324) screened positive due to parent concern, EIP concern, or a positive observational screen score. In turn, 77.2% (n=250) of these children went on to complete a diagnostic evaluation. At the diagnostic evaluation, 80.4% (n=201) received a diagnosis of ASD, 8% of the screen eligible sample, representing a more than three-fold increase over earlier years.

In terms of *reach*, the demographics (i.e., low-income, linguistic minority, and racial minority statuses) for children who received an ASD diagnosis through our protocol compared to EI-enrolled children already diagnosed with ASD through other routes revealed higher rates of low-income, linguistic minority, and racial minority children among the research project-diagnosed group. Despite early diagnosis, children whose parents were non-US-born, not English proficient, less than high school-educated, or living below the poverty level received roughly half as many hours of EI as their demographically-advantaged counterparts.

Conclusions:

Utilizing the RE-AIM framework, we addressed how early screening and assessment for ASD shows evidence for reach and adoption in improving rates of ASD diagnosis at early ages and in reducing health disparities in early detection. However, greater systemic efforts are needed to address health disparities in service receipt.

157 **146.157** Narratives of Autism and Skilled Employment: Barriers, Facilitators, and Considerations in Professional Settings

D. Raymaker[1]*, M. Scharer*[2]*, F. Gardiner*[3]*, S. K. Kapp*[4]*, K. McDonald*[2] *and C. Nicolaidis*[1]*, (1)School of Social Work, Portland State University, Portland, OR, (2)Portland State University, Portland, OR, (3)Academic Autism Spectrum Partnership in Research and Education, Portland, OR, (4)University of Exeter, Exeter, United Kingdom*

Background: A disproportionate number of autistic people are unemployed or malemployed. Most autism-related employment programs focus on entry-level work; however, many autistic people have specialized training or post-secondary degrees, making unskilled labor undesirable or inappropriate. Although better employment outcomes are a high priority in both services research and for the autistic community, little is known about what facilitates successful skilled employment–including what "success" means to employees.

Objectives: Our objective was to use a Community Based Participatory Research (CBPR) approach to conduct a qualitative study of skilled autistic employees and job-seekers. First, we aimed to understand experiences of: barriers and facilitators, how autism characteristics affect work, and environmental or personal factors. Second, we aimed to identify areas of systemic leverage that could inform an effective intervention. Lastly, we aimed to understand what autistic individuals with skilled training thought "success" and "good employment outcomes" meant to them.

Methods: Our team of academics, autistic people, family members, and disability services providers used our CBPR process to create an interview guide for eliciting detailed stories about employment experiences from autistic participants. To maximize accessibility, we offered interviews over email, video conferencing, telephone, text-based internet messaging, and in-person. We recruited a national sample of adults with an ASD diagnosis who had been trained in a profession, and had successfully found, or were looking for, skilled work in the US. We used purposeful sampling to obtain variation in professions, and to balance participants who did or did not self-identify as successful. We conducted a thematic analysis using an inductive approach at a semantic level. We verified findings through multiple coders, and by member checking. We discussed results and interpretations with our CBPR team to finalize findings.

Results: We interviewed 44 autistic people with skilled training (45% female, 41% male, 14% non-binary; 70% non-Latino white). Ages ranged from 21 to 65 (mean 36, std. dev. 11.5). 33% had used alternatives to spoken communication, and 76% had used some kind of disability services. They spanned a large geographical area, and represented a wide range of professions in trades, arts, sciences, administration, and technology. Key themes included the high stakes of autism disclosure, unconventional paths to success, disconnects with service and support systems, autistic "superpowers" in the workplace, discrimination, the importance of intersectionality, and success is more than a job.

Conclusions: Employment supports and services for autistic people with professional skills may need to look different than those for entry level jobs: for example, using skills demonstrations instead of interviews, or focusing on obtaining mentors and internships. Disclosure of autism was a key force in success *or* failure—even for the same person in similar jobs; this suggests coaching for both employees and employers around strategic disclosure could be useful. In addressing autism-related barriers to employment, it is important to remember that autistic people experience the same range of identities and experiences as any segment of the population; therefore, supports and services should also be mindful of ways in which autistic individuals can be multiply discriminated against in professional settings.

158 **146.158** Parenting Stress in Families with Concerns about ASD in Toddlers Prior to a Diagnosis

T. DesChamps[1]*, L. V. Ibanez*[2]*, S. R. Edmunds*[3]*, C. C. Dick*[1]*, E. A. Karp*[1] *and W. L. Stone*[1]*, (1)Psychology, University of Washington, Seattle, WA, (2)UW READi Lab, Seattle, WA, (3)University of Washington, Seattle, WA*

Background: Parenting stress, a specific kind of stress that arises from attempts to adapt to the demands of parenthood, is associated with many domains of parent well-being (Deater-Deckard, 2004). Parents of children diagnosed with autism spectrum disorder (ASD) experience higher levels of parenting stress compared to parents of children with developmental delays and typical development (Hayes & Watson, 2013). However, parents often have concerns about ASD long before receiving a diagnostic evaluation and face many challenges associated with caring for their child in the time between initial concern and diagnosis (Zuckerman et al., 2015). Although initial reports suggest that ASD-concerned parents may experience greater parenting stress prior to diagnosis compared to parents without ASD concerns (Mulligan et al., 2012; Ibanez et al., in prep), parenting stress has not been investigated longitudinally. To better characterize the challenging experiences faced by ASD-concerned parents, work is needed to explore patterns of parentings stress across a uniquely tumultuous time in their child's early development.

Objectives: To assess longitudinal level and change in parenting stress among parents with explicit concerns about ASD during their child's early development.

Methods: Preliminary analyses were conducted on data collected from 282 parents expressing different kinds of concern about their young child's development (ASD concerns, *n* = 50; other types of developmental concerns [e.g., motor delay], *n* = 57; no concerns, *n* = 175). Parents were recruited through their child's health care provider as part of a larger study (data collection on-going). Self-reported parenting stress (Parenting stress Index-Short Form; Abidin, 1995) was collected 3 times at 3-month intervals from parents of children who were 16 to 36 months old. Time 1 measures of parenting efficacy (Maternal Efficacy Scale; Teti & Galfand, 1991), parent psychological and social well-being (WHO Quality of Life, 1997), and child social behavior (Parent Interview for Autism-Clinical Version; Stone, 2003) were tested as additional predictors of parenting stress. Preliminary analyses using Hierarchical Linear Models (HLM; Raudenbush & Bryk, 2002) examined between- and within-person variation in parenting stress over time.

Results: Preliminary results revealed that parenting stress remained stable across early development. However, parents concerned about ASD had significantly greater parenting stress compared to parents with non-ASD developmental concerns, $b = 28.34$, $SE = 4.12$, $p = .000$, and parents with no concerns, $b = 31.96$, $SE = 3.50$, $p = .000$. Additionally, higher levels of Time 1 parenting efficacy, psychological and social well-being, and child social behavior predicted lower levels of parenting stress, $ps < .01$. Finally, psychological well-being mitigated parenting stress more strongly among ASD-concerned parents compared to parents with no concerns, $b = -6.50$, $SE = 3.04$, $p =.03$.

Conclusions: Parents who are specifically concerned about ASD during their child's early development experience levels of parenting stress that are consistently higher than parents with either non-ASD developmental concerns or no developmental concerns. However, greater psychological well-being may mitigate parenting stress among ASD-concerned parents, suggesting that parent-focused interventions to improve psychological health may benefit parents who are navigating unique challenges prior to an ASD diagnostic evaluation.

159 **146.159** Perspectives of Young Adults with an Autism Spectrum Disorder on the Use of Electronic Health Records in Research: The Balance between Privacy and Genetic Discovery

A. Edwards[1], *M. Raspa*[1], *S. Andrews*[1], *L. Turner-Brown*[2], *L. Wagner*[1], *R. Moultrie*[1], *M. Frisch*[2], *A. Alvarez*[3] *and A. Wheeler*[1], *(1)RTI International, Research Triangle Park, NC, (2)UNC TEACCH Autism Program, University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: The advent of electronic health records (EHRs) has enabled researchers to mine vast amounts of clinical data. Advances in genomic science have led to growing numbers of research studies recruiting adults with known or suspected genetic conditions. These individuals may have the most to gain from participation in research, but also face increased risks; therefore, it is important to understand their preferences for the use of their EHRs in research.

Objectives: To understand perspectives regarding research use of EHR data among young adults with three different genetic profiles: autism spectrum disorder (ASD), a suspected genetic condition; fragile X syndrome (FXS), a known genetic condition; and no known genetic condition.

Methods: A total of seven focus groups were conducted with young adults aged 18-40 with ASD (n=9 and n=6), FXS (n=5, n=4, and n=4), and no known genetic conditions (n=8 and n=8). Most individuals with ASD were male (87%). All individuals with FXS were female. Males and females were equally represented in the group with no known conditions. Individuals with ASD and FXS were screened for level of functioning to ensure their ability to participate. Focus groups were recorded, transcribed, coded and analyzed.

Results: All participants were willing to share their EHR with researchers under certain conditions. Fear of discrimination appeared to influence the perspectives of one of the groups with ASD, leading to higher levels of distrust of researchers. Participants in the other ASD group, however, expressed few reservations about sharing their EMR. Individuals with FXS were very open to sharing, particularly if the research focused on FXS. Individuals with no known disorder were the most conservative in their preferences, with females and minorities expressing the most concerns. All groups desired a high level of transparency regarding the purpose of the research, the information shared, the credentials of researchers, and data security measures. All groups also shared a profound distrust of insurance companies and concerns about the motives of for-profit entities. Reservations about pharmaceutical research were held by most, but were tempered by the potential for new medications especially among those with ASD and FXS. A primary concern of all groups was the risk of personal information being misused for non-research purposes (e.g., identity theft, discrimination). Individuals with ASD and FXS were more willing to share EHRs if they had a personal connection to the researcher and to share sensitive information, such as mental health records, if the research was related to their condition. Individuals without known conditions were generally unwilling to share sensitive information unless de-identified. All groups cited altruistic benefits from sharing EHRs, but the ASD and FXS groups focused more on benefits to others with ASD and FXS, in addition to direct benefits to themselves and/or their siblings.

Conclusions: Overall, participants with ASD and FXS believed the benefits of sharing EHRs for research outweighed risks if they received adequate, understandable information about study details. Receiving sufficient information was critical for all groups to make an informed decision about participation.

160 **146.160** Pilot Data Findings: Connections between Low-Resource Parents of Children with ASD and School Providers Pre- and Post-Transitions between Schools

E. McGhee Hassrick[1], *S. Iadarola*[2], *C. Friedman*[1], *Z. Shamsi*[3], *J. Chiappe*[4], *L. Hauptman*[5], *B. Bronstein*[6], *A. R. Fitzgerald*[7], *K. M. Carley*[8], *D. E. Linares*[9], *A. C. Stahmer*[10], *D. S. Mandell*[11], *P. Mundy*[12], *T. Smith*[2] *and C. Kasari*[5], *(1)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)University of Rochester Medical Center, Rochester, NY, (3)Drexel University, Phialdelphia, PA, (4)University of California Los Angeles, Los Angeles, CA, (5)University of California, Los Angeles, Los Angeles, CA, (6)University of Pennsylvania, Philadelphia, PA, (7)Department of Psychiatry and Behavioral Health, UC Davis Mind Institute, Sacramento, CA, (8)Carnegie Mellon University, Pittsburg, PA, (9)Maternal and Child Health Bureau, Office of Epidemiology and Research, Health Resources and Services Administration, Rockville, MD, (10)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (11)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (12)University of California at Davis, Sacramento, CA*

Background: Coordination between low resourced parents of children with ASD and the school and healthcare professionals that serve them is particularly challenging during school transitions due to gaps in supports between schools (Boyd, McDowall, & Cooper, 2002) and decreased communication between teachers and parents at receiving schools (Podvey, Hinojosa, & Koenig, 2013). Understanding who parents rely on for information about transition and how parent connections with providers change during transition will better position us to improve school transitions for low resourced children with ASD.

Objectives: Use descriptive whole social network methods to investigate communication exchanges about transition between parents, school staff and healthcare providers pre to post transition.

Methods: Participants were parents and key family, school and healthcare providers for 6 children with ASD transitioning to a new school and in families with incomes below the federal poverty line. We created a team roster of providers for each child, using a snowball recruitment process 6 weeks before transition (average enrollment of 8 key people per team) and at 3 months post transition (average enrollment of 12 key people). We interviewed key participants at each time using the **SoDI: The Social Dynamics of Intervention Measure**, where each participant identified the frequency with which they sought out people on the roster to discuss the child's transition. Using ORA (Carley et al 2004), we computed the **density** of each transition network (actual connections divided by total possible connections). To better understand how parents engaged in transition discussions, we computed parent **in-degree** (the # of other team members who sought out the parent to discuss transition) and parent **out-degree** (the # of people who the parent sought out to discuss transition) and parent **eigenvector centrality** (the degree to which parents were connected to other well connected team members). These measures allow us to systematically summarize parent engagement in transition networks and changes in engagement over time.

Results: During pre-transition, parents identified more key providers (M=58%) than during post transition (M= 23%). When comparing team composition by role type, the overall % of family members remains constant across transition, while the % of community providers decreases. Almost no staff from the receiving school are present during pre-transition (M= 1%), while a small, but significant number of sending school staff remain engaged post transition (M=17%). The average % of district providers decreases during post-transition (Table 1). **Whole social network analysis indicated that** the mean density of transition support decreased from pre to post transition (pre M=.29 / post M=.12). Mean parent in-degree and out-degree decreased post transition but mean eigenvector remained constant (Figure 1). Figure 1 Key: The green colored circles are people the parent identified as key supporters. The red circles are people who the parent did not identify.

Conclusions: On average, parents were more disconnected at post-transition. While no comparison data exist to determine optimal density of transition networks, data from this study suggest that low-resource families may require more support post-transition to maintain connections.

161 **146.161** Quality of Life in Families of Young Children with Autism Spectrum Disorder at Intake

C. Mello[1], *M. Rivard*[2] *and A. Terroux*[3], *(1)Applied Psychology, The Pennsylvania State University, Reading, PA, (2)Psychology, Universite du Quebec a Montreal, Montréal, QC, Canada, (3)Université du Québec à Montréal, Montréal, QC, Canada*

Background: Families of children with autism spectrum disorder (ASD) experience greater psychosocial difficulties than parents of typically developing children or children with other developmental disorders. In particular, the early childhood period poses unique challenges as parents come to terms with their child's recent diagnosis, make adjustments to the family's day-to-day life and activities, and begin to seek out services. Studies to date have identified socioeconomic, family-related, and child-related variables associated with family quality of life (FQOL) and other parent outcomes (e.g., parenting stress, mental health), but these have tended to focus on families of children who were older (e.g., school-aged or adolescent) and were receiving some form of intervention or external support.

Objectives: To report on, and identify predictors of, FQOL among families of young children with ASD following the child's former diagnosis, but prior to receiving early behavioral intervention.

Methods: Data were collected from 277 families (271 mothers, 222 fathers) of preschool-aged children (*M* = 45.9 months) with ASD. At the time of the study, these families had requested, but not received, free EIBI services from a public rehabilitation center in the province of Québec, Canada. Parents completed the Beach Center FQOL scale and standardized measures of the child's adaptive behavior, autism severity, and executive function. The child also completed a standardized assessment of intellectual functioning, and a caregiver rated the child's socioaffective competencies.

Results:

Overall, parents' satisfaction with their FQOL was relatively neutral (i.e., 3.66–3.70 on a scale of 1 to 5, M = 3.65). There were no salient differences between mothers' and fathers' FQOL levels. Families were most satisfied with their physical and material well-being and disability-related support, respectively, moderately satisfied with parenting and emotional well-being, and least satisfied with family interactions. Household income and mothers' employment were positively associated with FQOL. Reliance on, and perceived availability of, social support (primarily from the extended family) was also predictive of FQOL. While autism severity, executive functioning, adaptive behaviors and parents' subjective appraisal of their child's overall level of functioning were associated with FQOL, regression analyses indicated that adaptive behavior are a more robust predictor of mothers' FQOL, while autism severity was predictive of some aspects of fathers' FQOL.

Conclusions:: In contrast to previously examined populations, parents of young children with ASD who have taken steps to eventually receive free EIBI services for their child express relatively high satisfaction with their financial stability and support services. However, during the post-diagnosis period, they may benefit from low-intensity interventions that aim to improve interactions within the family and equip parents to respond to some salient features of their child's condition. To the extent social support is particularly important during this period, outreach and intervention efforts should aim to include other family members, particularly grandparents. By improving FQOL for these families, such interventions may ensure better parental compliance with, and effectiveness of, EIBI.

162 **146.162** Quality of Life in Families of Young Children with Autism Spectrum Disorder: Three-Year Follow-up

M. Rivard[1], *C. Mello*[2] *and A. Terroux*[3], *(1)Psychology, Universite du Quebec a Montreal, Montréal, QC, Canada, (2)Applied Psychology, The Pennsylvania State University, Reading, PA, (3)Université du Québec à Montréal, Montréal, QC, Canada*

Background: Families of children with autism spectrum disorder (ASD) are particularly vulnerable to challenges throughout the educational and care trajectory for their child. Additionally, previous studies show that parental programs offered during early childhood seems to have minimal impacts on parental mental health. All together, these situations suggest that family quality of life (FQOL) may be particular poor in these families during this period marked by elevated stress. In the following years, these families will have to cope with the diagnosis of their child (diagnosis period), reach out for the services (waiting period), adapt to early childhood intervention program for ASD, and adjust to their child's transition to school.

Objectives: To examine how parents of young children with ASD's experience of FQOL evolves over the course of three years following their registration to receive early intervention services: the 1) diagnosis and waiting; 2) early childhood intervention; and 3) integration into school periods.

Methods: Data were collected from 264 families of preschool-aged children (*M* = 45.9 months) with ASD. At the beginning of the study, these families had requested, but not received, free EIBI services from a public rehabilitation center in the province of Québec, Canada. These families subsequently received the center's most intensive service (20 hours per week, *N* = 55), a similar moderate-intensity intervention (4-10 horus per week, *N* = 94), or a low-intensity parent-mediated intervention and weekly coaching (1 hour per week, *N* = 115) for a one-year period. Once per year, parents completed the Beach Center FQOL scale and standardized measures of the child's adaptive behavior, autism severity, and executive function. The child also completed a standardized assessment of intellectual functioning, and a caregiver rated the child's socioaffective competencies.

Results: Overall, FQOL, and particularly families' satisfaction with family interactions, emotional well-being, and disability support, tended to increase over the year during which they received interventions. FQOL tended to increase more consistently with increase of intensity programs, but not in the high-intensity group, who only reported higher disability-related support. The 30 families who completed the third-year follow-up, corresponding to the child's enrollment in school, reported a decrease in satisfaction with disability-related support, which had returned to pre-intervention levels.

Conclusions: During the period in which they received free services from a rehabilitation center, families of young children with ASD tended to experience increased FQOL compared to the intake period. These gains tend to be maintained the year following the cessation of these services, but may not persist as the child begins school. Gains in FQOL appeared restricted to families of children with less severe clinical profiles, with the exception of disability-related support.

163 **146.163** Quality of Life of Parents of Individuals with ASD and Complacence with Services: A Study on a Large-n Representative Sample from Hungary

*M. V. Molnar[1], K. Stefanik[1], **M. Gyori**[1], A. Ábrahám[1], Z. Borsos[1], Á. Havasi[1], A. Horhi[1], E. Horváth[1], T. Oszi[1,2] and Á. Szekeres[1], (1)ELTE University, Budapest, Hungary, (2)Autism Foundation, Budapest, Hungary*

Background: Parents of individuals with ASD were shown to have a lower overall level of quality of life (QoL) and to experience themselves as less coherent agents than parents of typically developing individuals and of individuals with other forms of atypical development (Eapen & Guan, 2016). Positive relationships were found between these (and other related) parental indicators and the quality of the ASD-specific services received by the child with ASD (Lai & Oei, 2014; Siman-Tov, Kaniel, 2011, Frantzen et al., 2016). A pilot study from a Hungarian sample brought similar results (Gyori et al., 2016).

Objectives: The main objective of the study from which results are reported was to explore the relationship between quality of educational services received by individuals with ASD and the QoL of their families. Objectives of the present analysis were to compare QoL indicators in parents of individuals with ASD to those in parents of neurotypical individuals, and explore their relationships to indicators of autism-related services received.

Methods: Data were analyzed from a group of parents of individuals with ASD (n = 262, 237 female, 25 male; mean age 43 years, SD 7.8, providing data on 222 male and 35 female individuals with ASD, mean age 12 years, SD 7.3, range 3 – 47 years) and from a group of parents of neurotypical individuals (n = 126, 115 female, 11 male; mean age 43 years, SD 8.5, providing data on 64 male and 62 female offsprings; mean age 14 years, SD 8.5, range 3-48 years). There is no significant difference between parental groups in level of education and in type of residential settlement. Data were collected by an on-line questionnaire battery, composed of, among other tools, the WHO-QOL BREF; the Quality of Life in Autism Questionnaire (QoLA; Eapen et al, 2014); the Sense of Coherence Questionnaire; the Parenting Sense of Competence Scale; and items on educational and other services received. For respondents without on-line access or relevant competence, an assisted paper-and-pencil data collecting method was implemented.

Results: In line with findings from other countries, we found significantly lower level of overall QoL in the ASD parent group, both in WHO-QoL BREF total score ($F=13.657$, $p<0.001$) and in QoLA total score ($F=4.121$ $p<0.0001$), in their domain scores and in parental sense of competence and sense of coherence indicators. No significant relationships were found between parental QoL levels and the amount of autism-specific psycho-educational interventions received by the child, but in a subgroup of parents with a child with ASD between 3 and 18 years, there emerged weak but significant positive relationships between level of parental complacence with autism-specific educational services received, and QoL indicators (both WHO-QOL BREF and QoLA).

Conclusions: Results, coming from the first large-n representative study on the issue in Hungary, are overall in line with previous findings from other countries. As a novel aspect, they point to the potential importance of parental perception of quality and amount of autism-specific services received by the child.

164 **146.164** Racial Differences in Quality of Life of Parents of Children with Autism Spectrum Disorder

__T. Lavelle__[1] and C. Mule[2], (1)Center for the Evaluation of Value and Risk in Health, Tufts Medical Center, Boston, MA, (2)Center for Children with Special Needs, Tufts Medical Center, Boston, MA

Background: Previous research has documented a decreased health-related quality of life (HRQOL) for parents of children with autism spectrum disorder (ASD). However, limited research is available regarding whether these HRQOL outcomes vary by race/ethnicity.

Objectives: Our objective was to estimate the association between race/ethnicity and HRQOL among parents of children with ASD.

Methods: Parents of children between the ages of 3-17 years and diagnosed with ASD were selected from a nationally representative research panel in the United States to complete a survey. The online survey was administered in English. All survey respondents rated their own HRQOL on a 0-100 visual analog scale, where 100 represented the best imaginable health state, and 0 represented the worst imaginable health state. Parents of children with ASD were asked to report the severity of their child's social communication and behavior impairments, with descriptions of these impairments adapted from the DSM-5. We used linear regression analysis to examine the association between parent HRQOL scores and race/ethnicity (black, non-Hispanic, white, non-Hispanic, Hispanic, and other, non-Hispanic), controlling for socio-demographic characteristics, co-morbidities not related to the ASD diagnosis, as well as the presence of other children in the household.

Results: We received responses from 72% of parents of children with ASD who were invited to complete the survey. Eight respondents were eliminated from the sample due to age and diagnostic criteria, leaving a final analysis sample size of 137. Parents of children with ASD reported a mean HRQOL score of 77 (95% CI: 74-80). In adjusted analyses that controlled for child symptom severity and other socio-demographic and clinical characteristics, being Hispanic (vs. white, non-Hispanic) was associated with a 14 point decrease (95% CI: 1-26) in parent HRQOL. There were no statistically significant differences between black vs. white non-Hispanic parent HRQOL or "other" race vs. white, non-Hispanic parent HRQOL.

Conclusions: In adjusted analyses that accounted for other variables that affect parent quality of life, including child symptom severity, HRQOL is similar for black and white, non-Hispanic, parents of children with ASD, but Hispanic parents report significantly worse HRQOL compared to white, non-Hispanic parents. More research is needed to understand the reasons behind this decreased HRQOL in Hispanic parents of children with ASD.

165 **146.165** Stakeholders Set Research Priorities for Neurodevelopmental Disorders: A Canadian First Facilitated By Ontario Brain Institute, in Collaboration with the Pond Network

*E. Anagnostou[1], **J. Antflick**[2], R. Nicolson[3], A. Iaboni[1], M. Spoelstra[4], J. Jordao[5], C. Southward[2], S. Kwan[2], B. Andrade[6], S. Lynch[7], K. Cowan[8] and J. Mitchell[9], (1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Ontario Brain INstitute, toronto, ON, Canada, (3)University of Western Ontario, London, ON, Canada, (4)Autism Ontario, Toronto, ON, Canada, (5)Research & Informatics, Ontario Brain Institute, Toronto, ON, Canada, (6)Center for Addiction and Mental Helath, toronto, ON, Canada, (7)Community Living Toronto, toronto, ON, Canada, (8)James Lind Alliance, St Leonards-on-Sea, United Kingdom, (9)toronto, ON, Canada*

Background: Research into treatments often overlooks the shared priorities of patients, caregivers and clinicians. Academia and industry are important in developing and testing new treatments, but their priorities may not be well aligned with those of patients and clinicians. As such, a mismatch between the research being conducted and the research evidence needed by patients and clinicians may develop.
Objectives:

The objective of this study was to to identify research priorities of a wide range of stakeholders in Autism Spectrum Disorder (ASD) and neurodevelopmental disorders (NDD).

Methods: We employed the JLA method to address this gap in ASD and related NDDs. The method brings patient, carer and clinician groups together on an equal footing to identify treatment uncertainties which are important to both groups, jointly prioritise the uncertainties, and produce a 'Top 10' list of jointly agreed uncertainties as research questions to be presented to funders.

Results:

The priority setting process gathered over 1200 questions from 300 respondents across neurodevelopmental disorders across Ontario, Canada. Over a period of one year individuals with ASD and other NDDs, carers, advocates, and health/education professionals consolidated, prioritized and ultimately distilled these questions into a top 10 list of research priorities:

1. What are the most effective treatment options/plans (e.g., timing, frequency, duration, type, intensity or dosage) for individuals with neurodevelopmental disorders for both short and long-term benefits?
2. How can system navigation be organized in a manner that enables coordinated services and supports across the lifespan for individuals with neurodevelopmental disorders and their families?
3. Which biological treatments (including medications, gene therapy, stem cell therapy, etc.) are effective for neurodevelopmental disorders and associated symptoms?
4. Which child and family-centered interventions or approaches promote optimal individual and family functioning?
5. Which interventions best help individuals with neurodevelopmental disorders develop emotional and behavioural regulation (including increasing impulse control and reducing compulsive behaviour)?
6. Which resources are needed to more effectively address the health, social and emotional needs of families or caregivers of individuals with neurodevelopmental disorders?
7. How can treatment decisions for individuals with neurodevelopmental disorders be more precise (i.e., based on the diagnosis, age, functional need of the individual)?
8. Which are the most effective pharmacological and non-pharmacological treatments for aggressive and self-injurious behaviour in individuals with neurodevelopmental disorders?
9. Which are the most effective pharmacological and non-pharmacological intervention(s) to reduce anxiety in individuals with neurodevelopmental disorders?
10. Which interventions are most effective to help individuals with neurodevelopmental disorders improve their social skills and develop and maintain social relationships?

At the end of the process, participants expressed high satisfaction with the process and the final top 10 list.

Conclusions:

We carried out a large stakeholder engagement project to elicit priorities for research in ASD and other NDDs, using standardized methodology developed by the JLA. The top 10 priorities will serve as powerful and important tool to spur patient-oriented research into neurodevelopmental disorders.

166 **146.166** Support Needs, Experiences with Services and Characteristics of Families of Children with Autism Spectrum Disorders.

***B. van Gent**[1] and J. P. Teunisse[2], (1)HAN University of Applied Sciences, Nijmegen, Netherlands, (2)Dr Leo Kannerhuis, Oosterbeek, Netherlands*

Background:
Families caring for a child with autism spectrum disorders (ASD) experience many challenges and stressors that can have great impact on family members and lead to burden on the system. The care families provide can only be maintained if families receive sufficient support. Various support forms are available and are being used by families. However not all support is perceived as helpful and unmet support needs remain.

Objectives:

Our objective was to determine family support needs and prior experiences with services. We aimed to identify support characteristics which parents perceived as helpful. Furthermore we examined the association between support needs, satisfaction with services and family and child characteristics.

Methods:

Questionnaires (n=76) were used to question families (n=76) of a child with ASD living at home (age 12-18) about support needs and experiences with services. Then 30 semi-structured interviews were conducted to collect more detailed and extensive information about these subjects. Transcriptions of the interviews were analyzed using open coding. After this initial coding, codes were combined into concepts.

Results:

A broad variety of support needs were identified. Outpatient care, respite care, guidance on increasing independence, guidance on behavior modification, information point on available services and more community awareness of ASD were mentioned by the majority of families. All families reported unmet needs.

Support characteristics which parents perceived as helpful were flexible outpatient care, tailored care, guidance in finding and accessing services, counseling in small groups, expertise on ASD and care provided by a known, trusted counselor.

Family and child characteristics influencing support needs were acceptance of ASD, parents self-assurance about approach, parents attitude towards help, aggression, social support and caregiver burden. These characteristics play different roles in families and influence both the type of support needs and the perception of the support being helpful.

Conclusions:

Although many services are available, families face unmet support needs. Our findings indicate that several factors determine if a service is helpful for a family. Being aware of those factors and the role they play in families is essential in providing tailored care and meeting family needs.

167 **146.167** Symptom Recognition, Parental Help-Seeking, and Diagnostic Variation in Autism Spectrum Disorder

D. Schelly *and A. Ohl, Clarkson University, Potsdam, NY*

Background:

Autism spectrum disorder (ASD) symptom recognition studies often suggest that diagnostic variation in children is primarily explained by how quickly parents notice anomalous behaviors (e.g., Daley, 2004), a factor that is thought to be associated with exposure to health-related information (Mazumdar et al., 2013). Our research in Costa Rica (Authors et al., 2017) challenges this theory by showing that parents of varying socioeconomic status (SES) are about equally good at detecting anomalous behaviors, and at similar ages to early studies in the U.S. (e.g., Howlin & Asgharian, 1999). In our previous report, we find that the prevailing mechanism driving diagnostic variation occurs at the referring clinic rather than in the homes or minds of parents.

Objectives:

The aim of the present study is to develop an alternative theory of the parental role in ASD diagnosis, especially in the context of varying levels of health-related information and exposure to other children with the diagnosis. We focus on Costa Rica, where spatial clusters of low severity cases of childhood ASD have been identified (Authors et al., 2015) – the very cases for which information should be especially helpful.

Methods:

Semi-structured interviews were conducted with the parents of 54 children with ASD, including many cases within the spatial clusters that appeared after a genetic study conducted an information campaign for case recruitment. The interviews focused on factors influencing parents' symptom recognition and help-seeking behaviors, including contact with individuals with developmental disorders and clinical encounters leading to diagnosis. Parents also discussed any influence they had on parents of other symptomatic children. The analysis follows early ethnomethodological studies (e.g., Garfinkel, 1967)—a subfield of sociology—of the practical problems of research subjects, and is influenced by later conversation analytic studies of social actions such as advice-giving, complaining, and providing encouragement (e.g., Schegloff, 2008).

Results:

Parents' first concerns are related to generic developmental problems that are not attributed to specific diagnoses. Parents occasionally seek out advice from family and friends and primary care physicians, but the responses treat the advice-seeking as "troubles talk" (Jefferson, 1988), where appropriate responses include those that provide sympathy or encouragement. Parents commonly receive unsolicited advice from strangers, but these encounters are seen as criticism. When parents encounter other children with ASD, the heterogeneity of symptoms leads them to conclude that their children "have something else." Parents become convinced their children are atypical when they fail to meet additional developmental milestones and spend time with other children.

Conclusions:

Theories that account for parental symptom recognition and help-seeking behaviors in ASD tend to put the onus of early detection on parents, which is unfortunate given our history of blaming mothers for ASD. Our data suggest factors that contradict these theories. The pathways to ASD diagnosis include a give and take between typical development and concerning developmental delays, between encouragement to wait-and-see and unwanted advice to seek help. Ultimately, it is clinicians rather than parents that create diagnostic variation.

168 **146.168** Systems Science Approach to Conceptualize and Analyze the Role of Screening

R. C. Sheldrick*, Boston University School of Public Health, Boston, MA*

Background:

System science offers a range of models and methodologies that have the potential to improve public health programs, yet they are rarely applied to the problem of improving the detection and diagnosis of autism spectrum disorder (ASD) among young children. From a systems perspective, screening is but one (albeit critical) element in a system of care, and its effectiveness for improving children's health is dependent on other resources for further assessment, diagnosis, and linkage to effective service. Systems methods have the potential to offer insight at both the theoretic and methodological level that can be used to help improve systems of care for young children with ASD.

Objectives:

The objective of this talk is to introduce two systems science methods and how they can be applied to research on screening for ASD to address (1) questions regarding missing data in diagnostic accuracy studies, and (2) the potential for policy resistance resulting from clinical uncertainty during dissemination of evidence-based screening policies.

Methods:

To address the problem of missing data in studies of the diagnostic accuracy of ASD-specific screening instruments, we developed a Monte Carlo simulation model of the multi-stage screening process described in the published literature. The model was then tested under a range of assumptions regarding overall prevalence and reasons for dropout. To address the potential for policy resistance in the dissemination of evidence-based screening instruments, we created and validated a system dynamics model of the clinical decision making process and applied it to published implementation trials of behavioral screening instruments for children.

Results:

Results of the Monte Carlo model suggest that despite design challenges in the published study, evidence supports the hypothesis that screening demonstrates adequate sensitivity and specificity. Specifically, a range of prevalence estimates between 1 in 131 (as assumed in the original study) and 1 in 39 (a maximum value that approximates reported prevalence in New Jersey) are all consistent with findings that stage 1 screening displays sensitivity over 70% and specificity over 90%. Results also suggest alternative strategies for improving “process” accuracy, including improving follow-through at each stage of the process.

Results of the system dynamics model highlight how clinicians can use accurate screening instruments to reduce either false positive or false negative errors or both. Specifically, the model helps to explain heterogeneous findings from published implementation trials by demonstrating how observed changes in referral rates may be attributable not only to the use of screening instruments, but also to decision thresholds and the provision of screening support services. The model also suggests strategies for improving detection, including using systematic feedback and co-located care models to shift focus to reducing false negative errors.

Conclusions:

Systems science offers methods to conceptualize and analyze the role of screening as a single element in a larger system of care. Evidence from systems models offers insights into published research on the accuracy and implementation of screening instruments, as well as possible strategies for further improving detection of ASD in community settings.

169 **146.169** The Autgo Initiative: Building a Bridge between Genetics and Outcomes Research

Z. Talebizadeh *and A. Shah, Children's Mercy Hospital, Kansas City, MO*

Background: While the field of autism genetics has rapidly expanded our understanding of the genetic factors contributing to autism, the ability to translate these discoveries into clinically meaningful information remains a significant barrier. Concerns over the need to improve translational aspects of autism research and engage community members have been noted in the literature and raised by patient advocates. In addition to the work done by patient advocacy groups, organizations such as the Patient-Centered Outcomes Research Institute (PCORI) support a change in the culture of research from being solely researcher-driven to becoming more patient-driven. One of the main reasons why this gap has been overlooked is the lack of communication between genetics and outcomes researchers.

Objectives: We used the PCORI engagement approach to address this barrier and develop a platform that would enable synergistic relationships between the two disciplines to facilitate utilization of genetic information in patient-centered studies.

Methods: Our project, Autism Genetics and Outcomes (AutGO), consists of two phases. In Phase I, we formed a community advisory board (n=33 members), and convened six sessions over a twelve month period. Sessions were structured as a combination of webinars, surveys, and in-person group discussions. Feedback was analyzed using content analysis strategies to identify themes. In Phase II, we formed an autism focus group (n=30 members), including outcomes and genetics researchers, clinicians, and parent representatives. An engagement/educational model was developed for the autism research community, including a research example that utilizes genetic information to address a patient-centered question.

Results: In phase I, we identified key barriers, facilitators, and needs, and distilled actions that may facilitate utilization of patient/parent perspectives in designing genetic research studies (Figure 1). In Phase II, we organized an educational workshop for the autism research community and developed an educational example to show the workflow, including study design and expected impacts for a patient-centered research approach. In this example, we showed how known genetic risk factors (SNPs) for a burdensome drug side-effect [antipsychotic-induced weight gain (AIWG)] could be evaluated to answer a health-related question in autism. We analyzed genotyping data for n=115 AIWG SNPs from >2000 probands from Simons Simplex Collection. BMI data was used to identify obese and non-obese subjects. Our results suggest that factors beyond drug side effects may contribute to the observed higher rate of obesity in autism. Furthermore, an association with rs7702361 (located in the RXFP3 gene) in autistic individuals with obesity was found, which appears to be independent of anti-psychotic medication use. The RXFP3 gene is implicated in eating disorders and our finding suggests that at least a subset of individuals with autism and obesity may have underlying metabolic problems. This information may help with treatment management for this population of patients.

Conclusions: The AutGO initiative has created a unique collaborative forum to facilitate the much needed dialogue between genetics and outcomes researchers, the applicability of which we are exploring on autism. This novel approach has the strong potential to contribute to improving the translational aspects of autism genetics research.

170 **146.170** The Effect of Therapeutic Interventions of Children with Autism Spectrum Disorders on Their Parents’ Mental Health

T. Rehberger[1]*, M. Macedoni Luksic*[2] *and A. Bezenšek*[3]*, (1)Institut of Autism Spectrum Disorders, Medvode, Slovenia, (2)Institute of ASD, Slovenia, Medvode, Slovenia, (3)Institute of Autism Spectrum Disorders, Medvode, Slovenia*

Background:

Parents raising children with autism spectrum disorder (ASD) often struggle to manage the demands of everyday family life. A child with ASD affects the lives of all family members and has an important influence on quality of family life. Past studies report that parents of children with ASD experience not only significantly more stress than parents of typically developing children but even more stress than parents of children with other special needs. As highly-stressed they are more vulnerable to experience mental health problems, such as anxiety and depression. World-wide there are currently a lot of different forms of support for parents of children with ASD. They range from informal supportive to specific educational groups which are meant to empower the parents.

Objectives:

In our study we aimed to determine whether the parents' mental health (stress, wellbeing, satisfaction with life, depression) can be affected simply by their child's progress followed by the inclusion in regular and comprehensive therapeutic intervention.

Methods:

Total of 36 parents and 36 children with ASD took part in the study. Their children, aged 2-12 years (M = 5.2 years; 12 girls and 24 boys) participated in developmental and/or behavioural therapeutic interventions for two months. A questionnaire battery was developed for the purpose of the study. It included COPE – short version, Parental Stress Scale (PSS), Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS), Satisfaction with Life Scale (SWLS) and Centre for Epidemiologic Studies Short Depression Scale (CES-D 10). Parents filled out the questionnaires prior and after the treatment. Therapists measured children's progress (prior vs. after) using therapist's questionnaire specifically formed for this purpose.

Results:

The influence of the child's progress in therapeutic treatment on different aspects of their parents' mental health was not statistically significant. On the other hand, there is an evidence that the instrumental support, that parents received directly from therapist throughout the therapeutic sessions, had a positive impact on two aspects of their mental health - stress level and wellbeing.

Conclusions:

The parents in our study benefit the most from the instrumental support of professionals working with their children. The obtained results give us an insight of how to efficiently help parents of children with ASD to reduce their stress level and improve their well-being. Besides encouraging them to actively participate in their child's intervention, there is a great need for target educational groups in order to support them on their way to greater independence.

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146.171 The Importance of Addressing Heterogeneity in Autism Genomics Research to Inform Precision Medicine

***V. W. Hu**, Biochemistry and Molecular Medicine, The George Washington University, Washington, DC*

Background: Autism spectrum disorder (ASD) encompasses a broad range of neurodevelopmental disorders marked by core deficits in social communication and interaction as well as by repetitive, stereotypic behaviors and restricted interests. Despite the shared core symptoms, there is extensive heterogeneity in the clinical symptoms and behavioral manifestations among individuals diagnosed with ASD. This heterogeneity poses a significant challenge to patient-centered studies seeking to determine how knowledge of genetic and biological underpinnings of ASD can be useful to informing treatment, especially when a combined group of cases are compared against a group of controls.

Objectives: The goals of our ongoing studies have been to reduce the clinical heterogeneity within the ASD population in order to investigate the biological pathways and functions impacted in different subphenotypes of ASD and to increase the power of genetics analyses to identify genetic variation capable of distinguishing cases from controls. We accomplish these goals by: 1) subgrouping individuals according to their severity profiles across a breadth of behavioral and clinical symptoms probed by the Autism Diagnostic Interview-Revised diagnostic instrument, and 2) performing large-scale gene expression profiling and genetics analyses of the resulting ASD subgroups in comparison to controls to identify subgroup-dependent biological deficits as well as genetic variants and loci that are associated with each subphenotype.

Methods: Individuals with ASD were divided into four phenotypic subgroups by multivariate cluster analyses of item-level severity scores from the individual's ADI-R diagnostic assessment. Lymphoblastoid cell lines from individuals representing several clinically distinct ASD subgroups and a group of controls were used for gene expression profiling on 2-color custom human transcriptome arrays which were analyzed using the MeV microarray software suite. Ingenuity Pathway Analyses software was used to identify over-represented biological pathways and functions among the differentially expressed genes. Quantitative trait and case-control association analyses using ADI-R scoresheets of cases and the respective genotype data were performed using Plink, and linkage analyses were conducted with Merlin, again using publicly available genetic databases.

Results: Distinct but partially overlapping patterns of differentially expressed genes were identified for several subtypes of ASD in comparison to that of controls. Each expression profile suggested subgroup-dependent differences in biological pathways and functions that could be exploited for targeted therapies or for diagnosis. Enriched functions included a set of circadian rhythm-associated genes, such as AA-NAT, the rate-limiting enzyme in melatonin biosynthesis. Combined quantitative trait and case-control association analyses in which cases were divided by subphenotypes identified Bonferroni-significant SNPs that clearly distinguished cases from controls, while linkage analyses revealed subgroup-dependent genetic loci that were capable of unmasking genetic heterogeneity at both inter- and intra-family levels, with the highest subgroup-dependent LOD scores exceeding 4.0.

Conclusions: Large-scale omics and genetic analyses of ASD are greatly enhanced by reducing the heterogeneity of the cases included within the study. Heterogeneity reduction is critical for identifying subgroup-specific deficits (e.g., melatonin deficiency) for targeted therapies, thus advancing precision medicine.

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146.172 The Sociomateriality of Parent-Reported and Observation-Based Screening Tools for Autism Spectrum Disorders (ASD): A Sociological Investigation of Community-Based ASD Screening to Address Health Disparities

***T. Mackie**[1], L. Ramella[2], A. Cotroneo[3], A. Eisenhower[4], A. S. Carter[5], F. Martinez-Pedraza[6,7] and R. C. Sheldrick[8], (1)Institute for Health, Health Care Policy and Aging Research, School of Public Health, Rutgers Univer, New Brunswick, NJ, (2)Tufts Medical Center / Boston University, Boston, MA, (3)Department of Health Systems and Policy, Rutgers School of Public Health, New Brunswick, NJ, (4)Psychology, University of Massachusetts Boston, Boston, MA, (5)University of Massachusetts Boston, Boston, MA, (6)Florida International University, Miami, FL, (7)Psychology, Florida International University, Miami, FL, (8)Boston University School of Public Health, Boston, MA*

Background:

Challenges to ensuring the early identification of Autism Spectrum Disorders (ASD) among toddlers from racially and ethnically diverse backgrounds is well-documented. These challenges are related to population characteristics (e.g., limited access to ASD-specific knowledge, disability stigma, linguistic barriers for non-native English speakers, lack of institutional trust, and competing social needs) and the respective service delivery systems (e.g., inadequate cultural competency, provider non-compliance with professional guidance and challenges in diagnostic ascertainment). In this study, we investigate how the implementation of parent-reported and observation-based screening tools may address or amplify these challenges in the clinical encounter for families from historically underserved communities.

Applying a sociological lens, we examine the reflexive relationship between these technologies (i.e., the screening tools) and the social contexts in which they are introduced (i.e., 'socio-materiality of technology'). Our approach recognizes a situated ecology of use (or in some cases, non-use), consisting of various actors, practices, and their relationships. As Timmermans (1998) argues, the "potential and power of a technological device to shape an interaction is not pre-given but is realized in practice." We provide an in-depth and multi-method examination of screening tools when "realized in practice" and the ways within which these technologies potentially mitigate, reproduce, or propagate new challenges confronting diverse families across the ASD diagnostic process.

Objectives:

Examining implementation of parent-reported tools (BITSEA, POSI) and observation-based screening tools (STAT), this paper investigates the different ways within which parent-reported and observation-based screening tools restructure the clinical encounter and the tools themselves are simultaneously adapted.

Methods:

Our multi-method approach employs longitudinal interviews with caregivers of children with ASD (n=21), semi-structured cross-sectional interviews with Early Intervention providers (n=20), and observations of the screening tools with toddlers and families (n=12). We analyze transcripts and field notes using a modified grounded theory approach known as "Coding Consensus, Co-occurrence, and Comparison," in which analyses are derived from the data (based on *a priori* and emergent themes) and then illustrated by characteristic examples.

Results:

Our findings suggest that characteristics of the respective screening tools were influential both in reconfiguration of the clinical encounter and in how the providers and families adapt the tools. Administration of the parent-reported screening tools led providers and families to adapt the tools in a number of ways not seen in implementation of the observation-based screening tool. For parent-reported screening tools, providers adapted administration and content of the tools as strategies to address challenges regarding the caregiver's (1) ability to "see" and therefore report on the indicated behaviors of concern, (2) limited access to ASD-specific knowledge, (3) readiness for discussions of ASD, and (4) linguistic barriers. In contrast, adaptation to protocol in administration of the observation-based protocol primarily reflected family readiness but other challenges were rarely or not at all discussed or observed.

Conclusions:

Our study finds evidence of a reflexive relationship between ASD screening tools and the context in which they occur; this relationship occurred differently for parent-reported and observation based tools suggesting different types of tools may mitigate or reproduce well-documented challenges in addressing ASD disparities.

173 **146.173** Using a Patient Centered Outcomes Research Institute (PCORI) Approach to Engage Key Stakeholders on the Topic of Transitioning to Adulthood in Autism Spectrum Disorders (ASD)

***S. N. Brasher**, Nursing, Emory University, Atlanta, GA*

Background: There has been a significant increase in the incidence and prevalence of autism spectrum disorder (ASD) in recent years with current estimates of 1 in 68 children diagnosed with ASD and 3.5 million Americans living with ASD (CDC, 2017), including individuals with ASD transitioning from childhood to adulthood. Symptoms of ASD (e.g., impairments in social interaction, communication, repetitive behaviors) emerge in early childhood and span across adulthood. Considering ASD presents in early childhood, educating medical providers has largely focused on Pediatrics as opposed to Adult Internal Medicine. Thus, a growing concern on the forefront of everyone's mind is 'what next?' as these children transition to adults and parents, as well as providers, are no longer able to care for them

Objectives: The overarching aim of this Patient Centered Outcomes Research Institute (PCORI) award is to form equitable partnerships with key stakeholders to gain meaningful insight into issues encountered during transitioning to adulthood in ASD. This, in turn, will lead to the development of a comparative effectiveness research (CER) study on transition to adulthood in ASD.

Methods: Stakeholders were divided into four groups: two groups of young adults with ASD of varying degrees of severity, one group of caregivers of adults with ASD, and an Autism Advisory Board (AAB) comprised of diverse professionals and stakeholders. The AAB provided oversight on how to engage stakeholders and ways to formulate CER questions based on the stakeholder identified topics. Stakeholders engaged in monthly meetings and bi-annual united stakeholder group meetings to identify gaps in research, care, and services for individuals with ASD transitioning to adulthood.

Results: This newly funded PCORI Tier A award is the first step in PCORI's tiered Pipeline to PCORI. Expected results include gaining insight into the issues encountered during transitioning to adulthood that will enable the development of future research questions meaningful to this population. Given this health issue is not limited to any one area of the country (e.g., rural, urban, state), connections and outcomes have the potential to expand and influence nationally and internationally.

Conclusions: Historically, treatment and services in ASD have been targeted towards early childhood to promote developmental trajectories. While this is important, there is a need to shift interventions and services as the individual transitions from childhood into adulthood in order to account for their growing needs. Recent studies suggest that medical providers are not adequately trained or prepared to care for individuals with ASD transitioning to adulthood. As a result, families often report struggling to navigate this period between childhood and adulthood. Thus, the use of a PCORI approach to engage key stakeholders is an optimal method to gain insight into issues encountered by individuals with ASD and their families in order to build towards future research responsive to the needs of stakeholders.

174 **146.174** "the Doctor Said 'Google It' ...": Exploring African-American Caregiver's Help-Seeking for Their Child with Autism

***T. Benevides**[1], P. Kearney[2], E. DeGrace[3], M. So[4] and B. Kelly[4], (1)Augusta University, Martinez, GA, (2)Augusta University, Augusta, GA, (3)University of Oklahoma, Oklahoma City, OK, (4)Independent Investigator, Atlanta, GA*

Background: A large body of literature suggests that differences exist in service access for racial and ethnic minorities with autism spectrum disorder (ASD)[1] which are not accounted for by actual differences in need for services. Additional studies identify that parental beliefs, knowledge, and expectations may influence help-seeking among African-American (AA) caregivers. Understanding the reasons for differences in care from the perspective of AA caregivers is necessary prior to developing effective solutions to address differences in service access.
Objectives: The purpose of this study was to qualitatively identify AA caregiver beliefs, knowledge, and expectations that impact help-seeking, and the specific help-seeking steps caregivers used to obtain care for their children with ASD.

Methods: We used grounded theory methodology[2] with semi-structured interviews to ascertain how and why AA caregivers sought and obtained services from the time prior to diagnosis to the present. Beliefs and knowledge were probed, as were both formal and informal help-seeking. Purposive and snowball sampling was used to obtain a sample of caregivers of children with ASD. Inclusion criteria required caregivers to be self-identified AA adults with a primary caregiver role (>50% time spent caring for child) of a child with autism. A child's autism classification was identified by the investigator in either a medical or educational report provided by the caregiver. Additional sources of data included field notes and a follow up focus group to engage caregivers in member-checking discussion. Qualitative analysis occurred during the course of data collection and involved hand coding for beliefs, knowledge, and expectations reported during help-seeking actions. MaxQDA software was used to organize coding schemes.

Results: Demographic caregiver characteristics are presented (Table 1). Preliminary themes from the analysis include: "Just don't know/just didn't know..." (importance of knowledge in taking action); "[the doctor] told me to Google it" (impact of 'trusting' in providers on help seeking); the reliance on 'mother intuition' about their child which influenced help seeking; and the importance of others during the process ("they actually know what you go through"). Caregiver's knowledge acquisition was obtained primarily through lay and internet "network of others"; in contrast, caregivers reported asking for information from medical and education providers and not receiving the desired guidance.

Conclusions: Despite extensive literature discussing racial and ethnic disparities in access to services, little progress has been made to address culturally-relevant approaches to meet AA caregiver's needs for service and supports. Although findings are not widely generalizable due the qualitative nature of this study conducted in single southern U.S. state, important lessons for future research and provision of services include: helping parents connect with other parents is essential; the provision of resources regarding decision-making needs to be balanced by parent's reliance on 'intuition' about providers and services; and future work to improve help-seeking and reducing disparities should involve caregivers in all aspects of planning and implementation to identify preferred methods for receiving information. System interventions indicated include: provider training to facilitate care pathways, easily searchable and readable community level resources, & increasing parent advocacy skills.

175 **146.175** Autism Diagnosis Stories: What Latino Parents and Caregivers Know and Believe

L. I. Florindez[1] *and D. C. Florindez*[2]*, (1)Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)University of Southern California, Los Angeles, CA*

Background:
Of the 1 in 68 children diagnosed with autism spectrum disorders (ASD) in the United States (CDC, 2014), the prevalence varies significantly across racial and ethnic groups. Documented disparities exist regarding autism diagnosis for Latino children. When compared to White children, previous research has shown that Latino children are diagnosed at a later age (Mandell, Listerud, Levy, & Pinto-Martin, 2002), are less likely to be diagnosed even when meeting autism criteria (Mandell et al., 2009), and more likely to be misdiagnosed (Mandell, Ittenbach, Levy, & Pinto-Martin, 2007). Given these issues surrounding accurately diagnosing Latino children with ASD, it is necessary to explore what Latino parents, caregivers, and community members understand about ASD diagnosis.

Objectives:

The purpose of this study is to investigate what 18 Latino families know and believe about diagnosing autism, and the psychosocial, familial, medical, and cultural factors that inform their health beliefs.

Methods:

Narrative interviews with 18 Latino families (8 families with a typically developing child aged 6-12 and 10 families with a child with ASD aged 6-12) were conducted to identify the factors that impact their in-home oral care routines, including how the presence of ASD may alter their habits. Family units consisted of at minimum, the primary caregiver, and included other family members who provided care for the enrolled child. Each family was interviewed twice in their native language (Spanish or English) for approximately 1-2.5 hours each session. As a secondary line of questioning, families were probed to discuss their perceptions of ASD. Interviews were transcribed verbatim and thematically analyzed by 3 coders.

Results:

Five themes pertaining to where parents obtained their knowledge and details about their beliefs about ASD diagnosis were identified. The first, *Misconceptions,* explained the various fallacies perpetuated about ASD, including that their child is "broken" or cursed. The second theme, *Parents as students and teachers,* described how parents had to learn about their child's diagnosis to then be able to educate others and act as their child's sole advocate. Next, *Role of Family* was related to the influence of family members on sharing information and opinions, including the reluctance in some extended families to acknowledge that a child has ASD. Following, *Outside influence* clarified the information provided by non-family members, including health care providers, community members, or social network connections. The last theme, *Cultural Stigma,* focused on information that originated from the family's cultural background, including religious and folk tales, situating the ASD diagnosis within Latino culture.

Conclusions:

Researching how Latino parents, caregivers, and community members perceive Autism diagnosis will help illuminate how health information is communicated within this at-risk population, and inform the development of future targeted education and intervention programs.

176 **146.176** Raising a Child with Autism in India: Journey of Parents' over Decades

D. Taneja[1]*, N. Singhal*[1]*, T. Behl*[1]*,* ***R. Pradhan***[1]*, M. Barua*[1]*, T. Daley*[2] *and T. S. Weisner*[3]*, (1)Action For Autism, New Delhi, India, (2)Westat, Durham, NC, (3)UCLA, Los Angeles, CA*

Background: The lifelong nature of autism brings in a plethora of new experiences for the parents, making parenting a child with autism a challenging experience. How do parents usually experience while parenting a child with autism in India? What insights do they gain over the years? What would be their advice to parents of children who are now receiving a diagnosis? While they have been a parent for almost two decades or more, what do they think is happening for families receiving a diagnosis now? What government policies are required? This first study on adults with autism in India answers many such questions from the perspectives of parents of adults with autism.
Objectives: The present paper seeks to gain insight into parent's perspective on raising a child with autism.

Methods: 52 families (54 adults) living in New Delhi and NCR were interviewed in their homes. The home visits lasted for 2.5 – 5 hours. Using a range of instruments including semi structured interviews, standardized questionnaires, and home observations, parents responded to a variety of topics related to their experience of raising a child with autism and their needs.

Results: Parents spoke about the different actions that parents can take themselves; the different parenting approaches that may be used as well the key systemic changes required in low and middle income countries with limited resources such as India.

Conclusions: This is one of the first studies that informs practice and policies in India by highlighting parent's perspectives of key needs of the families of autistic individuals. The study has significant implications in generation of additional and improvement of existing services and provides valuable information to parents, particularly those of children newly diagnosed with ASD.

This study highlights the need and directions for new and improved services to cater to the needs of individuals with autism.

177 **146.177** The Role of Family Rituals and Routines: A Resilience Perspective of Mealtimes and ASD

S. L. Curtiss*, Michigan State University, East Lansing, MI*

Background: The shared meal is an iconic family ritual that provides significant benefits to families and its' members. Mealtimes serve as a context for development, rich with experiences and interactions, that can promote child well-being. For example, direct and clear communication, flexible adherence to carrying out a meal, and the repetition of roles are characteristics of mealtimes that have been linked to positive child outcomes (Fiese, Foley, & Spagnola, 2006). More frequent shared family meals are related to literacy development (Snow & Beals, 2006), healthy eating habits (Larson, et al., 2007), positive values, social competencies, and supportiveness (Fulkerson, et al., 2006). Unfortunately, general research on family mealtimes precludes children with autism so much is still unknown about the impact of the shared family meal for children with autism and their families. The research that has examined the connection between autism and mealtimes has focused on challenges and deficits, not on mealtimes as naturally occurring family processes and sources of resilience.
Objectives: For autistic families, who are more often viewed in terms of their deficits, research is needed to resituate family meals as a place where some foster resilience, without ignoring the real challenges and struggles faced in everyday family life. The goal of this study was to explore the role of mealtime rituals and routines in family life.

Methods: This is a grounded theory (Strauss & Corbin, 2008) study of 16 family mealtimes. The families varied in terms of ethnicity, socioeconomic status, community, and family structure. For each family, a mealtime was video recorded and one parent (all mothers) was interviewed about their family's meals. The observations and interviews were interpretatively coded.

Results: Mealtimes reflect and reinforce family functioning (Figure 1). The affective components of the meal were critical for mealtimes to be a place where sharing and problem solving could happen. Affective climate and bond were achieved through a dialectic of acceptance and control. Parents used controlling behavior during the meal to support their children with being successful with the tasks related to the meal. Parents also showed acceptance in terms of how they created expectations and communicated those expectations. Navigating the dialectic of control and acceptance, being at peace with the tension, and having some degree of balance were necessary to achieve the affective and symbolic elements of the meal. Family functioning was also reflected in communication, expectations, and the quality of interactions. There were times, however, when families simply did not have access to the resources necessary to support their children and, in those cases, adaptive family functioning was difficult to achieve.

Conclusions: This research provides a grounded understanding of how families use mealtimes to promote connection and facilitate problem solving. It can be used to suggest ways in which families can be supported. Warmth, acceptance, balance, and appropriate expectations were critical for family meals to foster resilience.

178 **146.178** Transitioning Pediatric Patients with Autism Spectrum Disorders to Adult Care

M. L. Massolo[1]*, M. N. Davignon*[2]*, Y. Qian*[1]*, A. E. Richards*[3] *and L. A. Croen*[1]*, (1)Division of Research, Kaiser Permanente, Oakland, CA, (2)Pediatric Specialties, Kaiser Roseville Medical Center, Roseville, CA, (3)Kaiser Permanente Division of Research, Oakland, CA*

Background: Children with Autism Spectrum Disorders (ASD) have a variety of medical and psychiatric co-morbidities, and increased use of health care services. As they become adults, their medical needs continue. The transition from pediatric to adult medicine can be challenging for patients with ASD, caregivers and health care providers. We conducted a study to determine barriers and facilitators of a smooth transition from pediatric to adult care for patients with ASD, and to inform the development of tools to support a smooth transition.
Objectives: To identify factors that influence the transition from pediatric to adult healthcare.

Methods: We conducted interviews (N=32) with patients, parents and clinical providers of transition age youth and young adults with ASD receiving health services at Kaiser Permanente (KP). We used a non-probabilistic purposive sampling approach to capture the range of ages (pre and post transition to adult care), sex and race/ethnic groups among patients. The provider group included KP adult and family providers and pediatricians. Three interviewers trained in qualitative methods developed guides and conducted all interviews. Areas explored in the interviews with patients and parents included communication with providers, accommodations (if any), experiences during appointments in pediatric and in adult care including registration, waiting room and interactions with medical assistants. In addition, we explored preparation, tools and resources for the transition. Questions to providers about their experiences transitioning patients with ASD completed the picture. Interviews, completed by telephone, ranged from 30 minutes to 1 hour.

Results: Many patients and parents expressed confusion and difficulty navigating a complex healthcare system. Obstacles to a smooth transition included gaps in care coordination and late or no preparation of the patient for the transition, lack of knowledge about ASD among adult care providers. Immigrant families encountered additional obstacles including language, cultural, and literacy barriers, and lack of culturally competent support. Many KP providers echoed the patients' and parents' frustration with the lack of patient preparation for transition, lack of resources and tools, and difficulties managing young adult patients with ASD. Possible solutions suggested by patients, parents, and KP clinicians included improved education and training for adult providers, active case management, improved care coordination, and tools to help patients move towards independence in terms of their healthcare.

Conclusions: The interviews provided insights about the experiences of a diverse group of ASD patients receiving healthcare at Kaiser Permanente. Many barriers were experienced by patients, their families and providers. Overcoming them is necessary in order to ensure a smooth transition and optimal care for this growing population of young adults.

179 **146.179** Trajectories of Maternal Depressive Symptoms Following ASD Diagnosis

A. Zaidman-Zait[1]*, P. Mirenda*[2]*, P. Szatmari*[3]*, I. M. Smith*[4]*, J. Volden*[5]*, L. Zwaigenbaum*[5]*, T. Bennett*[6]*, T. Vaillancourt*[7]*, C. Waddell*[8]*, S. Georgiades*[9]*, E. Duku*[9] *and M. Elsabbagh*[10]*, (1)Tel-Aviv University, Tel-Aviv, Israel, (2)University of British Columbia, Vancouver, BC, Canada, (3)Centre for Addiction and Mental Health, Toronto, ON, Canada, (4)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (5)University of Alberta, Edmonton, AB, Canada, (6)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (7)University of Ottawa, Ottawa, ON, Canada, (8)Simon Fraser University, Vancouver, BC, Canada, (9)McMaster University, Hamilton, ON, Canada, (10)McGill University, Montreal, PQ, Canada*

Background: Given the numerous challenges and demands involved in raising a child with ASD, mothers of these children are at an increased risk for elevated levels of depressive symptoms (Estes et al., 2009; Montes & Halterman, 2007). Such symptoms are concerning, as they are detrimental to mothers' long-term health (Vos et al., 2012) and are a robust correlate of children's maladjustment (Goodman et al., 2011). In addition, children with ASD may be particularly vulnerable to maternal depression because they require more sensitive and supportive parenting, which might be compromised in mothers with depression. Thus, understanding maternal depressive symptoms and their predictors following ASD diagnosis is highly important. Several studies have highlighted heterogeneity in the way individuals respond to stressful experiences, such that some people experience ongoing, high levels of distress; some experience distress that gradually declines; and others experience little or no distress (e.g., Bonanno et al., 2012). Yet, there is lack of knowledge about longitudinal trajectories of depressive symptoms among mothers of children with ASD.
Objectives: The purpose of this study was two-fold: 1) to investigate longitudinal depressive symptom trajectories among mothers following children's ASD diagnosis, using Latent Growth Mixture Modelling (LGMM); and 2) to examine correlates of depressive symptom trajectories, including children's autism symptom severity, behavior problems, and mothers' coping resources.

Methods: Data were drawn from the Canadian Pathways in ASD study and included 247 children with ASD and their mothers. Mothers' depressive symptoms were assessed at four time points between ASD diagnosis (T1; children's mean age was 39.02 months, SD=8.7) and when the children were between 7 and 8 years old (T4).

Measures: Maternal depressive symptoms were assessed with the Symptom Checklist-90-R (Derogatis, 1994). To assess coping resources, we used the Ways of Coping Scales (Folkman & Lazarus, 1988) and the Social Support Survey (NLSCY, 2008-2009). Children's behavior problems were measured with the Child Behavior Checklist (Achenbach & Rescorla, 2001). In addition, to assess autism symptom severity, we used the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) and the severity metric of the Autism Diagnosis Observation Schedules (ADOS; Lord et al., 2000).

Analysis: LGMM was employed to examine trajectories of depressive symptoms using LatentGold software. Predictors of membership of the identified trajectories (classes) were examined using a multinomial logit model.

Results: LGMM identified four discrete latent trajectory classes of depressive symptoms, including: No impact (no depressive symptoms across time; 33%), Minimal impact (low depressive symptoms across time; 36%), Moderate - Improved (medium depressive symptoms that decreased slightly across time, 25%), and High - Worsen (high symptoms that increased over time; 6%). Overall, trajectories were mostly stable across time (see Figure 1). Children's externalizing behavior, mothers' social support, and mothers' utilization of coping strategies predicted membership in depressive symptom trajectories. Autism symptom severity and internalizing behavior problems were not significant predictors.

Conclusions: Trajectories of depression symptoms are heterogeneous and are relatively stable in mothers of children with ASD. Findings emphasize the importance of screening for mothers' well-being, making coping resources available, and early treatment addressing children's behavior problems.

Poster Session
148 - Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
11:30 AM - 1:30 PM - Hall Grote Zaal

180 **146.180** A Biofeedback-Based Embodied Awareness Intervention for Adults with ASD: Feasibility of a Community-Based Treatment

R. S. Brezis[1]*, A. Levin*[2]*, Y. Oded*[3]*, O. Zahavi*[4]*, G. Gampel*[5] *and N. Levit-Binnun*[2]*, (1)Kanfei Nesharim St. P.O.Box 167, Interdisciplinary Center, Herzliya, Israel, (2)Interdisciplinary Center, Herzliya, Israel, (3)Center for CBT-BF, Tel Aviv, Israel, (4)Beit-Ekstein Organization, Kerem Maharal, Israel, (5)Private Psychotherapy Practice, Tel Aviv, Israel*

Background: As the number of adults living with ASD continues to grow, a lack of resources and lack of available interventions exacerbate their low quality of life, including low levels of education and employment, and high levels of co-morbid anxiety and depression. Here we build upon existing research showing the effectiveness of mindfulness-based interventions on individuals with ASD, to provide a low-cost biofeedback-enhanced training which can be implemented by non-professional staff, and may help autistic individuals grasp abstract contemplative techniques. We hypothesize that the intervention will decrease participants' anxiety and autism symptoms, and increase their self-awareness, self-determination, and empathy.
Objectives: (a) To determine whether a biofeedback-based embodied awareness intervention is feasible in a community setting and whether adults with ASD can improve in levels of physiological regulation; **(b)** to determine whether the intervention decreases participants' anxiety and autism symptoms, and increases their self-awareness, self-determination, and empathy; and **(c)** to determine whether improvements in

physiological regulation are related to psychological measures.

Methods: Fourteen adults with ASD, residing in assisted living, were provided with 16 weekly half-hour biofeedback-based embodied awareness sessions with non-professional trainers, in which they learned to reduce their arousal levels through combined biofeedback and embodied awareness techniques, and apply those to everyday life. Quantitative and qualitative data was collected pre- and post-intervention. Physiological measures included changes in Heart Rate (HR), and HRV coherence (i.e., Low Frequencies (0.04 to 0.15 Hz)/All Frequencies). Psychological measures examined self-awareness (Toronto Alexithymia Scale; TAS), self-determination (ARC), anxiety (Glasgow Anxiety Scale; GAS), autism symptoms (Social Responsiveness Scale; SRS), and empathy (Reading the Mind in the Eyes Test; RMET).

Results: Participants were capable of successfully improving their physiological arousal levels on the biofeedback setup and we found initial indications for gains in all hypothesized domains on the quantitative measures.

Participants' HR decreased through the time of the intervention by an average of 8.38bpm ($t(12)=2.86$, $p=.014$). At the same time, their HRV coherence increased, on average, during each session ($M=6.92$, $SD=8.3$), both measures indicating greater relaxation.

Participants showed a trend towards a reduction in ASD symptoms (SRS Self- and Caregiver report), a decrease in anxiety (GAS), an increase in self-determination (ARC), an increase in adaptive behaviors to challenging situations, and an increase in empathy (RMET); though these differences did not meet statistical significance. They did not show a decrease in alexithymia (TAS).

We further found a correlation between a decrease in anxiety symptoms (GAS pre-post) and the rate of increase in HRV coherence ($rho=-.694$, $p=.008$), suggesting that as participants gained control of their HRV, anxiety levels decreased.

Qualitative reports by participants and counselors revealed that participants applied the techniques in many real-life situations, and these had far-ranging effects on their emotional regulation, work and social motivation, and self determination.

Conclusions: The study provides proof-of-concept for a low-cost, community-based intervention which can ameliorate the lives of adults with ASD. Future studies should continue to examine the impacts of biofeedback-based embodied awareness interventions at various levels of intensity, and across different sub-populations of the autism spectrum.

181 **146.181** A Community-Based Randomized-Controlled Trial of High- and Low-Tech AAC Approaches

S. P. Gilroy[1], *J. McCleery*[2] *and G. Leader*[3], *(1)National University of Ireland, Galway, Galway, Ireland, (2)The Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)National University of Ireland, Galway, Ireland*

Background: Methods for teaching individuals with autism spectrum disorders (ASD) to engage in social and communicative behavior have traditionally employed low-tech approaches. Among these, the Picture Exchange Communication System (PECS) has extensive support as an approach for effectively teaching these skills. New and evolving technology (i.e., tablets, applications) has resulted in cheaper and more affording forms of speech-generating devices (SGD) and these SGD are increasingly used in practice. Despite early adoption of these newer methods, there are relatively few guidelines for using these devices to teach social and communicative behavior. To date, no studies have rigorously compared the relative effectiveness of high-tech and low-tech Augmentative and Alternative Communication (AAC) with randomized assignment, and it is also unclear as to whether a particular device may be better matched to certain individuals.

Objectives: A mobile application and associated custom teaching protocol was developed and systematically compared to PECS in a community-based randomized controlled trial (RCT). The objectives of the trial were to: 1) compare the effectiveness of high-tech and low-tech AAC approaches for teaching requesting skills; 2) compare the effectiveness of high-tech and low-tech AAC approaches for teaching queried requesting skills; and, 3) compare the effectiveness of high-tech and low-tech AAC approaches for teaching queried social responding.

Methods: Thirty-five school-aged participants assigned randomly to either a high-tech or low-tech AAC group. AAC intervention was provided in the schools of participants and trained therapists provided participants with either high-tech (n = 18) or low-tech (n = 17) forms of communication training. Trial participants were assessed before and following four months of AAC intervention. This trial was developed to examine the relative effectiveness of both types of AAC intervention for teaching social and communicative behavior to individuals with ASD. A repeated measures analysis of variance was used to systematically compare improvements in the two approaches. Time was included as a within-subjects factor and Type (i.e., high-tech, low-tech) was included as a between-subjects factor.

Results: The results from repeated measures analyses of variance indicated significant effects for Time for both types of requesting, but not for general social behavior. There was no significant effect for Type in any form of communication. These results indicate that the two approaches produced substantial benefit and that the benefits of these two approaches did not differ significantly.

Conclusions: The results from this community-based RCT suggest that high-tech AAC approaches, when implemented with a comprehensive teaching protocol, can be effective for teaching social and communicative impairments to children with ASD. While these results are supportive of the use of high-tech AAC with ASD, additional study is required to confirm similar outcomes when participants have more greater levels of impairment (i.e., ASD with comorbid intellectual disability). The results of this trial highlight how open-sourced technology can be combined with clinician-driven assessments and individualized intervention.

182 **146.182** A Fundamental Motor Skill Intervention Using a Dynamic Systems Apporach

A. M. Colombo-Dougovito[1] *and M. E. Block*[2], *(1)Kinesiology, Health Promotion, & Recreation, University of North Texas, Denton, TX, (2)University of Virginia, Charlottesville, VA*

Background: Autism spectrum disorder (ASD) is a complex neuro-developmental disorder characterized by deficits in social communication and pervasive repetitive behaviors (American Psychiatric Association, 2013). In addition to the hallmark characterizations of this condition is a growing body of research (Lloyd, MacDonald, & Lord, 2013; Liu, Hamilton, Davis, ElGarhy, 2014; Staples & Reid, 2010) that suggests that individuals with ASD also demonstrate delays in the development of gross motor skills. Despite mounting evidence of delay, few interventions have targeted gross motor skills as an outcome (Staples, MacDonald, Zimmer, 2012). Three recent studies (Bremer, Crozier, & Lloyd, 2016; Bremer & Lloyd, 2014; Ketcheson, Hauck, & Ulrich, 2016) demonstrate the increasing awareness of this issue; however, continued theory-based research is needed to build an effective motor intervention for children with ASD.

Objectives: The purpose of this parallel, convergent mixed methods design study was to test the validity and effectiveness of a fundamental motor skill (FMS) intervention for children with ASD that uses dynamic systems theory (DST; Newell, 1986). The intervention was based on intentional manipulations of task constraints—hereafter referred to as task modifications—to build FMS. This presentation will focus on the quantitative results, which focus on the fundamental motor intervention.

Methods: A purposive sample of 5 children (4 boys, 1 girl; Mage=7.92, SD=1.09) with ASD—in addition to two comparison (one age-matched and one developmentally-match) groups of children without ASD—completed a 6-week fundamental motor intervention with a retention assessment at 4 weeks post-intervention. Participants were provided instruction on one locomotor and one manipulative skill, based on pre-assessment of the Test of Gross Motor Development, 3rd ed. A repeated-measures ANOVA was done to analyze data collected during the intervention.

Results: Overall, a significant difference was found in motor scores across time, *F*(1.65,19.76) = 874.09, *p* < .001, partial n2 = .99, and between groups across time, *F*(1.65,19.76) = 874.09, *p* < .001, partial n2 = .99. A post hoc Tukey's pairwise comparison using a Bonferonni procedure was done to evaluate group differences. Significant differences were found between the ASD group and the developmental-match (*p* = .004) and age-match (*p* < .001) groups. Dependent *t*-tests using only data from the ASD group to understand how changes occurred over time found a significant increase between the pre- and post-assessments, *t*(4) = 4.98, *p* = .008, a significant decrease between the post- and retention assessments, *t*(4) = 4.52, *p* = .011, and a nonsignificant result between pre- and retention assessments, *t*(4) = 1.94, *p* = .124 (See Figure 1)

Conclusions: Data revealed that a motor intervention based on DST may: (a) significantly improve gross motor performance of children; (b) provide an effective means to build motor skills in children with ASD; and (c) allow for a high level of engagement and successful practice. Further, evidence reaffirms previous suggestions of significant motor delays in children with ASD and provides evidence that children with ASD may learn motor skills at rates closer to peers half their chronological age.

183 **146.183** A Randomised Feasibility Trial of a Low Intensity Intervention for Depression in Adults with Autism: The Autism Depression Trial (ADEPT)

A. Russell[1], *S. Barton*[2], *K. Cooper*[3], *I. Ensum*[4], *D. Gaunt*[5], *J. Horwood*[5], *B. Ingham*[6], *D. Kessler*[5], *C. Metcalfe*[5], *J. R. Parr*[7], *D. Rai*[8] *and N. Wiles*[5], *(1)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)Newcastle University, Newcastle, United Kingdom, (3)University of Bath, Bath, United Kingdom, (4)BASS, Avon and Wiltshire Mental Health Partnership NHS Trust, Bristol, United Kingdom, (5)University of Bristol, Bristol, United Kingdom, (6)Northumberland Tyne and Wear NHS Foundation Trust, Newcastle upon Tyne, United Kingdom, (7)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (8)Population Health Sciences, Bristol Medical School, Centre for Academic Mental Health, Bristol, United Kingdom*

Background:

High rates of co-occurring depression have been reported in Autism. Clinical guidelines recommend 'low intensity' psychological treatment based on cognitive behaviour therapy (CBT) as an effective treatment for mild-moderate depression. If adapted, CBT has been found to be effective in treating anxiety problems in children and adults with Autism if adapted. There has been less research into the usefulness of CBT as a treatment for co-occurring depression in Autism; several studies of group CBT showing mixed findings and no randomised controlled trials of individual, low-intensity CBT. There is a need to consider the feasibility of low intensity CBT for depression adapted for adults with Autism before investigating the effectiveness and efficacy of the intervention.

Objectives:

As part of a commissioned call by the NIHR HTA, this was a feasibility study for a large-scale Randomised Controlled Trial (RCT) that would determine the clinical and cost-effectiveness of a low intensity intervention for co-occurring depression in adults with autism.

Methods:

The feasibility study comprises a randomised controlled trial (RCT) and nested qualitative evaluation in preparation for a future definitive RCT. Participants are adults with Autism (n=70), aged 18 years or over with a PHQ-9 score ≥ 10, randomised to Guided Self-Help (GSH): a low intensity psychological intervention based on Behavioural Activation adapted for ASD or Treatment as Usual (TAU). Outcome measurement at 10, 16 and 24 weeks post randomisation is blind to group allocation for those measures that are not self-administered. Measures include standardised measures of depression symptoms, anxiety, social function, and service use. The analysis will aim to establish the rates of recruitment and retention for a larger scale RCT as well as the most appropriate measure of depression to serve as primary outcome.

Results:

At the time of writing, 70 eligible participants had been recruited and randomised; 35 were allocated to Treatment as Usual (TAU) and 35 to Guided Self-Help (GSH), across the two trial sites. The average PHQ-9 score at baseline was 16, indicating a severe level of depression. 23 of the 35 participants allocated to GSH had completed their treatment, which is 92% of those who had reached their ten week follow-up. At 10 week follow-up, 43 participants had completed outcome measures. At 16 week follow-up, 34 had completed outcome measures. At 24 week follow-up, 23 participants had completed measures. There had been four adverse events, none related to trial participation. One participant in the GSH arm had withdrawn, and seven in the TAU arm had withdrawn, with an additional TAU participant lost to follow-up.

Conclusions:

There is a need for evidence based psychological interventions in people with autism and co-occurring depression. This feasibility study considers if it is possible to conduct an effectiveness study of a newly developed, low intensity intervention for depression based on the principles of CBT for autistic adults.

184 **146.184** A Randomized Controlled Trial of the Korean Version of the Program for the Education and Enrichment of Relational Skills for Young Adults (PEERS®-YA-K) for Adults with Autism Spectrum Disorder

M. Oh[1], *J. Kim*[2], *K. Lee*[3], *J. Kim*[4], *S. Lee*[5], *G. Bong*[6], *S. Cha*[7], *I. H. Cho*[8], *H. J. Yoo*[9], *Y. S. Lee*[10], *M. S. Kim*[11], *D. W. Han*[12] *and C. Y. Shin*[13], *(1)Psychiatry, Seoul National University Bundang Hospital, Sungnam, Korea, The Republic of, (2)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, Republic of (South), (3)Special Education, Dankook University, Yongin, Korea, Republic of (South), (4)Seoul National University center for campus life and culture, Seoul, Korea, Republic of (South), (5)University College London, London, United Kingdom, (6)Psychiatry, Seoul National University Bundang Hospital, Seungnam, Korea, Republic of (South), (7)Smiletogether Foundation, Seongnam, Korea, Republic of (South), (8)Dr. Cho's Child & Adolescent Psychiatric Clinic, Seongnam, Korea, Republic of (South), (9)Psychiatry, Seoul National University Bundang Hospital, Seongnam, Korea, The Republic of, (10)Department of Physiology, Biomedical Sciences, Seoul National University College of Medicine, Seoul, Korea,* *Republic of (South), (11)Department Applied Chemistry, Kyung Hee University, Seoul, Korea, Republic of (South), (12)Dept. of Stem Cell Biology, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South), (13)Department of Neuroscience, School of Medicine, Konkuk University, Seoul, Korea, Republic of (South)*

Background: The evidence-based social skills intervention for young adults are limited, though social difficulties in autism spectrum disorder (ASD) persist after transition to adulthood. Program for the Education and Enrichment of Relational Skills for Young Adults (PEERS®-YA-K) is one of the evidence-based interventions effective in improving relational skills for young adults with ASD.

Objectives: The objectives of this study are, 1) examining feasibility of the PEERS-YA® through cross-cultural modification for Korean language and culture, and 2) validation of the Korean version (PEERS-YA®-K) using a randomized controlled trial (RCT) design, for efficacy in improving social skills of young adults with ASD.

Methods: 1) Cultural adaptation: The original version of the PEERS-YA® treatment manual was translated. Focus group interview was performed for 29 typical adults recruited from advertisement in the community. We asked 33 questions regarding dating etiquettes of young adults and 14 questions about social groups/activities and bullying. The interview questions consist of “whether the contents of the manual are different in Korea”, and “how to modify the differences if we implement it.” We modified the didactic lessons and role play scripts into more culturally sensitive and linguistically appropriate way. 2) Young adults diagnosed with ASD (18~35 years of age, IQ>70) and their social coaches were recruited for RCT. The subjects were randomly assigned to a treatment group (TG, n=19) or waitlist control group (CG, n=19). Primary outcome measures included questionnaires and direct observations quantifying social ability and problems directly related to ASD. Secondary outcome measures included scales for depressive symptoms, anxiety, and other behavioral problems. The effects of the intervention were analyzed by paired samples *t*-test and repeated measures ANOVA.

Results: 1) Based on focused group interview, several etiquettes for dating have been modified, including rules for follow up call and “blind dating”, examples of appropriate/inappropriate places for dating, conventions for compliments and controversies about online dating. Culturally unique characteristics of romantic relationship are added, and examples of social groups/activities were also modified. 2) Thirty eight young adults (age 23.50±3.89, IQ 99.34±15.01, all male) were participated in RCT. Attrition rate was 10.5% (4 subjects) due to diminishing motivation of the adults, social anxiety and major depressive episode). After the 16 weeks of treatment, participants showed significant improvement in social skills knowledge measured by Test of Adolescent Social Skills Knowledge Recised (TYASSK-R, t=-6.14, $p < 0.01$), decreased anxiety symptoms on Beck Anxiety Inventory (t=2.19, $p < 0.05$), and maladaptive behavior on Asperger Syndrome Diagnostic Scale (t=2.41, $p < 0.05$), ‘Offers Information’ item in language and communication domain score on the Autism Diagnostic Observation Schedule (ADOS, t=3.46, $p < 0.05$). When we compared TG and CG, TG showed significant difference in TYASSK-R (F=24.69, $p < 0.01$) and state and trait anxiety (F=5.78, $p < 0.05$).

Conclusions: After modest cultural adaptation focusing on dating sessions and social activities, implementation of PEERS®-YA-K was feasible to Korean community. We observed improvement in social knowledge and skills, as well as decrease in anxiety in the participants of PEERS®-YA-K.

185 **146.185** A Randomized Waitlist Controlled Trial of Cognitive Behavior Therapy to Improve Emotion Regulation in Children with Autism

J. A. Weiss[1], *K. M. Thomson*[2], *P. Burnham Riosa*[3], *C. S. Albaum*[1], *V. Chan (Ting)*[1], *A. L. Maughan*[1], *P. Tablon Modica*[1] *and K. R. Black*[1], *(1)Psychology, York University, Toronto, ON, Canada, (2)Applied Disability Studies, Brock University, St. Catharines, ON, Canada, (3)Brock University, St. Catharines, ON, Canada*

Background: Mental health problems are common among individuals with autism spectrum disorder (ASD), and difficulties with emotion regulation processes may underlie these issues. Cognitive behavior therapy (CBT) is considered an efficacious treatment for anxiety in children with ASD specifically; however, additional research is needed to examine the efficacy of a transdiagnostic treatment approach. The intervention in question, *Secret Agent Society: Operation Regulation* (SAS:OR) is an individually provided spy-themed manualized intervention using cognitive behavioral strategies. Systematic exposures, affect education, and strategies are applied across multiple emotions with a focus on practicing adaptive emotion regulation processes. Sessions progress from teaching basic skills, such as recognizing and labeling emotions in self and others (i.e., *affect education*) to more complex skills, such as adjusting responses to difficult emotions using relaxation strategies (*response modulation*), combined with planned systematic exposure to increasingly distressing family-informed situations. A parent is involved throughout each session; they follow along in their own manual, provide support to the child and therapist, and later, help the child transfer skills to school and home environments.

Objectives: The purpose of the present study was to examine the efficacy of SAS:OR with children with ASD, using a randomized waitlist controlled trial.

Methods: Sixty-eight children (M age = 9.75, SD = 1.27) and their parents participated in the study, randomly allocated to either a treatment immediate (n = 35) or waitlist control condition (n = 33). Parent-, child-, and clinician-reported measures of emotion regulation and mental health were administered at baseline, post-intervention, and at 10-week follow-up.

Results: Treatment integrity was high (85.8%) across sessions. Overall, children demonstrated good in-session engagement and program adherence. Results from ANCOVA revealed a significant treatment effect on two primary emotion regulation outcome measures: the parent-report Lability/Negative subscale of the Emotion Regulation Checklist (p = .03), with a medium effect, and the Emotion Regulation and Social Skills Questionnaire, with a large effect. Significant medium to large treatment effects were also found on parent reports of child adaptive behavior (p = .001) and behavioral symptoms (p = .04), overall Anxiety Disorder Interview Schedule Overall Severity (p = .04), and on blind clinician judgement on the Clinical Global Impression Scale-Severity (p = .01), and -Improvement (p = .003). Treatment gains were maintained at follow-up.

Conclusions: This study is the first transdiagnostic CBT efficacy trial for children with ASD. Additional investigations are needed to further establish its relative efficacy compared to more traditional models of CBT for children with ASD and other neurodevelopmental conditions.

186 **146.186** Acting out in Public School: How a Theatre Program Can Impact Imitation Skills in Children with ASD

S. Paterson[1], *M. D. Lerner*[2], *T. R. Goldstein*[3], *T. S. Toub*[4], *R. Golinkoff*[5] *and K. Hirsh-Pasek*[6], *(1)Department of Psychology, Temple University, Philadelphia, PA, (2)Psychology, Stony Brook University, Stony Brook, NY, (3)Department of Psychology, George Mason University, Fairfax, VA, (4)Psychology, Temple University, Ambler, PA, (5)University of Delaware, Newark, DE, (6)Temple University, Ambler, PA*

Background:
Does theater arts improve social emotional skills in ASD children? A growing body of work suggests that it might, with improvement in social behavior (Lerner et al., 2011), emotional recognition (Lerner & Mikami, 2012; Mehling et al., 2016), peer interaction (Guli et al., 2013; Corbett et al., 2015), theory of mind (Corbett et al., 2013; 2016), and anxiety (Lerner et al., 2012), Notably, however, most of these studies have been done on select samples of children who have the opportunity to go to specialized programs. Few investigate the effects of programs that are available to the wider community. Further, most of these studies examine only student outcomes rather than focusing on the stakeholder's perception of the effectiveness of that curriculum. In this study, we investigate the impact of an ongoing theatre arts program in a public school, incorporating the views of stakeholders (e.g.,teachers, administrators, paraprofessionals) into our measurement of students' performance

Objectives:

To assess children's social, emotional, and motor imitation skills before and after participation in an already existing school-based theatre arts program, evaluating those aspects of functioning stakeholders involved in the program thought were important.

Methods:

76 participants (74% male), aged 8-18 years old took part in a naturalistic study of a theatre arts program in a New York City public school for children with special needs. The program lasted for 40 sessions and was part of the regular school curriculum. Parent report of autism symptoms (SRS) was assessed. In person measures of imitation included the Rogers Battery (Rogers et al.,2010), Imitating Hand Position from NEPSY, and imitation trials of a Simon Says task. In person measures also assessed executive function (Simon Says) and social-emotional functioning (SEL-Web). Measures were chosen based on previous work with stakeholders working in the program (Goldstein et al, 2017) and were administered at the beginning of the academic year (Time 1) before participation in the program and again at year end (Time 2).

Results:

Standard scores on Imitating Hand Position significantly increased from Time 1 to Time 2, indicating improvement in core motor imitation skills. ($t(29) = -2.34$, $p<.026$). In addition, higher imitation skills on the Rogers battery positively predicted change on the SEL-Web ($b = .299$, $p<.01$).

Conclusions:

Stakeholders have endorsed imitation as an important outcome for children with ASD likely because it represents a potential portal for developing social skills. Indeed, imitation scores predicted change in social-emotional skills. Further, the fact that imitation skills improved in a public, not selective, school environment from Time 1 to Time 2 suggests that theater arts might be a conduit for the development of these foundational skills. Although significant differences were not seen in social-emotional skills per se from Time 1 to Time 2, these small gains in imitation are encouraging and provide an important step in more fully understanding school-based theatre interventions.

187 **146.187** Age As a Predictor of Treatment Outcome in Youth with ASD Following the PEERS® Social Skills Intervention

M. Jolliffe[1], *R. Ellingsen*[2], *N. E. Rosen*[3] *and E. A. Laugeson*[3], *(1)Psychiatry, UCLA PEERS Clinic, Los Angeles, CA, (2)Psychiatry, University of California Los Angeles, Los Angeles, CA, (3)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background: Prior research shows that psychiatric disorders may be triggered by stress in adolescence, and that social stress in particular is thought to have a disproportionate impact during this time (Anderson & Teicher 2008). It has also been suggested that while early childhood is a sensitive time for sensory, motor, and language development, adolescence may be a second "window of opportunity" in brain development, particularly for improving social skills (Fuhrmann, Knoll, Blakemore 2015), a factor that is known to be associated with better psychiatric outcomes (Hawker & Boulton 2000). However, there is a dearth of research comparing social skills treatment outcomes across different developmental stages to examine age as a predictor of success in social skills training.

Objectives: The purpose of this study was to compare differences in treatment gains from a parent-assisted social skills intervention across three age groups (preschool, adolescent, young adult). We hypothesized that the adolescent group would demonstrate the greatest treatment gains across these three conditions.

Methods: Participants included 28 preschoolers (85.71% male; mean age=4.50, SD=0.75), 181 adolescents (79.9% male; mean age= 13.73, SD= 1.80), and 76 young adults (77.6% male; mean age= 20.92 , SD= 2.34) with Autism Spectrum Disorder (ASD), presenting for treatment through the UCLA Program for the Education and Enrichment of Relational Skills (PEERS®; Laugeson & Frankel, 2010), an evidence-based, parent-assisted social skills program. All participants had clinically elevated ASD symptoms at baseline, as determined by a Total Score ≥ 60 on the Social Responsiveness Scale-Second Edition (SRS-2; Constanino 2012). Treatment gains were assessed using parent-reports on the SRS-2 pre- and post-treatment. Results were examined using repeated measures ANOVA to compare changes in SRS-2 Total Scores across groups.

Results: Paired samples t-tests revealed significant decreases in SRS-2 Total Scores pre- to post-treatment in all three age groups: preschool (t=2.48, p<.001), adolescent (t=10.17, p<.001), and young adult (t=6.87, p<.001). A repeated measures ANOVA compared change in SRS-2 Total Scores between groups and revealed a significant difference in amount of change between the adolescent and young adult groups (F=5.02, p<.01), such that SRS-2 Total Scores improved more in the adolescent group than the young adult group, supporting the original hypothesis. However, there were not significant differences in amount of change between the preschool group and the adolescent group or the preschool group and the young adult group.

Conclusions: These results suggest that the adolescent group did benefit more from treatment than the young adult group. This is consistent with the research advocating adolescence is a critical age for social skills development. This study demonstrates the importance of social skills treatment during adolescence. Future research might examine other social skills gains following the PEERS® intervention to determine if these differences are consistent across other domains.

188 **146.188** Are Children Severely Affected By ASD Underrepresented in Treatment Studies?: An Analysis of the Literature

A. Stedman[1], *M. Erard*[2] *and M. Siegel*[3], *(1)Spring Harbor Hospital, Westbrook, ME, (2)Maine Medical Center Research Institute, Portland, ME, (3)Maine Medical Center - Tufts School of Medicine, Westbrook, ME*

Background: Despite significant advances in the field of autism research, many experts have noted that those severely affected by Autism Spectrum Disorder (ASD) appear to have been understudied, particularly as the ASD phenotype has broadened over time. The extent to which this is true, and how severity is represented in the literature, has not been quantified. This question may exert its most proximal effects in the arena of treatment studies, which inform current clinical practices.

Objectives: We aimed to evaluate the degree to which the more severely affected population of children with ASD has been included in treatment studies, how severity is measured and represented, and if there have been changes in these areas over the past two decades in the autism literature.

Methods: A comprehensive literature search was conducted encompassing all autism research articles published from January 1991 to March 2013. Inclusion criteria for our analysis were peer-reviewed treatment studies with a sample size greater than one of pediatric subjects with ASD. Review of the articles based on these criteria yielded a final sample of 367 publications. The following was extracted from the full text of each article: publication year, sample size, age and sex of subjects, study design, type of treatment, and treatment target. To assess severity of participants in each study, information was extracted regarding communication level, IQ/level of intellectual disability (ID), and adaptive behavior, noting whether each was reported and with what measures. To determine overall presence of severely affected subjects, we evaluated each study based on severity cut-off scores on measures used in three domains (communication, IQ/ID, adaptive behavior). If an article included severely affected subjects in at least one domain, it was categorized as having evidence of inclusion of the severely affected population.

Results: Of the three severity domains, information regarding IQ/level of ID was most commonly reported (in 65.7% of papers, n=241), followed by communication (42.2%, n=155) and adaptive behavior (21.8%, n=80). Forty-nine percent of the studies (n=180) demonstrated evidence of inclusion of the severely affected population by our criteria. Notably, when examining the inclusion of the severely affected population over time, there was a significant decrease in the proportion of studies that included severely affected subjects (X^2 (8, n=367) = 36.7, $p<0.001$). Of the assessed papers published 1990-1994, 90% (n=18) included the severely affected population, whereas only 36.2% (n=42) of papers published 2010-2013 included the severely affected.

Conclusions: In reviewing treatment studies of children with ASD, it is clear that even by our liberal criteria of needing just one reported domain (IQ, communication, adaptive) to fall within the severe range, children severely affected by ASD were increasingly underrepresented in the literature over time. Particularly notable, in a disorder with a core feature of communication deficits and typically lowered adaptive functioning, was the underreporting of both domains. Future research could examine possible factors related to the underrepresentation of those severely affected by ASD, such as relative lack of gold-standard measures for communication and challenges in accessing more severely affected samples for outpatient studies.

189 **146.189** Assessment of Treatment Gains Following Social Skills Intervention: Parent and Adolescent Perceptions of Social Anxiety and Social Engagement

E. Veytsman[1]*, Y. Bolourian*[2]*, R. Ellingsen*[3]*, J. Blacher*[1] *and E. A. Laugeson*[4]*, (1)Graduate School of Education, University of California Riverside, Riverside, CA, (2)University of California - Riverside, Riverside, CA, (3)Psychiatry, University of California Los Angeles, Los Angeles, CA, (4)Semel Institute for Neuroscience and Human Behavior, UCLA, Los Angeles, CA*

Background:

The use of multiple informants in the assessment of treatment gains is critical in obtaining a better understanding of treatment progress. Some studies show inconsistencies between youth and parent report of socioemotional functioning among youth with Autism Spectrum Disorder (ASD) (e.g., Knott et al., 2006). The Program for the Education and Enrichment of Relational Skills (PEERS), an evidence-based social skills intervention, has been effective in improving adolescent social engagement and lessening social anxiety (Laugeson et al., 2012; Laugeson et al., 2009; Schohl et al., 2014). Previous correlational findings showed increased agreement between adolescent and parent ratings of adolescents' social anxiety and social engagement after participation in PEERS. However, the effect of informant ratings on treatment gains has yet to be examined.

Objectives:

The current study examines the association of parent and adolescent ratings on improvements of social anxiety and social engagement following an evidence-based social skills intervention.

Methods:

Participants included 133 adolescents (males=110; females=23) 11-18 years of age (M=14.02, SD=1.79) with ASD who attended 14 sessions of a weekly 90-minute social skills group (PEERS) with their parents. In order to assess adolescent social anxiety, parents and adolescents completed the *Social Anxiety Scale* (SAS; La Greca 1999) at pre- and post-test. The SAS Total Score was utilized in analyses. Parents and adolescents also completed the *Quality of Socialization Questionnaire* (QSQ; Frankel & Mintz 2008) at these two time points to assess the frequency of hosted and invited get-togethers in the previous month.

In order to determine the magnitude of change in adolescent social anxiety and social engagement by rater over time, gain scores on the SAS and QSQ were computed, and analyses of variance (ANOVA) were utilized with rater (parent vs. adolescent) as the independent variable. A significant omnibus test indicates that the mean change from pretest to posttest is not the same by rater.

Results:

Paired sample t tests revealed significant improvements on the SAS and on both domains of the QSQ as per parent and adolescent ratings ($p < .05$). ANOVAs of gain scores yielded no significant difference between raters on the SAS Total Score, F (1, 215) = .28, $p > .05$, or on the number of invited get-togethers on the QSQ, F (1, 218) = .33, $p > .05$. However, a significantly greater increase in hosted get-togethers per adolescent ratings (M = 2.20, SE = .27) was detected as compared to parent ratings (M = 1.38, SE = .27), F (1, 219) = 4.59, $p < .05$.

Conclusions:

Consistent with previous findings, parents and adolescents reported improvements on measures of social anxiety and engagement following the PEERS intervention. Analyses of gain scores were utilized to determine if treatment gains differed by parent and adolescent ratings. Overall, findings suggest that parents and adolescents perceive similar rates of improvement. However, adolescents reported a greater increase in the number of hosted get-togethers. This discrepancy in parent and adolescent report may be socially normative as adolescents become less socially anxious and more socially engaged and independent in planning their own get-togethers.

190 **146.190** Assistive Social Skills and Employment Training (ASSET) Program for Transition Youth with Autism Spectrum Disorder

K. White[1], *C. Sung*[2] *and G. Leader*[3], *(1)National University of Ireland, Galway, Galway, Ireland, (2)Department of Counseling, Educational Psychology and Special Education, Michigan State University, East Lansing, MI, (3)National University of Ireland, Galway, Ireland*

Background: Youth with autism spectrum disorder (ASD) face disappointing employment outcomes, including high unemployment and underemployment rates, following high school. This holds true for individuals with ASD without intellectual disability (ID) who have average intellectual abilities, but often have significant difficulty navigating the demanding social interactions in the workplace. While interventions targeting social skills in the larger ASD population have become increasingly prevalent, the majority of studies are atheoretical and focus on the needs of children. Research has not systematically examined work-related social skills interventions as evidence-based practices for transitioning youth with ASD. In addition to this area of need, recent legislative initiatives, including the Workplace Innovation and Opportunity Act in U.S., which mandates significant emphasis on pre-employment training for transition youth with disabilities, highlight the need for work-related social skills interventions to promote successful transition outcomes.

Grounded in social cognitive career theory and developed using a developmental iterative process, the Assistive Social Skills and Employment Training (ASSET) program, consists of ten 90-minute sessions offered in a community-based setting. One trained facilitator led sessions with 6 to 8 transition youth. Using multidisciplinary collaboration and community-based participatory design, curriculum was developed to meet the end-users needs, while emphasizing its appropriateness for practical and clinical utility. Topics covered included: communication, attitude and enthusiasm, teamwork, networking, problem-solving and critical thinking, and professionalism.

Objectives: This study aims to contribute to the evidence base by validating a work-related social skills training intervention, namely ASSET, for transition age youth with ASD (without ID) designed to improve social skills and social self-efficacy.

Methods: Twenty-seven transition youth with ASD participated in the pilot study of the ASSET program between 2014 and 2016 in the U.S. Preliminary findings included 17 high school and college students ranging from 19 to 23 years (M = 20.08; SD = 2.03) with ASD without ID (IQ M = 98.21; SD =16.78). All participants reported a previous diagnosis of an ASD according to DSM-IV-TR criteria.

Results: Findings revealed that 90% of a sample of 17 transition youth with ASD demonstrated significant improvements in social skills (d = .69) and social self-efficacy (d =1.58), as well as in secondary outcomes such as adaptive skills (d = .21) and self-reported levels of anxiety (d = .49) (Sung et al., in preparation; Connor & Sung, in preparation). Qualitative reports indicated that more than 80% reported that overall satisfaction rate was very high (rating between 8 to 10) on a 10 point-Likert scale with 10 being the highest satisfaction.

Conclusions: This study offers preliminary evidence for the efficacy of a work-related social skills training on social skills, self-efficacy, job readiness, adaptive functioning, and mental health for transition youth with ASD. The ASSET program is currently being piloted as a multi-site randomized control trial in two U.S. states, as well as being adapted and implemented in Ireland highlighting its potential for broader national and international collaboration, as well as its practicality and utility in community-based settings. Implications for research and practice, and lessons learned will be discussed.

191 **146.191** Autism Summer Employment Program Improves Job-Readiness and Employment Prospects in ASD Post-Secondary Students

J. Doidge[1], *A. Porthukaran*[2], *I. Yusupov*[1], *S. Konanur*[1], *M. Segers*[1] *and J. M. Bebko*[1], *(1)York University, Toronto, ON, Canada, (2)Psychology, York University, Toronto, ON, Canada*

Background: Entering the workforce and obtaining employment is an important goal for students in contemporary society, and a challenge for many young students with Autism Spectrum Disorder (ASD) who seek to transition into the workforce. Recently, studies have begun to show the effectiveness of supported employment programs for individuals with ASD and have demonstrated that employment programming for ASD participants can raise employment rates up to 35% (Garcia-Villamisar & Hughes, 2007;García-Villamisar, Wehman, & Navarro, 2002; Hillier et al., 2007; Lawer et al., 2009; Morgan & Schultz, 2012). Yet because of the length of time and expenses, these programs are often not feasible for many vocational centers, or student service centers. Similarly, many students with ASD may not utilize these programs since they are looking for summer or short-term employment.

Objectives: We explored a shortened and specialized Autism Summer Employment Program (ASEP) for post-secondary students with ASD with limited or no prior employment experience. We then examined how ASEP affected students' employment success, job-related knowledge and skills, as well as program satisfaction amongst ASEP participants.

Methods: 18 Canadian post-secondary students with ASD who were currently enrolled in university were recruited for the study. The program took place at a Canadian university, and used employment workshops specific to the ASD population for job searching, plus mock interviews with participants that were videotaped, in addition to ongoing job-related support. Job-readiness was evaluated with the Job-Readiness Questionnaire (JRQ).

Results: Overall, a significant increase in students' post-program scores compared to their pre-program scores, was found on the JRQ, indicating that students perceived an improvement in their job skills ($p < 0.001$). Students of the ASEP also reported a significant increase in their interview skills ($p = .03$), and confidence ($p = .01$), across the two time points, as well as high program satisfaction. Significant gains were also made in terms of employment goals and communication skills from pre- to post-program evaluations. As for employment, 100 percent of the students achieved employment positions; 14 participants accessed paid employment and 4 had volunteer positions. Of the 14 employed students, 100 percent maintained employment for the duration of their jobs. It seemed that smaller size workplaces sites were beneficial to individuals with ASD for several related reasons: such sites may be less intimidating, friendlier, and more flexible than large-scale workplaces.

Conclusions: These results demonstrated that the ASEP was helpful for obtaining and sustaining summer employment, often the first real work experience for the students. The program provided university students with ASD the opportunity to increase their employment skills in a safe and supported setting for a short duration and with limited costs. Students reported a significant increase in their job-related skills, knowledge, and confidence, and had generally positive work experiences during the program. The ASEP may be a viable support for post-secondary students with ASD in finding not just paid summer employment but also better preparation for full-time employment in the future.

192 **146.192** Best Practices in Supporting Social Participation of Young Adults with Autism Spectrum Disorder (ASD) : A Systematic

Review.

E. L. Bussières[1]*, J. Trépanier*[2]*, O. Laverdière*[3]*, M. H. Poulin*[4]*, D. St-Laurent*[5]*, J. Berbari*[6]*, C. Dumont*[7] *and M. Couture*[8]*, (1)Psychology, Université du Quebec à Trois-Rivières, Trois-Rivières, QC, Canada, (2)Faculté de médecine et des sciences de la santé, Université de Sherbrooke, Sherbrooke, QC, Canada, (3)FAculté de Médecine et des sciences de la santé, Université de Sherbrooke, Sherbrooke, QC, Canada, (4)Psychoeducation, UQAT, Rouyn-Noranda, QC, Canada, (5)Psychoeducation, UQAT, Royn-Noranda, QC, Canada, (6)FAculté de médecine, Unviersité de Sherbrooke, Sherbrooke, QC, Canada, (7)Rehabilitation, UQTR, Trois-Rivières, QC, Canada, (8)Rehabilitation, Universite de Sherbrooke, Sherbrooke, QC, Canada*

Background: The majority of ASD studies focuses on early childhood and early intervention (Howlin, 2008) while the challenges associated with autonomy and independent living is a major issue for avdults with ASD
Objectives:

The purpose of this systematic review (SR) is to document the effectiveness of interventions to support social participation of young adult with autism (16-40 years old). In this review, social participation is defined by three domains: social relations, employment and independent living.

Methods:

A comprehensive literature search was conducted to identify published articles and unpublished dissertations, using the following databases ProQuest, Medline, PsycInfo, Cinhal, ERIC. The research covered the period from 1 January 2000 to 1 June 2016. Two persons independently screened articles for eligibility. Studies were included if they: 1) include more than 10 participants ; 2) focuses on at least one aspect of transition to adulthood, including social relations, employment and independent living. Critical appraisal of included studies was done independently by two persons, using the Scientific Merit Rating Scale (National Autism Center, 2015).

Results:

Fourteen studies were retained, evaluating work-related interventions (10 studies), independent living programs (3 studies) and a leisure program (1 study). Methodological quality varies greatly across studies. Among high quality studies, three different interventions appear promising: a leisure program and two programs related to work, including a virtual training to job interviews, and a school-based employability program including an internship.

Conclusions: This SR suggests that interventions targeting transition to adulthood may be beneficial; it also highlights the need for more research, especially regarding the effectiveness of programs targeting independent living.

193 **146.193** Building from Strengths: A Curriculum to Help Adolescents with ASD Develop Creative Technology Skills and Succeed in STEM Fields

A. Riccio[1]*, M. Hossain*[2]*, B. Rosenberg*[3,4] *and K. Gillespie-Lynch*[5]*, (1)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (2)Hunter College, CUNY, New York, NY, (3)Tech Kids Unlimited, Brooklyn, NY, (4)Technology, Culture, Society, New York University Tandon School of Engineering, Brooklyn, NY, (5)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: People with ASD are chronically underemployed (Burgess & Cimera, 2014) despite their often heightened interest in computers (Wei et al., 2013) *and* the growing need for professionals who specialize in computing. Despite a deeply problematic gap between the potential of youth with ASD and their employment outcomes, evidence-based services to bridge this gap remain very limited (Taylor & Seltzer, 2011). Tech Kids Unlimited (TKU), a not-for-profit, aims to provide students with ASD and other learning differences with opportunities to build from their strengths to obtain meaningful careers.
Objectives: We aimed to gain insights about the interests/goals of teens with ASD and their perspectives about TKU to inform curriculum adaptations.

Methods: Throughout seven weeks of summer programming, twenty students with ASD (13-20 years; $M = 15.6$) participated in structured interviews at the beginning and end of each week-long workshop. After achieving reliability, the lead author coded students' responses. Optional Likert scale surveys were distributed at the end of the week to parents and instructors of all students who participated in summer programming.

Results: When asked what they were looking forward to at the beginning of the week, most students indicated excitement about technology (68%), 26% reported anticipation of social opportunities. When asked what social skills they hoped to learn at TKU, 36% of students did not know or did not feel they needed social skills supports. When asked what job they would like, 79% of students indicated STEM careers. Only 26% of students identified specific job-related skills they hoped to learn. Few students (35.29%) provided a specific employment-preparation strategy.

When asked what they had learned, most (82%) students indicated technological skills, 24% indicated social skills. When asked what they had learned which could help them get a job, most students (47%) indicated technological skills, 24% indicated social skills. When asked how their instructor made activities interesting for them, 56% of students described hands-on activities and 31% described playful humor/games.

In post-test surveys, instructors indicated that all program participants (n=42) developed technological skills (M= 5.59 out of 7) and were engaged with the curriculum (M= 5.49) and other teens (M= 5.05). Parents (n=23) indicated that students gained skills needed to obtain employment (M= 5.48 out of 7), technological skills (M= 5.45), social-emotional skills (M= 5.14), and friendships (M=5.21).

Conclusions: Students', parents' and instructors' indicated that adolescents with autism gained technological and social skills at TKU. Students and parents reported that skills learned could help students obtain jobs. In order to help students transition into careers aligned with their interests, TKU's innovative curriculum should increasingly emphasize activities to help students identify goals and monitor progress developing job-related soft skills (e.g., planning and collaboration). Given that teens with ASD reported that hands-on, playful, technology-based activities are a central aspect of their enjoyment of TKU, curricular adaptations should continue building on these strengths.

194 **146.194** Community-Based Intervention Research for Adolescents and Young Adults with ASD Is Uneven across Designs, Diversity & Domains: A Review

T. M. Girolamo[1] *and S. F. Warren*[2]*, (1)Child Language, University of Kansas, Lawrence, KS, (2)Speech-Language-Hearing: Sciences and Disorders, University of Kansas, Lawrence, KS*

Background: Little is known about community-based intervention (CBI) research on adolescents and adults with Autism Spectrum Disorders (ASD). Yet, research suggests adolescents and adults with ASD face adverse outcomes upon exiting public education. CBI may be an effective way to provide support across the life span.

Objectives: The aim of this study was to summarize the state of research on CBI for adolescents and adults with ASD, particularly with regard to: demographics of participants in CBI research, development of the literature as a whole, and domains targeted by interventions.

Methods: This study included all peer-reviewed journal articles from 1980–2015. Inclusionary criteria were: (1) an explicitly identified CBI; (2) taking place in a real world setting outside of a residential setting or school; (3) targeting one or more adolescents and/or adults, of 14 years of age or older; (4) a diagnosis of autism or demonstration of the characteristics of autism under the DSM-4 or DSM-5. This criterion includes individuals from earlier studies who did not have an ASD diagnosis, but demonstrated symptoms consistent with ASD.

ERIC, GoogleScholar, Medline, and PsycInfo searches were conducted with the following terms in all permutations: (adolescents OR adults) AND (community-based OR community based OR community OR vocational) AND (autism OR asperger) AND (treatment OR intervention OR training). Reference lists of articles were also checked. Fourteen studies were identified that met the inclusionary criteria.

Articles were evaluated using a template developed by a NIMH work group. Phase I research is formulation and systematic examination of intervention techniques. Phase II research involves protocol development and manualization. Phase III research consists of randomized controlled trials. Phase IV research is community effectiveness studies.

Results: 13 of the 14 eligible studies were Phase I studies. Of the 13 Phase I studies, 11 were single-subject designs, and 2 were pre-/post-test designs. Challenges to strong single-subject designs included: sufficient intervention duration, changes in level and trend to claim treatment effect, as well as generalization. No studies explicitly qualified as Phase II. Only one study qualified as Phase III. No studies qualified as Phase IV.

Second, most studies focused on the vocational domain. Nearly 60% had vocational goals, 20% behavioral goals, 14% social skills goals, and 7% activities of daily living goals. Interventions targeting language were wholly absent from the CBI literature.

Third, studies may lack diversity. Information on participant race/ethnicity was obtained for 85% of participants overall and for 9/14 studies. 70% of participants were Caucasian, 22% African American, 4% Asian, and 3% Hispanic. No participants were Alaska Native/Native American.

Conclusions: The literature suggests that CBI research for adolescents and adults with ASD has stagnated over the past 35 years. Most studies are Phase I studies focusing on the vocational domain. It is unclear how interventions might vary with culturally and linguistically diverse participants. The paucity of research may be tied to a lack of funding and advocacy for this age group. Future research should focus on replication, especially with diverse participants, and CBI targeting other domains, including language.

References available upon request.

195 **146.195** Constructing Successful in-Home Oral Care Habits in Latino Children with and without Autism

D. H. Como[1]*, L. I. Florindez*[1] *and D. C. Florindez*[2]*, (1)Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)University of Southern California, Los Angeles, CA*

Background:

Dental care is the most prevalent unmet health need in US children (Stella et al., 2002). Children who are from an underrepresented, underserved minority population, like Latinos, or have a special health care need such as Autism (ASD), are at increased risk for experiencing oral health disparities (Fisher-Owens et al., 2013). When intersected, Latino children with ASD face unique and unresearched oral care challenges. Performing routine dental activities can be especially difficult for a child with ASD due to their unique set of sensory sensitivities (Stein et al., 2012). Most literature discussing oral health disparities recognizes a need for further research to mitigate the inequalities, but little focuses on promoting successful home-based oral care strategies like tooth brushing and flossing.

Objectives:

The purpose of this qualitative study is to use videos recorded by parents to explore and compare how 18 Latino children with and without Autism perform in-home oral care routines, note both successful aspects of their routines and areas for improvement, and summarize findings into suggestions for practitioners working with these families.

Methods:

This study employed a qualitative approach to analyzing oral care videos. Eighteen Latino families (8 families with a typically developing child ages 6-12 and 10 families with a child with ASD ages 6-12) were interviewed to identify the factors that impact their in-home oral care routines, including how the presence of ASD may alter their child's habits. Each family was asked to film their child performing their typical oral care routine for 3 days. A research assistant blindly coded 61 videos (n=30 from a child with ASD and n=31 from a typically developing child) using a checklist of dental behaviors (amount of toothpaste, duration of brushing, etc.), in addition to making notes about unique aspects of the oral care routines. Videos were discussed and co-coded by the research team to decide on final themes.

Results:

From the videos, three themes pertaining to successful oral care practices were observed. The first, *Parent Involvement*, identifies parents as partners in the oral care process, helping facilitate the activity physically or with verbal cues. The next, *Wait, there's more,* describes that tooth brushing was often the only routine performed by the child; noticeably absent were flossing and mouthwash habits, which were often described by parents as too difficult to incorporate into their child's routine. Finally, *Sensory modifications* describes being aware of the sensory needs of the child, and modifying the activity to meet those needs, including altering the environment where the activity takes place, or using timers to help establish routines.

Conclusions:

Understanding in-home oral care routines may address oral care disparities in Latino children. This involves addressing the occupation of oral care itself, while also considering the influence of the cultural contexts, family and child descriptors, performance patterns, and systemic restrictions on the activity. By synthesizing components of oral care routines into suggestions for successful practice, we hope to begin the discussion on effective oral care for Latino children.

196 **146.196** Delivery of ABA to Children in Rural Communities Via Teleconsultation and Rethink Autism

J. Viskochil[1]*, W. Jenson*[2]*, W. M. McMahon*[3]*, P. Carbone*[4]*, J. Davis*[2] *and J. Hood*[5]*, (1)Utah Autism Research Program, Salt Lake City, UT, (2)Educational Psychology, University of Utah, Salt Lake City, UT, (3)Psychiatry, University of Utah, Salt Lake City, UT, (4)University of Utah, Salt Lake City, UT, (5)Carmen B. Pingree Autism Center of Learning, Salt Lake City, UT*

Background: Applied Behavior Analysis (ABA) is an effective intervention for individuals with ASD, and parents can be trained to provide ABA intervention in their home. Families in rural areas face a lack of nearby ABA service providers, thus parent training for this population is imperative. Developments in telehealth and teleconsultation may further increase ABA training opportunities for these rural communities. Rethink Autism is an online, video-based treatment program designed to provide parents with the training to implement ABA with their children at home. Although online parent training programs confer multiple benefits, therapist-assisted modalities show greater outcomes than self-directed use. Contact with a trained interventionist could bridge some of the common barriers in online parent training.
Objectives: The purpose of the present study was to evaluate outcomes of an online, ABA-based intervention with video modeling delivered to children with ASD in rural areas and supplemented by teleconsultation. This model may provide the education, training, and scaffolding needed for parents to implement behavioral interventions with their children. Outcome measures of import included the following: child behavioral gains; parent ABA skill development; fidelity of the ABA programming and implementation integrity; and generalization of ABA skills to novel behaviors. Additionally, this study reviewed access to evidence-based intervention in rural communities, cost-effective delivery of intervention, and the utility and social validity of behavioral teleconsultation.

Methods: A non-concurrent multiple baseline design was used across three rural families. Following an in-vivo orientation, three phases were completed remotely through Rethink and teleconsultation. The baseline phase involved novice participants implementing ABA using only a one-page lesson printout. This was followed by successful completion of four Rethink ABA training modules. During the intervention phase, participants had access to Rethink's high definition video modeling and coaching delivered via teleconsultation. The generalization phase replicated baseline conditions with a never-before-seen lesson; participants had only the lesson printout without coaching or video modeling.

Results: Outcomes reveal large effect sizes for parent increases in ABA implementation integrity from baseline to generalization (Tau-*U* = 0.82), coupled with child skill gains in their ABA lesson programming (Tau-*U* = 0.80). Both Rethink and teleconsultation were rated with high acceptability and perceived effectiveness. Cost analyses show financial benefits of Rethink and teleconsultation in terms of ABA programming (annual savings = $18,051 per child), logistical expense (average travel of 49 driving hours over 2,900 miles), and ABA consultation costs (average savings by teleconsultation = $300.16).

Conclusions: This study supports the use of digitally delivered intervention to increase child skills via targeted ABA lesson programming. These gains were achieved with relatively short duration (three months) and with low intensity (four hours/week). Parents were able to develop ABA implementation skills over the course of the study through the completion of online training modules and coaching received over teleconsultation sessions. These skills were critically demonstrated in the generalization phase to a novel behavior. This model of service delivery is apropos for families living in rural geographies, elegantly addressing limitations in service access and economic burdens.

197 **146.197** Developing Self-Reflection: A Novel Social Skills Intervention Using First-Person Video Recording Eyeglasses

S. Hurwitz[1]*, D. P. Kennedy*[2]*, T. Ryan*[3]*, K. Quest*[4]*, B. Schmitt*[4] *and A. Zero*[4]*, (1)Special Education, Indiana University, Bloomington, IN, (2)Psychological and Brain Sciences, Indiana University, Bloomington, IN, (3)Special Educaiton, Indiana University, Bloomington, IN, (4)Indiana University, Bloomington, IN*

Background:
Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by profound and lifelong impairments in social relationships and communication. Social-communication deficits are important targets for intervention because proficiency is critical for successful functioning within society.

Objectives:

This study takes a novel approach to social skills development by improving participants' ability to self-reflect. In this context, self-reflection is the capacity to think about one's own behavior during social interactions and consider whether it was appropriate. Using first-person-perspective video recordings as a tool, participants with autism learned to reflect upon their conversational behavior, learn from their mistakes and successes, and improve future social interactions.

Methods:

Participants: Four adolescent males with autism (diagnosis confirmed by ADOS-2), ages 12-16 years-old, with average IQs (as measured by WISC-V) and fluent spoken language, participated in this study.

Study design: Single-case design; multiple-baseline across participants, replicated across four individuals.

Measures: The following measures were administered to all participants and/or their parent. ADOS-2, WISC-V, Autism Social Skills Profile (ASSP-II), Social Responsiveness Scale (SRS-2), Social Skills Improvement System (SSIS), Self Reflection and Insight Scale (SRIS), a social validity questionnaire.

Intervention approach: Each session consisted of a 10-minute, unstructured, naturalistic conversation between the participant with ASD and an interventionist (i.e. a trained school psychology doctoral student or a principal investigator). Both members wore first-person, video capture eyeglasses that recorded the conversation from their viewpoint. Baseline sessions involved a 10-minute conversation (nothing else). Intervention sessions involved a conversation and then the participant was asked to, "Think back about how the conversation went." Video clips were viewed so the participant could see himself from the outside (e.g. the expression on his face, the gaze of his eyes, the topics he brought up) and the interventionist (e.g. to see the puzzled look or smile on her face). Sometimes, clips showed the table or floor because the participant had looked down during much of the conversation. Participants identified moments of conversational strength and imperfection.

Videos of the participants were coded for behavioral changes by trained graduate students. A randomization procedure was used to reorder videos before coding began so coders were blind to treatment condition. IOA was completed for 30% of videos to an average level of 93%.

Results:

Each participant engaged in 14-23 conversational sessions (this number varied due to the multiple-baseline study design), and two generalization sessions six weeks later. Participants improved in at least one conversational measure. These target skills were individualized, as some participants developed their eye contact, while others talked less about restrictive-interests and asked more questions. Participants and parents completed a feedback survey; learned new skills, recommended the study to others. Effect sizes and visual analyses will be presented.

Conclusions:

First-person video recording eyeglasses can be used as a tool to improve some conversational behaviors for adolescents with ASD. Nonverbal communication skills (like eye contact, facial affect, and physical orientation) were easy for participants to self-identify from videos. Conversational skills, like perseverating on restrictive interests or initiating new topics, were more difficult for participants to recognize independently.

198 **146.198** Development of Immersive Gaze-Controlled Video Game Therapy for Children with Autism Spectrum Disorder

L. Cordero[1]*, Z. M. Dravis*[1]*, B. Farber*[2]*, L. Robinson*[2]*, M. Farber*[3] *and J. D. Herrington*[4]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)BioStream Technologies, LLC, Boston, MA, (3)BioStream Technologies, LLC, Philadelphia, PA, (4)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background:

Existing interventions for children with autism spectrum disorder (ASD) require significant therapist or educator time, with an estimated annual cost of more than $11B. As such, there is a pressing need for affordable and accessible tools to evaluate and treat children with ASD. In collaboration with the University of Pennsylvania and the Children's Hospital of Philadelphia, BioStream Technologies, LLC (“BioStream”) is developing a commercial-quality immersive 3D video game to augment social skill training for children with ASD. BioStream’s game leverages behavioral and educational principles used in applied behavior analysis, such as discrete trial training and differential reinforcement, to shape behavior and drive positive outcomes. To inform game design, BioStream has developed a proprietary research platform (“BioStream Platform”), which uses state-of-the-art software to collect and interpolate synchronized biosensor data and enable programmatic adaptation of player experiences in real time.

Objectives:

1) To determine that the BioStream Platform can collect accurate synchronized physiological and behavioral metrics. 2) To qualitatively evaluate BioStream’s game that includes tasks designed to facilitate social abilities (eye contact and facial expression recognition).

Methods:

This observational pilot study is actively recruiting children between the ages of 6 and 17 targeting 50 children with ASD and 20 typically developing children. To date, BioStream’s game has been administered 36 times over 13 children (10 ASD and 3 TDC) (mean age = 12.25 years, 83% Male). The wide age range aids in further identifying a target demographic of those who may benefit most from the game. Study visits include computer game play while wearing biosensors including ECG, EDA/GSR, EEG, and use of eye trackers (table-top and eyeglass-mounted depending on the task). Participants are also recorded with front facing cameras to analyze facial expressions. After a physiological baseline is obtained via a 3 minute long fractal video with no sound, participants engage in a three minute dyadic conversation. Next, they move on to play BioStream’s game, which includes repeatedly administered discrete trials that require participants to attend to specific contents on a computer screen (i.e., eyes within a face), and provides immediate, rewarding feedback upon success. The use of real-time eye tracking data is essential to truly evaluating eye contact and providing effective differential reinforcement.

Results:

To date, the BioStream Platform and BioStream’s game have proven to be safe and well tolerated by participants. The gaze-contingent eye tracking portion of the game has worked successfully for all children. Quality assurance and basic analyses are presently underway for the remaining biosensor data.

Conclusions:

BioStream’s game and platform have been well received by participants and the platform effectively collects simultaneous biosensor and behavioral data among children with varying abilities. In addition to the value of the BioStream Platform in developing interventions, present data suggest that it provides a convenient method for researchers to simultaneously measure multiple data streams during dyadic communication, gameplay training and social skills assessments. By INSAR 2018 Annual Meeting we will have implemented analyses on data from each biosensor (including eye tracking), as well as on child ratings of the game.

199 **146.199** Employment Interventions for Individuals with ASD, DD, & ID: A Meta Analysis of Single Case Research

J. Davis[1]*, K. Mendenhall*[2]*, T. Glad*[2]*, M. Walkingshaw*[3] *and W. M. McMahon*[4]*, (1)Educational Psychology, University of Utah, Salt Lake City, UT, (2)University of Utah, Salt Lake City, UT, (3)University of Utah, Salt lake City, UT, (4)Psychiatry, University of Utah, Salt Lake City, UT*

Background:

Individuals with autism spectrum disorder (ASD), intellectual disabilities (ID), and/or other developmental disabilities (DD) often face challenges when transitioning from school based services to competitive employment in adulthood. Many individuals in this population enter adulthood without the necessary skills to independently acquire a competitive job or maintain a position. At this crucial transition point, needed are effective intervention practices to support individuals on the path to gainful employment.

Objectives:

The objective of this study is to review and analyze the available literature to better understand the current state of intervention research that supports individuals with ASD, ID, and or DD in the process of obtaining and maintaining competitive employment.

Methods:

A comprehensive literature review was conducted that resulted in a pool of 3,372 studies. After reading the title and abstract of each of the identified articles, the number of included studies was reduced to 544. Additional inclusion criteria included 1) studies that had utilized Single Case methodology, 2) studies that targeted an individual with ASD, ID or DD, and 3) studies that targeted outcomes related to pre-employment skills or specific job skills. Following the application of additional inclusion criteria, 21 studies were identified and coded for relevant variables.

Each study was coded based on the following variable 1) quality of research design 2) Intervention method, 3) Participant Characteristics (age & diagnosis), and 4) Setting of Intervention. For the current study, the Tau-U ES was used to determine intervention effects. Tau-U is a method for measuring data non overlap between two phases (A and B). Statistical significance between variables was assessed using the Kruskal-Wallis H test with the Dunn post-hoc test.

Results:

The current study found an overall TauU effect size = .79 CI95 [.72, .81]. These results include 67 effect sizes from 21 studies with 50 unique participants. Sixteen studies employed a high quality single case research design. Three studies utilized technology mediated interventions (TauU = .81 CI95 [.77, .85]), three studies targeted social skill interventions (TauU = .65 CI95 [.62, .68]), one study investigated interviewing skills (TauU = 1.0 CI95 [.77, 1.00]), and 14 studies targeted specific job skills (TauU = .80 CI95 [.77, .83]) as outcomes. No significant differences between studies were found based on age, diagnosis or setting of intervention.

Conclusions:

The current study examined intervention research for individuals with ASD, ID, and DD in the areas of employment and pre-employment skill development. Much of the research in this area centers around training specific skills for specific jobs. Relatively few studies target job preparation skills (e.g. interviewing, application development, etc.). While several high quality single case studies exist that promote effective practices for developing employment skills with this population, more research is needed to support individuals with ASD, ID, and /or DD in the process of obtaining jobs and maintaining employment opportunities.

200 **146.200** Examining the Effectiveness of a Mind Reading Emotion Intervention for Children with Autism Spectrum Disorders

D. Davidson[1]*, E. Hilvert*[2]*, M. Giordano*[1] *and I. Misiunaite*[3]*, (1)Psychology, Loyola University Chicago, Chicago, IL, (2)Loyola University, Chicago, IL, (3)Loyola University Chicago, Chicago, IL*

Background: Emotion processing plays a pivotal role in the maturation of social interactions and communication in children with Autism Spectrum Disorders (ASD). Although interventions that target emotion processing have the capacity to improve these social deficits, only a handful of technology-based emotion interventions have been designed and implemented with children with ASD.

Objectives: The goal of the present study was to examine the effectiveness of the software: *Mind Reading: The Interactive Guide to Emotions* (Baron-Cohen, Golan, Wheelwright, & Hill, 2004) on improving accurate recognition of basic and self-conscious emotions from facial and contextual stimuli in children with ASD.

Methods: Eighteen children with ASD (M_{age} = 12;02) participated in a four-week technology-based emotion intervention using the *Mind Reading* software (Baron-Cohen et al., 2004), which aims at improving emotion recognition abilities and social behaviors. All children had an IQ > 75, and were mainstreamed in their school district (see Table 1 for additional demographics).

Before the intervention began, children completed two tasks to assess their emotional development. The first was a measure of facial emotion recognition where children viewed pictures of happy, sad, angry, and fearful faces presented at varying expression intensities (0%, 50%, 100%). In the second task, children were read short stories and asked to identify the character's emotions from the situational context that elicited either a basic (i.e., happiness, sadness, fear) or self-conscious (i.e., pride, guilt, embarrassment) emotional reaction.

Two months after this initial assessment, all children participated in the Mind Reading intervention at their schools for three hours twice a week for four weeks. The Mind Reading software consists of three modules: the emotions library, learning center, and game zone. In the emotions library, children were exposed to over 400 basic and complex emotions through videos, recordings, and mini-stories. In the learning center, children completed lessons and quizzes on these emotions. In the game zone, children played games that tested their emotion recognition skills. Children spent the majority (~70%) of each session working in the emotions library and learning center, and at the end, they worked in the game zone. During each session, an intervention facilitator ensured students stayed on task. Children were then re-assessed two weeks later using the same battery of emotion tasks.

Results: After the intervention, children with ASD showed improvement in basic and self-conscious emotion processing skills. With regards to facial recognition, we found improvements in children's ability to detect happy and fearful facial expressions, subtle facial expressions (at 50% expression intensity), and their ability to specifically recognize basic emotions on male faces. On the situational emotion task, we found that after the intervention, children were better able to identify subtle and intense expressions of self-conscious emotions, especially guilt, from situational contexts (see Table 2).

Conclusions: These findings provide support for the efficacy of the Mind Reading program. Additional assessment of this intervention across various settings and with different emotion outcome measures will be essential to further establish its utility.

201 **146.201** Fidelity with Flexibility: Implementing Evidence-Based Interventions to Enhance Child Outcomes through Telehealth Parent Training

S. M. Egan, ***M. S. Torres-Viso*** *and M. D. Powers, The Center for Children with Special Needs, Glastonbury, CT*

Background:

In recent years, advances with telehealth technology have improved the opportunity for families of children diagnosed with Autism Spectrum Disorders (ASDs), living in areas with resource shortages, to collaborate with providers. As this distance consultation model becomes more prevalent, clinicians must adapt their service delivery repertoire to incorporate a fidelity with flexibility approach to training a parent acting in the role of practitioner. Best practices for children with ASD indicate that interventions must concurrently target decreasing challenging behavior which impair functioning and increasing the child's adaptive and functional repertoire. When utilizing telehealth technology, it is essential that added emphasis be placed on developing interventions which embed family and cultural values into evidence-based treatment. This will lead to culturally-sensitive interventions which incorporate variables that are meaningful to the family's values, and consequently improve child functioning within their cultural context.

Objectives:

The efficacy of telehealth-delivered, evidenced-based methodology on interfering and functional adaptive behaviors for children diagnosed with

ASD using a parent training model was evaluated. Modifications made to the implementation of best-practice strategies to match the needs of families and educators in a manner that maintains the integrity of evidence-based services are also discussed.

Methods:

Telehealth consultation was delivered to parents of three school-aged children (ages 5, 10, and 15) with ASD to manage disruptive behavior and teach appropriate, functional skills in response to child-specific adaptive challenges. The families were located in Europe and Asia with participants living in England, Norway, and Sri Lanka. Regularly-occurring telehealth consultations provided the parents with training by a clinician via didactic instruction with role plays/review of video, development of protocols for parent practice and electronic sharing of data. Data were collected by the parents on interfering behaviors and replacement responses.

Results:

Participant 1's avoidant feeding behavior decreased from 100% of trials met with refusal when target foods were presented at baseline to 3% of trials met with refusal after intervention. Additionally, his repertoire of food consumed increased by 25 foods with intervention. For participant 2, the weekly average of episodes of aggressive behavior decreased by total of 77%, from 3 episodes per week at baseline to <1 episode per week after intervention. Participant 3, demonstrated a decrease in voiding accidents from 48 per week at baseline to 7 per week after intervention and increased the frequency of initiation requests from 0 per week at baseline to 34 per week following intervention.

Conclusions:

Parent training delivered through telehealth was an effective intervention in reducing interfering behaviors and increasing parent-identified adaptive responses. Additionally, as the child’s interfering behaviors decreased, their availability to access family and community-based activities increased. Following the reduction in interfering behavior, intervention for each participant was advanced to incorporate assessment of additional adaptive skills and develop instructional protocols that further promoted community participation and family functioning. By incorporating a family’s cultural variables into the development of a strong distance consultation framework, the needs and resources of families were meaningfully embedded into intervention strategies which promoted generalization of successful outcomes and prevented consultative failures.

202 **146.202** Ideas: Inventing, Designing and Engineering on the Autism Spectrum

K. P. Koenig[1], *W. Martin*[2], *R. Vidiksis*[2] *and Y. L. Chen*[1], *(1)Occupational Therapy, New York University, New York, NY, (2)EDC, New York, NY*

Background: Preparation for a career as an inventor, designer, or engineer requires that students not only learn disciplinary knowledge, but also to engage in scientific and engineering practices. These abilities are difficult for most students to master, but they can be particularly challenging for students with ASD, who often struggle with peer interactions, critical reflection, executive function, and communication yet have a high interest in the STEM fields. The overarching goal for this project is for a collaborative team of researchers, program developers, ASD educators and students to create an inclusive design and engineering program for middle-school students with ASD and general education peers
Objectives: To explore preliminary indicators of positive social behavior during a high interest inclusive STEM club for middle school students with and without an autism spectrum disorder (ASD).

Methods: A 10-week afterschool program (Maker Club) was conducted in a large urban district in three pilot schools with six teachers and 37 students (14 with ASD and 23 without). Researchers conducted structured observations of every program session (n=50), a mid-year focus group with all six teachers, and post-implementation focus groups with the two teachers at each of the three pilot schools (N=6), to gather data about their experience at different stages in the program. As a result of this initial data collection, a Behavioral Coding Scheme will be used (Bauminger, 2002) during the Fall of 2017 to code social initiation and response in 3 main behavioral categories: positive social interaction, negative social interaction, and low-level social interaction. Observations and coding will be made in two 15-minute periods (2 before treatment 2 after treatment in the study) and data will be coded for presence of behavior in 1-min intervals.

Results: Initial results from the focus groups and structured observations indicate that over the 10 week period, students with ASD showed an increased frequency of social initiations that included a) asking for help from their peers, b) direct questioning of their peers for information about their projects, c) initiation of spontaneous conversations while working on Maker activities, and d) increased social initiations with students without an ASD. As a result of these findings a behavioral coding scheme will be used in the fall of 2017 to examine social interaction systematically and these findings will be presented along with the preliminary data from structured observations and focus groups.

Conclusions: An after school STEM club that is designed and implemented by a collaborative team of general education and special education teachers, engineering students and science museum personnel shows promise in generating a higher frequency of social initiations and duration of social interactions for students with ASD. By starting from a place of strength and interest rather than remediation, students can be motivated to internalize and integrate practices that are difficult for them—namely, those that support development of social and functional skills.

203 **146.203** Impact of Vigorous Exercise on Behavior Problems and Academic Engagement Among Adolescents with Autism Spectrum Disorder

A. C. Woodman[1], *M. Evans*[2], *R. Golden*[3], *J. Maina*[4] *and Y. Mori*[1,4], *(1)University of Massachusetts Amherst, Amherst, MA, (2)EdTogether, Inc., Boston, MA, (3)Boston Children's Hospital, Boston, MA, (4)Boston Higashi School, Randolph, MA*

Background: Children with autism spectrum disorder (ASD) experience less active lifestyles than their peers without ASD, which may place them at risk for poor mental and physical health outcomes. Regular, vigorous exercise may reduce these health risks and improve behavior and academic engagement for students with ASD. Few studies have examined the impact of exercise on well-being for adolescents with moderate to severe autism. Moreover, much of the past research has relied on subjective measurements of activity, such as heart rate and flushed faces, and small samples.
Objectives: The goal of the present study is to extend our understanding of the impact of vigorous exercise on behavioral and academic outcomes for adolescents with moderate to severe ASD, using objective measures of activity (Metabolic Equivalent Tasks or METs). We hypothesized that more vigorous (6-9 METs), but not strenuous (9+ METs), activity would predict fewer problematic behaviors and greater academic engagement during the school day.

Methods: The sample consisted of 21 junior high students (2 female) with ASD, recruited from four classrooms in a school for children with ASD in the Northeast. Mean age was 15.67 years (*SD* = 0.73). A research assistant reliable on the Autism Diagnostic Observation Schedule conducted ADOS-2 assessments and teachers completed the Child Behavior Checklist (CBCL/6-18) at baseline. Two of the classrooms were randomly assigned to jog outside for 20 minutes at the start of each school day for weeks 1 and 2, while the remaining two classrooms walked, stretched, and engaged in less vigorous activity at the same time (also outside). The conditions were counterbalanced in weeks 3 and 4. Immediately following the exercise period, students were videotaped during a standardized Basic Study lesson for 20 minutes. Students wore an Omron 750C accelerometer on their waist band during the school day that tracked METs at 10 second intervals. Teachers completed student behavior logs (e.g., tantrums, noncompliance, aggression) and a modified version of the Problem Behavior subscale of the Scales of Independent Behavior-Revised (SIB-R) on a randomly selected "target day" each week. Research assistants blind to student condition coded on and off task behaviors during Basic Study using the Behavioral Observation of Students in Schools (BOSS) on each student's "target day".

Results: The number of minutes of vigorous activity was significantly higher for students in the jogging condition, $t(20) = -8.09$, $p < .001$. Hierarchical linear modeling was used to examine the impact of vigorous exercise on outcomes. Analyses controlled for week number (Level-1), autism symptoms and externalizing behavior problems measured at baseline (Level-2). Greater vigorous exercise predicted significantly fewer behavior problems (Table 1). Students spent a significantly higher percentage of their time on task during the Basic Study lesson on days with greater vigorous activity.

Conclusions: Findings from the present study suggest that school-based exercise programs for adolescents with ASD may improve student outcomes by minimizing disruptive behaviors in the classroom and improving academic engagement. This is the first study to our knowledge to examine the effects of vigorous exercise in adolescents with ASD.

204 **146.204** The Effect of Music on Exercise Intensity Among Children with Autism Spectrum Disorder

A. C. Woodman[1]*, E. Breviglia*[2]*, Y. Mori*[3]*, R. Golden*[4]*, J. Maina*[3] *and H. Wisniewski*[2]*, (1)University of Massachusetts Amherst, Amherst, MA, (2)Psychological and Brain Sciences, University of Massachusetts Amherst, Amherst, MA, (3)Boston Higashi School, Randolph, MA, (4)Boston Children's Hospital, Boston, MA*

Background: Children with autism spectrum disorder (ASD) are at risk for obesity and other health problems as a result of insufficient exercise. Past research suggests that vigorous exercise can yield immediate improvements in challenging behavior, sleep, and academic engagement as well as physical and mental health over the life course for people with ASD. To date, little research has identified strategies to motivate children-particularly young children-with ASD to engage in levels of physical activity analogous to their peers.

Objectives: The present study aimed to extend this limited body of literature on motivation and exercise by examining the effect of music on exercise intensity in elementary school children with ASD. It was expected that exercise intensity would be greatest when fast music was playing, followed by slow music then no music. Potential moderating factors (e.g., student gender, age, body mass index, adaptive skills, behavior problems, autism symptom severity) were explored.

Methods: The sample consisted of 13 elementary school children (2 female) with ASD, recruited from a school for children with ASD in the Northeast of the United States. The mean age was 9.31 years (*SD* = 2.25), with a range from 5 to 13 years. Teachers completed a baseline booklet of questionnaires about participating children, including measures of adaptive skills (Waisman Activities of Daily Living Scale, Maenner et al., 2013), behavior problems (Problem Subscale of the Scales of Independent Behavior Revised, Bruininks et al., 2016), and autism symptom severity (Autism Spectrum Quotient-Children's Version, Auyeung et al., 2007). Child age, gender and body mass index were obtained from the nurse's office with parents' permission. Data on exercise intensity were collected on six days within a 16-day period. Each morning, students jogged alongside their teachers for 20 minutes (structured exercise period). Later in the morning, students were encouraged to jog again for 20 minutes around a circle of cones in the gymnasium, with minimal prompting from teachers (unstructured exercise period). On each of the six days of data collection, students listened to either fast music, slow music, or no music across both jogging periods (two days for each condition). Accelerometers were placed on students' waistbands to measure exercise intensity every 10 seconds as Metabolic Equivalent Tasks (METs). Vigorous exercise was operationalized as the percentage of 10-second intervals within the exercise period that exceeded 6 METs, in line with current definitions from the World Health Organization.

Results: A one-way repeated measures ANOVA with post-hoc tests was conducted with music condition as the independent variable and vigorous activity as the dependent variable. Music condition had a significant effect on vigorous activity in the unstructured, but not structured, exercise period. Vigorous exercise was significantly higher during the slow music condition, compared to the no music condition. This effect was significantly moderated by adaptive behavior, such that only children with low or average levels of adaptive skills showed heightened vigorous exercise in response to slow music.

Conclusions: Music may be a helpful tool for school-based exercise programs to motivate youth with ASD to engage in vigorous exercise.

205 **146.205** Impacting Real World Social Outcomes: An Examination of Changes in Social Engagement and Friendships Associated with START Program Participation

S. J. Cohen[1]*, T. W. Vernon*[1]*, J. A. Ko*[1]*, A. Miller*[2]*, A. Barrett*[1] *and E. McGarry*[1]*, (1)University of California Santa Barbara, Santa Barbara, CA, (2)University of California, Santa Barbara, Santa Barbara, CA*

Background: Adolescents diagnosed with Autism Spectrum Disorder (ASD) frequently have difficulty making and sustaining friendships, which can lead to adverse consequences later in life (Mazurek, 2014). Group-based social skills interventions, have been shown to be effective in helping teens with ASD improve their performance on a variety of social skills (e.g. Laugeson et al., 2012; Vernon et. al., 2016). The ultimate aim of improving social competencies is to create a pathway towards meaningful change in the social lives of the participants; however, the extent to which program participation impacts real-life social success, such as making friends and engaging in social outings and activities on a regular basis, remains largely unknown.

Objectives: The purpose of the present study was to use self- and parent-report data collected in a randomized control trial of the Social Tools And Rules for Teens (START) intervention to provide insight into the impact of the program on real-life social outcomes. Specifically, the investigators sought to determine if participants and their parents independently endorsed increases in, (1) telephone contact with others, (2) extended and received invitations for get-togethers, (3) structured and unstructured social activities, and (4) number of friendships.

Methods: A randomized control trial (RCT) was conducted with 35 participants. Data were obtained from 16 participants in the treatment condition and 19 in the waitlist condition. Participants in the treatment condition (and later the waitlist group) engaged in a 20-week social skills group with a structured curriculum, covering a variety of key social skills including introductions and initiations, conversation skills, and higher order social skills such as sportsmanship, humor, and social media use. In addition to standardized measures and observational conversation skill data (reported elsewhere), all participants and their parents were asked to complete pre- and post-intervention surveys regarding frequency of phone communication, invitations for get-togethers, social activities, and reported friendships. Data were analyzed using a mixed group x time MANOVA with follow-up ANOVAs to identify specific survey items with significant differences.

Results: Results revealed a significant Time x Group interaction in the total number of friends reported by the adolescent participants (p = 0.025), as well as a trend in number of participant-reported invitations received (p = 0.067). Analyses also revealed a significant Time x Group interaction in parent reports of total number of friends (p = 0.001), as well as a trend for number of unstructured social activities (p = 0.084).

Conclusions: Results suggest that there were measurable real-world differences that occurred as a result of participation in the START intervention program. Most notably, an increase in the total number of friends reported by both the parents and adolescents suggest that the skills gained in the START program may generalize to other settings and result in meaningful change in the lives of these adolescents. Overall, the results suggest that the START program successfully targets social competence and motivation barriers that impede optimal social success in adolescence.

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146.206 Improvement in Social Functioning Following Participation in TUNE in, a Novel Cognitive-Behavioral Treatment Program – Results from a 2nd Cohort of Adults with ASD

A. A. Pallathra[1], *J. Day-Watkins*[2], *M. E. Calkins*[3], *B. B. Maddox*[3], *J. S. Miller*[4], *J. Parish-Morris*[5], *J. D. Herrington*[4], *S. Kangovi*[3], *R. Tomlinson*[6], *T. A. Creed*[7], *C. M. Kerns*[8], *W. Bilker*[9], *F. Handy*[3,10], *J. Connell*[11], *G. S. Dichter*[12], *D. S. Mandell*[13], *R. T. Schultz*[5] *and E. S. Brodkin*[14], *(1)Department of Psychiatry, Catholic University of America, Washington, DC, (2)Drexel University, Philadelphia, PA, (3)University of Pennsylvania, Philadelphia, PA, (4)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (6)Temple University, Philadelphia, PA, (7)Psychiatry, University of Pennsylvania School of Medicine, Philadelphia, PA, (8)University of British Columbia, Vancouver, BC, Canada, (9)Univ of Pennsylvania, Phila, PA, (10)School of Social Policy and Practice, University of Pennsylvania, Philadelphia, PA, (11)AJ Drexel Autism Institute, Philadelphia, PA, (12)Psychiatry, University of North Carolina, Chapel Hill, NC, (13)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (14)Department of Psychiatry, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA*

Background: Impairments in social functioning—the ability to navigate the social world and form and maintain relationships in community settings—are among the most critical challenges faced by individuals with autism spectrum disorder (ASD). Social functioning difficulties become particularly problematic in adulthood, when expectations for skillful social functioning increase. However, there are few evidence-based social functioning treatment programs for adults with ASD beyond their early twenties (Bishop-Fitzpatrick et al., 2013, Spain and Blainey, 2015). TUNE In (Training to Understand & Navigate Emotions and Interactions) is an integrated, three-part cognitive-behavioral intervention, which targets the multiple behavioral categories underlying social functioning (social motivation, social anxiety, social cognition, social skills) in adults with ASD, and has components to generalize new social understanding and social skills to community settings. In a first group of adults with ASD to complete TUNE In, we reported significant improvements in overall social functioning, as measured by the Social Responsiveness Scale-2 (SRS-2) and the Social Network Index – Number of People in Social Network Subscale (SNI) (Pallathra et al. 2017, IMFAR). We hypothesized that a second cohort of adults with ASD would show the same improvements in SRS-2 and SNI following TUNE In treatment.
Objectives: To assess the effects of TUNE In on social functioning in adults with ASD.

Methods: Adults with ASD and without intellectual disability were recruited for the study. TUNE In consists of 17 weekly sessions divided into three consecutive components addressing (1) social motivation/anxiety, (2) social cognition/social skills, and (3) generalization of skills to community settings (Pallathra et al. 2017, IMFAR). Participants underwent assessments of social functioning before starting (Time 1) and after completing (Time 2) TUNE In. Based on our previous results (Pallathra et al. 2017, IMFAR), we tested the hypothesis that this second cohort would also show an improvement in the SRS-2 (informant-report) and the SNI (Cohen, 1991), a self-report assessment of social network size. A paired analysis was performed to assess changes in outcome measures between Time 1 and Time 2, using the nonparametric Signed Rank Test, because the data were not normally distributed.

Results: Fifteen adults were enrolled into this second treatment group, of which 13 completed TUNE In (Table 1). Results demonstrate evidence of social functioning improvements from Time 1 to Time 2 as reflected by a significant reduction in the SRS-2 score (z=2.76, p<0.01, Cohen's effect size, d=0.44) (Figure 1a) and a significant increase in the SNI score (z=-2.25, p<0.05, d=0.38) (Figure 1b).

Conclusions: Data from this study replicate the findings of improvement in social functioning, as reflected by the SRS-2 and SNI, following participation in TUNE In. These results suggest there are benefits to the integrated service strategy of TUNE In that targets multiple behavioral domains underlying social functioning and provides opportunities for skill generalization. A randomized control trial of TUNE In with a larger sample size and with greater inclusion of women, minorities, and older age groups is warranted in order to address the urgent need for evidence-based treatments targeting social functioning in adults with ASD.

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146.207 Improving Conversational Fluidity in Adults with Autism Spectrum Disorder

D. Tagavi[1], *R. L. Koegel*[2] *and L. Koegel*[3], *(1)University of California, Santa Barbara, Santa Barbara, CA, (2)Stanford Medical School, Stanford, CA, (3)Stanford University School of Medicine, Palo Alto, CA*

Background: Young adults with ASD often demonstrate significant challenges in their social conversation skills, including difficulty with conversational fluidity (reciprocal, to-and-fro conversation) and social pragmatics. Previous research has demonstrated that with appropriate intervention, these individuals can make significant improvements in this area. In particular, video-based interventions may be useful for this population because of frequently observed strengths in visual perception skills and sustained attention with this medium (Sherer et al., 2001; Bellini & Akullian, 2007). Video-feedback, which involves the viewing and evaluating of a client's previously filmed performance, has shown promise as an effective means to improve social initiations and general social communication skills in individuals with ASD (Koegel, Ashbaugh, Navab, & Koegel, 2016; Maione & Mirenda, 2006), but it is unclear if this type of intervention can improve conversational fluidity in high-functioning adults, specifically.

Objectives: This study evaluated the merits of using a tailored video-feedback intervention to improve conversational fluidity and overall social conversational desirability in young adults with ASD.

Methods: Three adults ages 19–26 participated in this study. Each adult had a diagnosis of ASD according to current criteria of the DSM-5. Participants demonstrated difficulties with social communication skills and conversational fluidity, as noted by the referring agency, direct observations, and self-report. A multiple baseline design across participants was used to assess the effects of the video-feedback intervention on level of conversational fluidity and social desirability. During baseline sessions, participants engaged in a 10-minute, video-taped conversation, in which the conversational partner purposely created an unnatural (three second) pause at least once per minute. During intervention sessions, participants were shown video clips of opportunities for conversational fluidity. Each participant was instructed to think of filler words or follow-up or novel questions they could have communicated to fill the gap in the conversation. The participant and clinician role played the exchange to ensure the participant could effectively implement the skills. Video-recorded conversation probes with novel peers were collected every session. Dependent measures included (1) level of conversational fluidity, defined as the percentage of minutes in the conversation with no pauses lasting three seconds or more; and (2) rating of social desirability, as rated by age-matched peers who were blind to study aims and time point.

Results: Preliminary results indicate that all participants increased their conversational fluidity and ratings of social desirability in the context of a multiple baseline design. Participants increased from a mean of 15% of conversationally fluid intervals to 90% of intervals (an increase indicative of a large effect size). Participants also increased their rating of social desirability from an average score of 1.5 (“undesirable”) to 4 (“desirable”). These effects generalized one month after completion of the intervention.

Conclusions: Results of this study demonstrate the promise of video-feedback interventions to improve conversational fluidity and other social communication skills among adults with ASD. The results highlight the utility of implementing these interventions in practice and suggest that future research on improving reciprocal conversation in adults with ASD may be highly lucrative.

208 **146.208** Improving Daily Living Skills in College Students with Autism Spectrum Disorder Using a Peer-Mediated Daily Living Checklist Intervention

E. Engstrom[1]*, R. L. Koegel*[2] *and M. Higgins*[3]*, (1)Koegel Autism Center, UCSB Koegel Autism Center, Santa Barbara, CA, (2)Stanford Medical School, Stanford, CA, (3)UCSB Koegel Autism Center, Santa Barbara, CA*

Background:

Research suggests individuals with Autism Spectrum Disorder (ASD) have difficulties with daily living skills that affect adaptive behavior, which are a major barrier to success in higher education settings and beyond. Few interventions target the improvement of daily living skills within this population, with even fewer targeting college students. Since interventions that integrate motivational and peer-mediated components have improved social communication in college students with ASD, it is possible that incorporating these methods into a daily living checklist, a type of self-management intervention, may lead to greater improvements in daily living skills for this population as well.

Objectives:

The purpose of this study is to assess whether the use of peer-mediated motivational components would increase the number of daily living tasks completed per week. In addition, data will be collected to systematically examine if this intervention will improve overall adaptive behavior, mental health, quality of life, and academics.

Methods:

Participants included three adults between 18 and 26 years diagnosed with ASD according to DSM-5 criteria. Participants were full time students in a four-year university, had average intellectual functioning, and demonstrated difficulties in daily living skills.

A multiple baseline across participants with reversals design was used, in which a baseline condition with a self-management daily living checklist without peer-mediation was compared to a peer-mediated intervention condition where individualized prompts were provided to complete the self-management daily living checklist.

The primary dependent measure was the total number of daily living tasks completed per week. Additionally, secondary data was collected for the following measures pre and post intervention: (1) Vineland Adaptive Behavior Scales- 3rd Edition (2) Beck Depression Inventory-II; (3) Beck Anxiety Inventory; (4) Quality of Life Assessment for Adults with ASD; and (5) quarterly grade reports.

Results:

Preliminary data from two participants suggest that a peer-mediated daily living checklist intervention is effective in increasing frequency of daily living skills in college students with ASD. At baseline, Participant 1 completed an average of 5 tasks per week. After the peer-mediated intervention began, Participant 1 increased the number of completed tasks to an average of 13.5 tasks per week. At baseline, within the context of a reversal design, Participant 2 completed an average of 13.5, 20, and 24 tasks per week, respectively. After the intervention began within the reversal design, Participant 2 increased the number of completed tasks to an average of 33, 30, and 40 tasks per week, respectively. Preliminary data show medium to large effect sizes. Follow up data will be completed one month after the completion of the intervention. Additional analyses will confirm these findings in three participants and across pre-post measures.

Conclusions:

Preliminary results show promise that this peer-mediated intervention may be more effective in improving daily living skills among college students with ASD than without peer-mediation. The results suggest that future research on improving daily living skills for college students with ASD may be highly profitable.

209 **146.209** Improving Emotion Regulation in Teens with Autism through Mindfulness

S. W. White[1]*, C. M. Conner*[2]*, K. B. Beck*[3] *and C. A. Mazefsky*[2]*, (1)Psychology, The University of Alabama, Tuscaloosa, AL, (2)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (3)Rehabilitation Science & Technology, University of Pittsburgh, Pittsburgh, PA*

Background: Research indicates that impaired emotion regulation (ER), or the ability to modulate one's arousal and emotional state, underlies many of the co-occurring psychiatric and behavioral concerns that are frequently seen in ASD (Mazefsky & White, 2014). The majority of psychosocial treatment research in ASD has focused on the remediation of anxiety in children via cognitive-behavioral therapy (CBT). While largely efficacious, response has been variable with effect sizes lower than in non-ASD youth (Kreslins et al., 2015); further, anxiety protocols generally do not address other common problems such as explosive behavior, meltdowns, irritability, anger, and depression that stem from impaired ER. ER impairments may magnify the developmental vulnerability of adolescence for those with ASD who do not have co-occurring intellectual disability. Adolescents with ASD face a critical gap in empirically based treatment options to support the transition to adulthood. To address this significant treatment need, we developed the *Emotion Awareness and Skills Enhancement* (EASE) Program. EASE is a 16-session individual therapy program for verbal adolescents and young adults with ASD designed to improve ER capacity.

Objectives: We sought to develop and evaluate a novel treatment targeting ER impairment in adolescents and adults with ASD. EASE emphasizes awareness of one's own emotional responses as a foundational skill that promotes the ability to manage intense negative emotions, which is taught through mindful awareness. Mindfulness may be ideally suited for improving ER, as it involves cultivating awareness of emotional states and distress tolerance, and an open and accepting attitude through the use of meditative practices and activities (Kabat-Zinn et al. 1985).

Methods: We utilized a participatory action framework for manual development. After development of the first draft of materials, we sought input from individuals with ASD, therapists experienced in MBIs, ASD, and manualized intervention trials, and parents of children with ASD. Refinements to the treatment were made based on feedback received. In a pilot, two-site open clinical trial, eligible participants (i.e., 12-17 years old, confirmed diagnosis of ASD, IQ > 80) received the treatmentulti-method data were collected at pre, post, and three-month follow-up.

Results: Pilot data support feasibility (20 eligible participants enrolled within less than six months), acceptability to consumers (based on quantitative and qualitative data and high retention rates), and viability of dissemination (high treatment fidelity across 8 therapists and 2 sites). Preliminary analyses suggest that EASE is associated with statistically significant improvements with moderate to large effect sizes. Clinical Global Impressions-Improvement (CGI-I) scores (made by an independent rater) that take functioning across environments and overall symptom impairment into account correspond to a mean of "Much Improved" and 100% of participants demonstrated at least some improvement. Declines in emotional reactivity, irritability, and depression were also observed.

Conclusions: EASE is a new mindfulness-based intervention, developed for adolescents and adults with ASD. The primary treatment target is improved emotion regulation, which should have downstream positive effects on socialization, mental health, and more global and functional outcomes.

210 **146.210** Improving Social Motivation, Competency, and Empathy in Young Adults with ASD: Results from a RCT of the START Adult Program

T. W. Vernon*, J. A. Ko, E. McGarry, A. Chiu, R. Graef, E. Prado, C. Torres, K. Chuor, S. Said, J. Littleton and A. Huerta, University of California Santa Barbara, Santa Barbara, CA*

Background: Individuals with ASD often face tremendous challenges during the transition to adulthood (Barnhill, 2007; Engstrom, Ekstrom, & Emilsson, 2003; Howlin, 2000; Hurlbutt & Chalmers, 2004). Specifically, a sharp increase in social and independent living demands are often paired with an equally jarring reduction is crucial support services. The transition to post-secondary and vocational settings requires a number of interrelated social readiness skills, including adequate social motivation and competency to successfully navigate interactions across novel situations and settings. Fortunately, there is a growing recognition of the need to address the unique socialization difficulties of this burgeoning population (Williams-White et al, 2007). Intervention programs specifically designed to equip young adults with a variety of socialization strategies may hold promise for improving their experienced success during this daunting time of transition and change.

Objectives: To evaluate preliminary outcomes associated with participation in the Social Tools And Rules for Transitions (START) Program for Young Adults in the context of a randomized controlled trial.

Methods: A randomized controlled trial was used to investigate outcomes associated with the START for young adults group intervention model. The participants were young adults (aged 18-25) with an ASD diagnosis who had a verbal IQ over 70 and fluent language use. Participants were randomly assigned to immediate or waitlist control groups for 20 weeks. Those in the immediate treatment group participated in the START program for young adults, a weekly 90-minute peer-facilitated experiential socialization program based loosely on the structure of the adolescent model (Vernon, Miller, Ko, Barrett, McGarry, 2017). Program components included a weekly social outing with a same-aged peer, free socialization periods, an interactive social topic discussion, structured games and activities, and individual check-in and check-out sessions. Weekly topics included crucial conversation skills, relationship maintenance, dating and romantic relationships, social momentum, employment, and shared living space considerations. Measures included the Social Motivation & Competency Scale (SMCS), Empathy Quotient (EQ), Behavior Assessment System for Children Third Edition (BASC-3) – College Self-Report, and Social Responsiveness Scale (SRS). Data is being analyzed with a mixed Group X Time mixed MANOVA with follow-up ANOVAs for individual variables.

Results: Data from 22 participants analyzed thus far are indicative of significant Group X Time differences on both the SMCS and EQ Scores. Additional analyses of the BASC-3 subscales and SRS scores are currently underway.

Conclusions: Preliminary results are indicative of significant improvements in START participants' social motivation, competencies, and empathy. These data indicate that this comprehensive socialization intervention may hold promise for improving the complex, multifaceted social vulnerabilities of young adults with ASD. During a time in which social demands shift dramatically, this program appears to significantly improve social motivation to engage with peers, the competencies to facilitate successful interactions, and empathy to foster deeper personal and professional relationships.

211 **146.211** Internet-Based Psychoeducational Intervention for Youths with ASD

A. Backman[1,2]*, A. Mellblom*[2]*, E. Norman-Claesson*[2]*, G. Keith-Bodros*[2]*, S. Bolte*[3] *and T. Hirvikoski*[2,4]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden, (2)Habilitation & Health, Stockholm County Council, Stockholm, Sweden, (3)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (4)Karolinska Institutet, Stockholm, Sweden*

Background: The recommended support for youths with ASD include interventions to facilitate coping with life challenges and improving social skills, as well as treatment of psychiatric comorbidity, by using e.g. cognitive behavioral therapy. The number of intervention trials with satisfactory quality is low, especially regarding transitioning youths with ASD. Psychoeducation has been recommended as a first-line post diagnostic intervention. Only a couple of previous studies have described psychoeducational interventions for individuals with ASD. However, these studies have shown preliminary promising results in teaching the participants about ASD. Internet-delivered treatment options for youths with ASD have scarcely been developed and evaluated. This may be considered surprising, considering the possible reservations among youths with ASD to participate in traditional interventions from health care organisations, as well as the group´s good capacity and willingness to utilize computer-mediated communication.

Objectives: The objective of the open feasibility study was to evaluate feasibility, treatment credibility and satisfaction, as well as preliminary efficacy of an internet-based psychoeducational intervention named SCOPE (Spectrum COmputerized PsychoEducation), for youths with autism spectrum disorder (ASD without intellectual disability), in an outpatient clinical context of disability services in Sweden.

Methods: The internet-based psychoeducational intervention, consisting of eight ASD themed modules, was developed in cooperation with youths with ASD. The internet-based delivery was chosen to utilize the interactive pedagogical potential of the Swedish national platform for internet-delivered treatment. The intervention includes weekly contact with an experienced clinician via a message-function. The youths (16 – 25 years of age; n=28) completed self-rating scales measuring knowledge about ASD, mental well-being, as well as acceptance of their diagnosis and quality of life.

Results: Treatment feasibility was good in the clinical context: 79% of the participants completed at least 6 out of 8 modules in the program. Treatment credibility was good and increased from pre- to post-treatment. Participants' knowledge about ASD increased significantly from pre- to post-treatment, and the increase in knowledge was not associated with negative effects on psychological well-being. The three-month follow-up showed that the participants had retained their knowledge, and also had improved acceptance of diagnosis.

Conclusions: Internet-delivered psychoeducation is a promising, new treatment method for youths with ASD. An ongoing randomized controlled study will generate further evidence concerning the SCOPE intervention.

212 **146.212** Is Eye Movement Desensitization and Reprocessing Effective in Adults with an Autism Spectrum Disorder and Comorbid Post Traumatic Stress Disorder?

S. Piening[1]*, A. van Dijk*[1]*, N. Mirzaeva*[1]*, P. Huizinga*[1]*, M. Vieira Rocha*[1]*, S. P. Dijkstra*[1] *and I. D. van Balkom*[1,2]*, (1)Autism Team Northern Netherlands, Jonx (Lentis), Groningen, Netherlands, (2)Lentis Psychiatric Institute, Zuidlaren, Netherlands*

Background:

People with an autism spectrum disorder (ASD) are more likely to experience traumatic events and to develop post traumatic stress disorder (PTSD). Eye Movement Desensitization and Reprocessing (EMDR) is an effective treatment option for PTSD, but its effect on adults with ASD and comorbid PTSD is largely unknown.

Objectives:

To study the effectiveness of EMDR in adults with ASD and comorbid PTSD.

Methods:

In this before-after study, adults with ASD and comorbid PTSD (diagnosed according to DSM criteria) filled out Dutch versions of three self-report questionnaires: the Impact of Event Scale (IES-R; assessing trauma symptoms); the Social Responsiveness Scale Adult (SRS-A; assessing ASD symptoms) and the World Health Organization Disability Assessment Scale 2.0 (WHODAS 2.0; assessing social functioning). Treatment was given by experienced and qualified psychologists. Repeated measures ANOVA were performed to assess any significant differences in total scores of the questionnaires. A distinction was made between patients with single versus multiple traumas.

Results:

To date twelve service users have been included in the study (n=3 females; aged 18 to 41; five participants with multiple traumas). Preliminary results show that EMDR reduced PTSD symptoms significantly at group level (F(1,11)=7.76, p=0.02). Half of the participants did not meet the PTSD criteria anymore after EMDR treatment. ASD characteristics and social functioning did not improve significantly at group level (F(1,11)=0.01, p=0.92) and F(1,11)=0.10, p=0.76), respectively). However, a significant improvement in social functioning was observed for the single trauma group (F(1,4)=27.24, p=0.006). When looking at individual results, scores for ASD-characteristics improved in 8 of 12 participants and social functioning improved in 9 of 12 participants.

Conclusions:

EMDR appears to be effective in reducing PTSD symptoms, but not ASD symptoms and social functioning in patients with ASD and comorbid PTSD. Data collection will continue to facilitate a more reliable conclusion regarding the effect of EMDR in patients with ASD and comorbid PTSD.

213 **146.213** Long-Term Social Skills Group Training in Children and Adolescents with Autism Spectrum Disorder Indicates a Dose-Response Relationship: A Randomized Controlled Trial

S. Bolte[1]*, N. Choque Olsson*[2]*, U. Jonsson*[3]*, K. Tammimies*[4]*, S. Berggren*[3] *and C. Coco*[3]*, (1)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (2)Clinical Neuroscience (CNS), Karolinska Institutet, Stockholm, Sweden, (3)Karolinska Institutet, Stockholm, Sweden, (4)Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: Social skills group training (SSGT) is widely used for intellectually able children and adolescents with autism spectrum disorder (ASD). Previous studies indicate small to moderate effects on social communication capacities. Objectives: We hypothesized that an extended training program would result in larger effects. Methods: This randomized controlled trial compared 24 weekly sessions of the SSGT program KONTAKT with standard care alone. The SSGT combined a previously evaluated 12 session version of KONTAKT with 12 additional sessions designed to facilitate generalization of acquired skills to real-world settings. A total of 50 participants with ASD (15 females; 35 males) aged 8-17 years were included. The study was conducted at two child and adolescent psychiatry outpatient units in Sweden. The primary outcome was the

Social Responsiveness Scale -2 (SRS-2) rated by parents and blinded teachers. Secondary outcomes included parent- and teacher-rated adaptive behaviors, trainer-rated global functioning and clinical severity, and self-reported child and caregiver stress. Assessments were made at baseline, post-treatment, and at 3-months follow-up. Results: Parent-rated SRS-2 scores indicated large effects post-treatment (-19.2; 95% CI, -29.9 to -8.5; *p* < .001, effect size [ES] = 0.76), which were maintained at follow-up (-20.7; 95% CI, -31.7 to -9.7; *p* < .0001, ES = 0.82). Conclusions: These estimates indicate substantially larger improvement than previously reported for shorter SSGT. However, the effects on teacher-rated SRS-2 and most secondary outcomes did not reach statistical significance. These preliminary results indicate a dose-response relationship, and imply that service providers can reach better results by optimizing the length of SSGT.

214 **146.214** Managing Anxiety in Autism: A Pilot Trial of Newly Developed Psychoeducation Toolkits

R. Kent[1]*, S. Carruthers*[2]*, L. Bridge*[3]*, A. Ozsivadjian*[4] *and E. Simonoff*[5]*, (1)Institute of Psychiatry, Psychology and Neuroscience, Kings College London, London, United Kingdom of Great Britain and Northern Ireland, (2)King's College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, United Kingdom, (4)St. Thomas Hospital, Evelina London Children's Hospital, london, UNITED KINGDOM, (5)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

Background: Additional psychiatric disorders are common in individuals with ASD especially co-occurring anxiety, with around 40% of individuals meeting diagnostic criteria for an anxiety disorder and 80% experiencing symptoms (White et al., 2009). Although modified cognitive behavioural therapy has been shown to be effective at reducing anxiety in young people with ASD (Sukhodolsky et al., 2013), it is likely that not all people with ASD and milder anxiety require specialist one to one therapy. Furthermore, such specialist interventions may not be universally available. Self-help programmes have the benefits of wide accessibility and availability without a referral. Effectiveness of self- or parent-facilitated programmes based on CBT principles have been demonstrated for anxiety in people without ASD (Lucksted et al., 2012) but have been understudied in ASD populations.

Objectives: To develop and evaluate a set of psychoeducation self- or parent-led toolkits in collaboration with clinical professionals aimed at recognising and managing anxiety in young people with ASD.

Methods: Young people with ASD experiencing clinically significant anxiety, as measured at baseline using the Screen for Anxiety and Related Disorders (SCARED; Birmaher et al., 1999), were recruited from mental health services in South London, UK. Thirty four participants aged 8-18 years old were randomised to receive the psychoeducation intervention either immediately or after a 4 week delay. Parents completed questionnaires at baseline, at Time 1 four weeks later (post-intervention for the immediate start group) and at Time 3 eight weeks later, young people also completed questionnaires where possible. The primary outcome was a study-specific measure of parental knowledge and confidence and secondary outcomes were total anxiety (SCARED) and quality of life scores (KidScreen-10 index; Ravens-Sieberer et al., 2010). All measures were completed at the three time points.

Results: Intention to treat analyses explored effect sizes at Time 2 for primary and secondary outcomes, with the recognition that small sample sizes would likely render results non-significant, which was the case. Cohen’s d effect sizes (ES) revealed small effects of the randomisation group on knowledge and confidence score (0.26; 95% CI: -0.46 – 0.98) and anxiety symptoms (-0.22; 95% CI: -0.94 – 0.50) and a moderate (but non-significant) ES for quality of life (-0.40; 95% CI: -1.12 – 0.33). At the end of the intervention, all but one parent said they would recommend the toolkit to other families with 63% being very likely to recommend. Ninety three percent of parents reported their knowledge improved, 96% that it was useful in helping them understand their child’s anxiety and 61% said there was improvement in their child’s anxiety after 4 weeks.

Conclusions: Statistical analyses were limited due to the small sample size of the pilot trial. From qualitative feedback, it is likely that four weeks was too short to read the toolkits and implement the suggested management strategies. The study-specific knowledge and confidence questionnaire was not tested for sensitivity to change and many parents reported high baseline levels, leaving little room for improvement. Acceptability of the toolkits was positive and supports further development and evaluation of the materials.

215 **146.215** Meta-Analysis of Group Social Skills Interventions Using the SRS in Children with High Functioning Autism Spectrum Disorders

J. Wolstencroft[1]*, W. Mandy*[2] *and D. H. Skuse*[3]*, (1)UCL GOS ICH, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background:

Social skills deficits are an important target for intervention for children with Autism Spectrum Disorders (ASD) because they have a significant impact on academic, adaptive and psychological functioning. Group social skills interventions (GSSIs) are one of the most popular treatments recommended for children with high functioning ASD. Previous meta-analyses of GSSIs have evaluated the efficacy of GSSIs by combining the scores of different social skills assessments, despite evidence that these tools may be measuring different underlying constructs. As a high proportion of GSSIs now use the Social Responsiveness Scale (SRS), this presents an opportunity to examine which domains of social skills are changed by intervention.

Objectives:

Conduct a meta-analysis of multimodal GSSI randomised controlled trial studies using the SRS as parent-report outcome measure.

Methods:

Online electronic searches were conducted on four databases. The search used medical subject heading key terms including ‘social skills’ and ‘group interventions’. Two independent reviewers rated the abstracts against the eligibility criteria (1) age (6-25years), (2) no intellectual disability, (3) multi-modal GSSI, (4) conducted and assessed in English, (5) used Social Responsiveness Scale (SRS). The Cochrane Collaboration tool Risk of Bias (RoB) v2 tool was used to assess bias. Authors were contacted for unpublished total scores and subscale scores for the meta-analysis.

Results:

The initial electronic search returned 593 articles after duplicates were removed. 9 studies that met criteria for eligibility were retained for RoB analysis, after which one study was excluded from the meta-analysis due to poor study methodology. SRS total and subscale scores were available from 7 studies following correspondence with authors.

Participants that received a GSSI obtained better outcomes than the control group on the total standardised score (SMD= -0.85, 95% CI [-1.12,-0.59], Z= 6.35, p=0.000) and all the SRS subscales. The effect sizes on the social communication (SMD= -0.89, 95% CI [-1.2,-0.59], Z= 5.71, p= 0.000) and ritualised and repetitive behaviours subscales (RRB; SMD= -0.9, 95% CI [-1.23,-0.57], Z=5.4, p=0.000) were large. The effect sizes for the social awareness (SMD= -0.57, 95% CI [-0.87,-0.28], Z= 3.78, p= 0.000), social cognition (SMD = -0.53, 95% CI [-0.98,-0.09], Z= 2.34, p= 0.019) and social motivation subscales (SMD= -0.55, 95% CI [-1.02,-0.07], Z= 2.27, p= 0.023) were moderate.

Conclusions:

Large and significant effect sizes in the SRS on social communication as well as the RRB subscales suggests that GSSIs had the largest impact on these domains. Improvements on the RRB subscale were unexpected, as the teaching materials of GSSIs do not explicitly target the reduction of these behaviours. One hypothesis might be that the cognitive and emotional skills taught during GSSIs such as cognitive flexibility, problem solving or controlling emotional impulses are mediating this change. It may be that these skills help to make the participants more confident and less anxious in social situations, which in turn reduces their restrictive and repetitive behaviours.

216 **146.216** Mindfulness-Based Program for Autism Spectrum Disorder: A Qualitative Study of the Experiences of Children and Parents

A. Ridderinkhof[1], *E. I. de Bruin*[1], *R. Blom*[2] *and S. M. Bögels*[1,3], *(1)Research Institute of Child Development and Education, University of Amsterdam, Amsterdam, Netherlands, (2)Child and adolescent psychiatric center Karakter, Zwolle, Netherlands, (3)Academic outpatient child and adolescent treatment center UvA minds, Amsterdam, Netherlands*

Background: Effective psychosocial intervention options for children with autism spectrum disorder (ASD) are sparse. Mindfulness-based programs for children with ASD and for their parents are a potentially promising approach to improve their quality of life. However, research in the field of mindfulness for ASD is in the beginning stages worldwide. Mindfulness is primarily an internal experience. The way people relate to their internal thoughts, feelings, bodily sensations, and action tendencies is the target of mindfulness trainings. Therefore, it seems valuable to include a qualitative approach to investigate the experiences of children and parents.

Objectives: This study explores what children with ASD and their parents perceive as benefits of a mindfulness-based program with parallel sessions for children and parents, and how they explain the processes that lead to these benefits. Thereby, our aim is to contribute to theory development on how mindfulness-based programs might work for this population from a participants' perspective.

Methods: Participants were 11 children with ASD, aged 9 till 17 years old, and 22 parents (mothers and fathers) that took part in the mindfulness-based program MYmind. MYmind consisted of nine weekly parallel sessions for children and parents of 1.5 h. After two months a booster session took place. The program consisted of educating theory, practicing meditations, and discussing experiences. Thereby, participants trained to pay attention to the present moment with a non-judgmental attitude, including awareness of bodily sensations, feelings, and thoughts, and to cultivate an accepting and compassionate stance towards experiences. Interviews were conducted within six weeks after the booster session and lasted between 30 and 60 minutes. Children and parents were interviewed separately. The interviews were transcribed and incorporated into ATLAS.ti. Guidelines of grounded theory are followed to analyze the data.

Results: Main categories that emerged from the preliminary analyses are acknowledging feelings and thoughts, taking a moment for mindfulness in daily situations, increased calmness, and improved relating to the needs of the child. Several processes seem to lead to the benefits of mindfulness. Participants describe that acknowledging feelings or thoughts leads to choosing how to respond rather than responding automatically, which leads to responding more calmly. Also, acknowledging feelings towards themselves leads to acknowledging feelings of and towards others, which leads to more constructive solutions in the interaction between children and parents. Furthermore, taking a moment for mindfulness leads to increased calmness, which helps to respond less emotionally, to improve school work, or to better fall asleep. Children seem to describe the same constructs as their parents, but with less depth in their explanations.

Conclusions: Children with ASD and their parents are able to give insights into the processes of change following from a mindfulness-based program. This study provides a participants' perspective on how mindfulness-based programs might work for children with ASD and their parents.

217 **146.217** Mindfulness-Based Program for Children with Autism Spectrum Disorder and Their Parents: Direct and Long-Term Improvements

A. Ridderinkhof[1], *E. I. de Bruin*[1], *R. Blom*[2] *and S. M. Bögels*[1,3], *(1)Research Institute of Child Development and Education, University of Amsterdam, Amsterdam, Netherlands, (2)Child and adolescent psychiatric center Karakter, Zwolle, Netherlands, (3)Academic outpatient child and adolescent treatment center UvA minds, Amsterdam, Netherlands*

Background: Children with autism spectrum disorder (ASD) experience difficulties in social interaction, restrictive behavior patterns, and neurocognitive deficits. Also, children with ASD are more stressed and suffer more frequently than typically developing children from comorbid anxiety, depression, and attention problems. In addition, their parents experience increased parenting stress, which leads to mental health problems and deteriorated parenting behavior. Previous research shows that mindfulness-based programs could decrease mental health- and attention problems in various populations, and is hypothesized to improve social communication. A previous pilot study showed that a mindfulness-based program was beneficial for adolescents with ASD and their parents.

Objectives: In this study we investigated a mindfulness-based program for children with ASD and their parents. In doing so, we examined whether this intervention is beneficial for children with ASD with a broad age range, whether social communication problems and common comorbid problems are reduced, whether it is beneficial for their parents, and whether effects last up to one year later. Furthermore, on a neuropsychological level we explored whether children's attention is improved.

Methods: Forty-five children referred with ASD, aged 8 till 19 years old, and their parents participated. The mindfulness-based program MYmind consisted of nine weekly sessions of 1.5 h with parallel sessions for children and parents. The program consists of meditation practices, educating theory, and inquiry of participants' experiences. Repeated measures of children's and parents' social communication problems, emotional and behavioral functioning, mindful awareness, and of parenting were conducted pre-intervention, post intervention, 2-month follow-up, and 1-year follow-up. Children also completed the Attention Network Test (ANT) to index their alerting, orienting, and executive attention networks. In addition, children's and parents' experienced changes as reported on open-ended questions were explored qualitatively.

Results: Children's social communication problems decreased over time, and their emotional and behavioral functioning improved. However, children did not report significant changes in mindful awareness. Results were inconsistent across occasions; improvements reported by children were most substantial at 2-month follow-up and only partly remained at 1-year follow-up, while all children's improvements as reported by parents were present on all occasions. Parents reported about themselves improved emotional and behavioral functioning, improved parenting, and increased mindful awareness on all occasions. Parents' social communication problems were only reduced at post intervention. Most improvements were supported by the themes emerging from the qualitative analysis. Preliminary results on the ANT showed an increase for the alerting score, a reduction for the executive score, and no change for the orienting score after MYmind.

Conclusions: This study suggests that children with ASD with a wide variety of ages and their parents can benefit from a mindfulness-based program by improving children's ASD symptoms and common comorbid problems, parents' mental health problems, parenting, and parental mindful awareness. Most improvements seem to last on the long term. However, differences in the attention network are conflicting. Overall, the results imply that a mindfulness-based program may support families in coping with the demanding consequences of ASD.

218 **146.218** On the Feasibility of Rt-fMRI Neurofeedback Training in ASD: A Clinical Trial Study

***S. Mouga**[1,2], B. Leitão[3], A. Sayal[4], I. Bernardino[5], M. Simoes[4,6,7], G. Oliveira[2,8,9,10] and M. Castelo-Branco[11], (1)IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine, University of Coimbra, Coimbra, Portugal, (2)Centro Hospitalar e Universitário de Coimbra - CHUC, Coimbra, Portugal, (3)University of Coimbra, Coimbra, Portugal, (4)Institute of Nuclear Sciences Applied to Health, University of Coimbra, Coimbra, Portugal, (5)Institute for Nuclear Sciences Applied to Health (ICNAS), Coimbra, Portugal, (6)IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine – University of Coimbra, Portugal, Coimbra, Portugal, (7)Center for Informatics and Systems, University of Coimbra, Coimbra, Portugal, (8)Faculty of Medicine, Institute for Biomedical Imaging and Life Sciences (IBILI) and Center for Neuroscience and Cell Biology (CNC), University of Coimbra, Coimbra, Portugal, (9)University Clinic of Pediatrics, Faculty of Medicine, University of Coimbra, Coimbra, Portugal, (10)Centro de Investigação e Formação Clínica – Hospital Pediátrico – Centro Hospitalar e Universitário de Coimbra (HP-CHUC), , Portugal, Portugal, (11)CIBIT & IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine – University of Coimbra, Portugal, Coimbra, Portugal*

Background: The posterior superior temporal sulcus (pSTS) has been previously identified as part of the face processing core network. It also plays a key role on basic aspects of social information processing, with some imaging studies reporting abnormal function and structure in Autism Spectrum Disorder (ASD).
Advances in functional Magnetic Resonance Imaging (fMRI) allow to feedback *quasi* real-time information about the brain function to the participant (rt-fMRI-neurofeedback). In this sense, the participant learns to volitionally self-modulate the activation of a specific brain region. It has been demonstrated that neurofeedback training alters neural activity and preliminary studies suggest that the approach may represent a viable neurorehabilitation tool.

Objectives: We investigated the feasibility of a neurofeedback-based intervention in ASD, targeting a brain region involved in social cognition - the pSTS.

We aim to a) evaluate patients' acceptability and recruitment over multiple sessions, b) assess preliminary efficacy measures derived from neuropsychological evaluation and imaging data.

Methods: 15 participants (mean age 19y11m) with high-functioning ASD (mean full-scale IQ 103) were invited to enroll in a single-arm feasibility clinical trial. The intervention structure consisted of an initial eligibility screening, pre-intervention (first week of study, baseline measures), 5 sessions rt-fMRI-NF intervention process (4 weekly sessions, fifth one month later), post-intervention, and follow-up (at 6 months).

Each neurofeedback session lasted for approximately 1 hour. During this time, the participants were asked to imagine different facial expressions (as a strategy for volitional control of pSTS activity), while looking at a representation of their own brain activity. The primary outcome measure is the FEEST - Hexagon test - and the secondary outcome measures are the Autism Treatment Evaluation Checklist (ATEC) and Vineland Adaptive Behaviour Scale (VABS). Mood and depression state were also assessed. Regarding imaging data, we assessed a general linear model in our region-of-interest (ROI-GLM) throughout the intervention.

Results: 10 out of 15 patients improved in global ability to recognize expressions according to FEEST. The results present a 13% average decrease in total ATEC (Z=-2.076, p=0.038) rated autism symptoms (23% in Sensory/Cognitive Awareness, Z=-2.446, p=0.014; 21% in Health/Physical/Behaviour, Z=-2.176, p=0.030); 6% average improvement in Adapted Behaviour Composite (Z=-2.768, p=0.006) and in all VABS subareas: 6% in Communication (Z=-2.366, p=0.018), 4% in Daily Living Skills (Z=-2.324, p=0.020), 5% in Socialization (Z=-2.491, p=0.013); 9% average decrease in Total Mood Disturbance (Z=-2.103, p=0.035), 44% in Tension (Z=-2.313, p=0.021); 82% in Depression (Z=-2.139, p=0.032), 64% in Anger (Z=-2.286, p=0.022) and 43% average decrease in mood disturbance/depression, Z=-2.421, p=0.015.

The ROI-GLM analysis suggests that pSTS modulation is possible (42.67% of the runs were successful according to two-tailed t-tests, P-val<0.05). We further explored the data, with an individual assessment of the event-related averages curves, and found evidence for heterogeneity (e.g. participants modulated either positively or negatively to distinct regulation conditions).

Conclusions: These findings support the hypothesis that neurofeedback may represent a viable neurorehabilitation tool. Tailored strategy optimization may represent an important aspect in future studies.

Results emphasize the need to proceed to a two-arm randomized clinical trial to validate the reported preliminary efficacy findings.

219 **146.219** Outcome Evaluation of Personalized Multidimensional Interventions on Children with Low-Functioning ASD through an Innovative Machine Learning System: A Proof of Concept Study.

***K. Hall**[1] and E. Grossi[2], (1)Autism Research Unit, Villa Santa Maria, Tavernerio, Italy, (2)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy*

Background:
Evaluating treatments outcome in children with low-functioning autistic disorder requires the utilization of specific but manageable instruments, both for patients and for their environment (parents, educators, doctors). Few studies so far have focused how use multidimensional data for outcome assessment in residential health settings.

Objectives:

The aim of this study is to highlight the possible outcome prediction of personalized plans of intervention for low-functioning ASD subjects using innovative machine learning systems enabling also to understand which treatment factors are significantly involved.

Methods:

In this pilot observational study, twelve consecutive new patients with low-functioning autism (range of age 3-13 years) have been enrolled between November 2015 and October 2016. Four complementary assessment instruments (*Vineland Adaptive Behavior Scales*, a 540-item questionnaire which evaluate personal and social autonomy, communication and motoric competences; *SDQ-Strenghts and Difficulties Questionnaire-*, a 25-item questionnaire useful to screen emotional, behavioral and social problems in children aged 4-16 years; The *HoNOSCA-Health of Nation Outcome Scale for Children and Adolescents-*, a 15-item clinical assessment scale used as part of the routine outcome monitoring in mental health services, which measures global functioning in patients aged 3-18 years through 4 different areas: behavioral, impairment, symptoms, social functioning; *DC-GAS -Disability Child Global Assessment Scale-*, a dimensional scale used by the clinician to evaluate global functioning in disabled children and adolescents) have been used at the patients first access in the neuropsychiatric clinic and after 6 months of intensive personalized treatment. Vineland Scales and SDQ questionnaire have been completed by educators and parents; HoNOSCA and DC-GAS have been completed by the clinician. Increase of at least 4 points in the DC-GAS total score between baseline evaluation and the assessment after 6 months the has been individuated as main outcome measure. Ninety four variables related to demographic, familiar, therapeutic, pharmacological, medical and checkup information represented the input for preprocessing. An evolutionary algorithm (TWIST system-Semeion) has been used to subdivide the dataset into training and testing set and select features yielding the maximal amount of information. After this pre-processing, 21 input variables were selected and different machine learning systems have been used to develop a predictive model based on a training-testing crossover procedure.

Results:

Eight out of twelve subjects have shown an improved global functioning at the end of the follow-up. The best machine learning system (three-layers feed- forward neural network with 8 hidden nodes) obtained a global accuracy of 83.3% (91.7 % sensitivity and 75% specificity) with a ROC of 0.89. The variables selected for the predictive model included previous pharmacological and non-pharmacological treatments, actual treatment plan, and baseline scores of different subscales of Vineland, SDQ, HoNOSCA and DC-GAS.

Conclusions:

Machine learning systems shows a promising potential in predicting the outcome of personalized multidimensional interventions in low-functioning ASD subjects. Accurate data collection, considering multidimensional aspects, and the use of a complex and complete statistical analysis, as the machine learning systems, could be useful in order to highlight predictable positive treatment factors.

220 **146.220** Parent- Assisted Social Skills Training: The UCLA Peers® (Programs for the Education and Enrichment of Relational Skills)-Thai Version for Adolescents with Autistic Spectrum Disorders in Bangkok, Thailand

N. Sittanomai[1,2]*, V. Boonyasidhi*[2]*, S. Chantaratin*[2]*, J. Tarugsa*[2]*, D. Sainampran*[2]*, V. Sathirangkul*[2]*, S. Apinantanakul*[2] *and N. Songrujirat*[2]*, (1)Department of Pediatrics, Faculty of Medicine Siriraj Hospital, Bangkok, Thailand, (2)Department of Pediatrics, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Background:

Social impairment is one of the challenging problems among high- functioning autistic teenagers worldwide and requires social skills interventions. Programs for the Education and Enrichment of Relational Skills (PEERS®) is a manualized, parent- assisted social skills training for high- functioning adolescents with Autistic Spectrum Disorder (ASD) developed by Semel Institute for Neuroscience and Human Behavior, UCLA, which the effectiveness was proved in western countries. In Thailand, there have been no previous studies regarding any parent- assisted social skills interventions before. Given social and cultural difference between Thailand and the country where PEERS® program was developed, cultural adaptation is one of essential elements of success and acceptance of the intervention among Thai autistic teenagers and their families.

Objectives:

To study the feasibility and effectiveness of The UCLA PEERS® (Programs for the Education and Enrichment of Relational Skills)- Thai Version delivered as an outpatient service for high- functioning adolescents with ASD at Division of Child and Adolescent Psychiatry, Department of Pediatrics, Faculty of Medicine Siriraj Hospital, Bangkok, Thailand. Adaptation of the program to Thai social and cultural context was highlighted.

Methods:

In a retrospective study , 12 high- functioning autistic adolescents were referred from their responsible child psychiatrists for the program in 2015. Parents completed the division intake form. Pre-intervention Clinical Global Impression- Severity (CGI-S) was assessed. The PEERS® - Thai Version was 10- weekly parent- assisted social skills training program with one booster session at 4 months, adapted from the original 14- session program regarding Thai culture. The program was led by a Thai certified PEERS® provider. Pre and post intervention Vineland Adaptive Behavior Scales (Survey Form), Children's Depression Inventory (CDI), Thai version, Clinical Global Impression- Improvement (CGI-I) and parents' behavioral report and satisfactory survey were evaluated. The data was analyzed by descriptive statistics, independent t test and chi-square test.

Results:

The participants' mean age was 14.8±1.99 years, 83.8% were male, and average IQ was 94.7±20.21. All participants studied in regular classes, grade 5- 12. 58.3% were moderately ill, 33.3% were mildly ill and 8.3% were borderline ill. Overall, there was no attrition. The attendance rate of each session was ≥ 80%. Individual attendance rate was ≥ 70%. There were 7 in 10 social skills delivered in the program which at least half of parents reported improvement. Eight skills remained being reported the improvement four months after interventions. Eleven children were clinically improved (1 very much improved, 5 much improved and 5 minimally improved). In regard to Vineland Scales, there were significant increase in raw score for communication, domestic, community, daily living skill, play and social domain as well as decrease in maladaptive behavior domain standard score ($p<0.05$). No significant change demonstrated in CDI. Parents' satisfaction survey was 81.92%.

Conclusions: The UCLA PEERS®- Thai Version is a feasible and promising social skills intervention among Thai adolescents with high- functioning ASD.

221 **146.221** Peer Mediated Intervention for Minimally Verbal Children with Autism Spectrum Disorders; Strength of Evidence and

Future Directions

M. O'Donoghue[1]*, N. Kennedy*[1]*, J. Forbes*[2] *and C. A. Murphy*[1]*, (1)Clinical Therapies, University of Limerick, Limerick, Ireland, (2)Graduate Entry Medical School, University of Limerick, Limerick, Ireland*

Background: Peer mediated intervention (PMI) involves engaging peers in intervention to improve social communication and/or educational outcomes for people with autism spectrum disorder. A number of reviews and meta-analyses have established PMI as an evidenced-based practice for young people with autism (Wong et al 2015; Chan et al 2009; Zhang and Wheeler 2011; Chang and Locke 2016). The majority of research published in this area is with participants who use verbal language to communicate. The evidence base for PMI with minimally verbal children with autism spectrum disorder has not been examined. This group are underrepresented in the research base in general, with Tager-Flusberg and Kasari (2013) describing minimally verbal school-aged children with autism as “the neglected end of the spectrum”. Between 25% and 30% of children with ASD can be classified as minimally verbal (Rose et al 2016). As schools become more inclusive more minimally verbal children are attending mainstream schools. Interventions that foster increased personal contact, such as PMI, may have an important part to play in fostering positive attitudes and creating opportunities for social interaction. This review aims to inform future research on PMI with minimally verbal children by investigating the current evidence base and gaps therein.

Objectives: 1) Investigate studies that implement PMI with minimally verbal children with autism. 2) Evaluate the quality of these studies. 3) Identify the outcomes targeted in these studies. 4) Consider the impact on peers involved in the studies. 5) Identify implications for practice and directions for future research.

Methods: The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology was utilised. Systematic searches of the following databases were conducted: Scopus, Web of Science, Embase, ERIC, PsychInfo and PubMed. There were no restrictions on publication date or language. Studies were included in the review if their method included PMI, the participants were children who were diagnosed with autism and were minimally verbal, and it was an original piece of research; not a review, meta-analyses or commentary. Single case and group-design studies were included. Data on study description, participant characteristics, components of intervention and outcomes, and quality of evidence were extracted from included full texts and narrative synthesis was undertaken.

Results: We present the findings in terms of eligible studies and the quality of the presented evidence. Variation in participant characteristics and processes that were used to select peer participants in the included studies are identified. Findings address details on the components of PMI as described in the studies, and the primary and secondary outcomes. We also consider the impact on the peers involved in the interventions where reported.

Conclusions: This study determines whether PMI can be considered an evidence based practice for minimally verbal people with autism. This will inform future research on PMI with this population, an area determined to require further research (Chang and Locke 2016; Watkins et al 2015).

222 **146.222** Pilot Evaluation of an Adaptive Virtual Reality Based Social Intervention for Teens with ASD

J. W. Wade[1]*, E. Bekele*[1]*, D. Bian*[2]*, A. Swanson*[3]*, A. S. Weitlauf*[4]*, Z. Warren*[5] *and N. Sarkar*[1]*, (1)Vanderbilt University, Nashville, TN, (2)Electrical Engineering & Computer Science, Vanderbilt University, Nashville, TN, (3)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, NASHVILLE, TN, (4)Vanderbilt Kennedy Center, Vanderbilt University Medical Center, Nashville, TN, (5)Vanderbilt University Medical Center, Nashville, TN*

Background: Deficiency in social communication is a core characteristic of individuals with Autism Spectrum Disorder (ASD). Interventions designed to address these deficits, especially those based on innovative technology, show evidence of outcome improvement. However, currently available systems do not fully leverage the ability of technology to utilize sensor-based biofeedback in a manner that is adaptive and individually tailored. Atypical patterns of gaze in individuals with ASD are related to processing and cannot be directly addressed through exclusively performance-based systems. Thus, there is a need to develop and evaluate social intervention technologies capable of utilizing such biofeedback in real time to enhance current approaches.

Objectives: We created and pilot tested a novel social intervention technology called Multimodal Adaptive Social Interaction in Virtual Environments (MASI-VR). In this system, conversations between users and avatars are mediated by a virtual facilitator who gives feedback designed to guide users towards ideal conversational exchanges (i.e., those that are reciprocal and on topic). We hypothesized that MASI-VR would lead to improved emotion recognition accuracy and that group differences would emerge with regards to visual attention.

Methods: MASI-VR consists of a 3D virtual high school cafeteria populated by animated avatars, with whom users verbally communicate using a built-in speech recognition module. Two modes of MASI-VR were developed and tested: one in which task progression depends solely on performance in conversational tasks, and another in which task progression depends on both performance and attention directed towards the emotionally expressive elements of avatars' faces. N=18 teenagers (M=15.24 years of age, SD=1.68) with a clinically verified diagnosis of ASD took part in an IRB-approved study to evaluate the novel system. Subjects were randomly assigned to groups using one of the two modes described above (9 in each group). Training consisted of 30 minutes of exposure to MASI-VR at three different time points. Changes in performance were assessed at two time points (pretest and posttest) using a novel system designed to quantify users' abilities to recognize the seven universally accepted emotions described by Ekman (1993) as presented on animated faces (i.e., fear, joy, surprise, anger, sadness, disgust, and contempt).

Results: All but one participant completed the study. Performance on the emotion recognition task increased significantly in both the performance-based ($p < .05$; 12.05% increase) and gaze-sensitive ($p < .05$; 12.95% increase) groups. With regards to gaze measures, blink rate decreased significantly from pretest to posttest ($p < .05$), and durations of fixation on the mouth decreased while durations of fixation on the forehead and entire face increased (all $p < .05$).

Conclusions: We implemented and pilot tested a novel system for social intervention in teens with ASD. Training with this system demonstrated significant improvements in social skills as measured by accuracy in emotion recognition. Additionally, we found significant changes in patterns of visual attention related to processing of the emotional faces. These results show promise for the use of an adaptive technology in training social skills and warrant further investigation into the use of our novel system.

223 **146.223** Professionals’ Perspective on Using a New Strengths and Interests-Based Intervention Model with Autistic Children and Adolescents

C. Jacques[1]*, S. M. Fecteau*[2]*, J. Ruel*[3]*, C. Normand*[4] *and L. Mottron, M.D.*[5]*, (1)University of Quebec in Outaouais, Gatineau, QC, Canada,* *(2)Psychoéducation et psychologie, Université du Québec en Outaouais, St-Jérôme, QC, Canada, (3)Science de l'éducation, Université du Québec en Outaouais, Gatineau, QC, Canada, (4)Psychoéducation et psychologie, Université du Québec en Outaouais, Gatineau, QC, Canada, (5)University of Montreal Center of Excellence for Pervasive Developmental Disorders (CETEDUM), Montreal, QC, Canada*

Background: Interventions in autism mostly target deficits (McConachie et al., 2017). However, a strength–based approach has been recommended by NIH guidelines (Kendall et al., 2013), parents and young autistic adults (McConachie et al., 2017) as well as critical reviews (Mottron 2017). An innovative intervention model using strengths and interests was therefore developed through action-research, and implemented with autistic children and adolescents.

Objectives: To evaluate the feasibility of implementing a Strengths and Interests-Based Intervention Model according to professionals' experience.

Methods: The research was conducted over a period of 10 months. Ten professionals (psychoeducators), whose main caseload was in autism intervention, received a two-day training session on a Strengths and Interest-Based Intervention Model (Jacques et al., unpublished) under the supervision of four of the authors (CJ, JR, SMF and CLN). A section of the training was dedicated to the use of a new questionnaire specifically designed to evaluate strengths and interests of autistic children and adolescents. Consecutively, these professionals implemented the intervention model with 16 autistic youths (8 to 17 years). Four telephone interviews were then conducted with each psychoeducator during implantation of the intervention model. One focus group, facilitated by two of the authors (CJ and JR), brought together all participants. Exchanges were recorded, transcribed and imported to NVivo, for content analyses. The effective use of strengths and interests in each component of the intervention model (needs assessment, interventions with the youth, parental guidance, and evaluation of the outcomes of the interventions) was evaluated using a qualitative analysis of the themes evoked during the interview and the exchanges of the focus group.

Results: Four major themes were extracted from the thematic analysis of the data collected through interviews and focus group: 1- the strengths and interests' questionnaire is more suitable for youth with high-functioning autism; 2- this questionnaire allows professionals to improve their awareness of strengths and interests among autistic youth; 3- a shift of focus on strengths and interests requires time to be mastered; 4- although interests are commonly used as reinforcement, professionals find it difficult to design interventions, or guide parents, focusing on the children's strengths and interests. The interviews also showed that, with time, the psychoeducators seem more at ease in using a Strengths and Interests-Based Intervention Model.

Conclusions: The intervention model allowed the participating psychoeducators to consider strengths and interests in addition to the challenges of autistic youths. However, participants underlined the necessity to have more time and support measures in order to adequately implement this new focus. Further steps will enable us to improve the Strengths and Interests–Based Intervention Model for future applications by providing mentoring to new users, as well as developing tools that foster knowledge sharing between professionals and parents, and that allow professionals to measure their use of strengths and interests in their evaluation of and intervention with autistic children and adolescents.

224 **146.224** Project Evo: Feasibility and Initial Efficacy of an Interactive Digital Treatment to Improve Attention in Autism Spectrum Disorder

***B. E. Yerys** and J. R. Bertollo, Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Children with autism spectrum disorder (ASD) and co-morbid attention deficit/hyperactivity disorder (ADHD) symptoms experience significant impairments in attention and executive function skills. These children also demonstrate lower adaptive functioning skills, more severe maladaptive behaviors, poorer responses to social skills treatment, and less successful transitions to independence as adults. Relative to an ADHD population, frontline medications for ADHD, such as stimulants, have a lower success rate and greater rates of side effects in ASD. Thus, there is a need to develop alternative treatments targeting attention and executive function.

Objectives: To examine the feasibility and initial efficacy of an interactive, multi-tasking training "app" for attention and executive function.

Methods: 42 children between the ages of 9 and 15 years enrolled in the study. If children met screening criteria, they were assigned to either an adaptive multi-tasking training condition in a game-like environment or an alternative non-multi-tasking training in a game-like environment. Children accessed the treatment in twenty ~30-minute sessions over four weeks. Pre-treatment testing occurred on Day 0 and post-treatment testing occurred within 3 days of Day 28. Feasibility variables included acceptability (percentage of prescribed sessions played) and consumer satisfaction obtained from post-treatment surveys. The primary outcome was measured with the Attention Performance Index (API) from the Test of Variable Attention (TOVA), and secondary outcomes included validated measures of executive function and parent ratings across several domains of function.

Results: 19 of 42 children met the screening criteria. Nineteen children failed to meet the TOVA API entry criterion, three did not meet the IQ criteria, and one withdrew. Overall, excluded children were significantly older (12.14 years) than included children (10.75 years; Hedges' g=0.83). Of the 19 children enrolled, 11 completed the multi-tasking treatment and 8 completed the alternative, non-multi-tasking treatment. Acceptability was high and similar across groups (Table 1). Satisfaction surveys revealed that children were impressed with the graphics and rewards in the multi-tasking treatment, but expressed moments of frustration with the training. In both conditions, parents believed the treatment had potential to improve attention and executive function skills.

Given the small samples, only within-group effects were examined. At post-treatment, the multi-tasking treatment group showed a moderate-to-large improvement on the TOVA's API, and large effects in parent ratings, but weaker effects on other measures. The alternative treatment group showed a worsening effect on the TOVA's API, and other effects were approximately half the size of those observed in the multi-tasking treatment group (Figure 1).

Conclusions: The high exclusion rate is consistent with prior Project: EVO studies. This 'personalized' treatment approach ensures that treated children have impairments in the targeted skills. Acceptability measures indicate high engagement with both treatments, and that the alternative treatment is comparable with respect to child engagement and parent belief of treatment potential. The initial efficacy findings from the TOVA for the multi-tasking treatment are in line with effect sizes from prior Project EVO studies. This finding plus the large parent-reported effects for multi-tasking over the alternative treatment condition, suggest Project: EVO may plausibly improve attention in ASD.

225 **146.225** Promoting Self-Advocacy Skills through Leadership Opportunities: A Participatory Peer-Mentorship Program for

Neurodiverse College Students

D. DeNigris[1], E. Hotez[2], A. Riccio[3], A. Cosenza[4], V. Lee[5], W. Long[5], P. J. Brooks[6], M. Hossain[7], J. D'Onofrio[8] and K. Gillespie-Lynch[9], (1)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (2)City University of New York, Hunter College, New York, NY, (3)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (4)College of Staten Island, City University of New York, Staten Island, NY, (5)Psychology, College of Staten Island, CUNY, Staten Island, NY, (6)Psychology, College of Staten Island, Staten Island, NY, (7)Hunter College, CUNY, New York, NY, (8)Center for Student Accessibility, College of Staten Island, CUNY, Staten Island, NY, (9)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY

Background: Although increasing numbers of autistic students are entering college, many face challenges adapting to college, including social difficulties, challenges self-regulating and engaging in self-advocacy, and mental health issues (Schindler et al., 2015). Interventions to help autistic students are often neither evidence-based nor informed by the perspectives of autistic students (Barnhill, 2014). In response to the need for programming that directly aligns with the needs and interests of autistic students (White et al., 2017), we developed a *participatory mentorship program* (Project REACH), in which neurodiverse students play leadership roles in developing, delivering, and evaluating curriculum. *Autistic students* have the opportunity to become *mentors* and *researchers,* whereby they develop leadership skills and shape the program with their unique perspectives.

Objectives: We examined strengths and challenges experienced by autistic and non-autistic students, perspectives of mentors with and without disabilities, and perceived benefits of programming.

Methods: As part of an initiative to help autistic students succeed in college, we developed the Project REACH mentorship program in 2013 (Gillespie-Lynch et al., 2017). Project REACH is open to students with diverse disabilities because a number of autistic students were disinterested in participating in a program solely for autistic people and exposure to diverse peers is likely beneficial. Students participate in weekly hour-long mentor-led group meetings with a structured curriculum and/or hour-long one-on-one meetings. Mentees are encouraged to become mentors and provided with scaffolding to facilitate this transition. Increasingly, autistic students have transitioned into becoming mentors/researchers (and co-authors of this report). Mentees/mentors completed optional semi-structured qualitative interviews at the beginning and end of each semester. Interviews with 26 autistic students (6 mentors), 7 students with other disabilities (4 mentors), and 14 neurotypical students (all mentors) were qualitatively coded after obtaining reliability.

Results: At the end of the term, we asked students which classes/assignments they found easiest and hardest and what non-academic challenges they experienced (Table 1). When asked about goals post-graduation, 46% of autistic students and 33% of non-autistic students indicated employment; 21% of autistic students and 56% of non-autistic students indicated further education. When asked what they gained from mentorship, most indicated social relationships (52% autistic; 47% non-autistic), academic skills (22% autistic; 13% non-autistic), and self-advocacy skills (17% autistic; 20% non-autistic). When asked why they wanted to become a mentor, most mentors indicated that they wished to help others (Table 2). While mentors without disabilities frequently indicated that they had prepared for mentorship by planning, mentors with disabilities often described preparing by maximizing responsiveness to their mentee. Mentors often hoped that their mentee had become empowered through mentorship.

Conclusions: The current study provides a model of a participatory peer-mentorship program for neurodiverse college students. Although research about autistic college students is increasing, autistic students are rarely invited to take on leadership roles in programming. Participatory programming helps align services to the needs of students, provides autistic college students with opportunities to develop communication and teamwork skills, and encourages students with disabilities more generally to become empowered community members.

226 **146.226** Psychiatric Outcomes in an Addressing Disparities Comparative Effectiveness Trial for Elementary Students with ASD or ADHD

C. E. Pugliese[1], L. Anthony[2], B. J. Anthony[2], A. Verbalis[1], A. B. Ratto[1], S. Seese[1], J. Safer[3], A. C. Armour[1], Y. Myrick[1], D. Limon[1], M. F. Skapek[4], M. D. Powers[5] and L. Kenworthy[1], (1)Children's National Health System, Washington, DC, (2)University of Colorado, Denver, Aurora, CO, (3)Georgetown University, Washington, DC, (4)Psychological Sciences, University of Connecticut, Storrs, CT, (5)Children's National Health System, Rockville, MD

Background: Executive functions have been linked to real world behaviors, such as learning, adaptive behavior, and adult outcome. Cognitive flexibility, specifically, has been robustly linked to anxiety and oppositional defiant behavior in typically developing children and children with autism spectrum disorders. Clinical trials are natural vehicles for testing whether executive function mediates psychiatric outcomes, as well as to see whether effects vary based on diagnosis or intervention type offered.

Objectives: This study presents secondary analyses of change in psychiatric symptoms from a larger comparative effectiveness trial of two executive function interventions that targeted cognitive flexibility in a sample of youth diagnosed with ASD and ADHD who also had primary impairments in inflexibility.

Methods: The trial compared Unstuck and On Target (UOT) to Contingency Behavior Management (CBM) in 21 Title I (low-income) elementary schools in 3 school districts for students with ASD (n=43) or ADHD (n=79). All participants had an FSIQ above 70 (range: 70-138) on the WASI-2, and diagnoses were verified using gold standard diagnostic measures (the Autism Diagnostic Observation Schedule for ASD and the MINI-Kid for ADHD). Both interventions targeted executive functioning skills in the classroom. Participants were divided into four groups based on diagnosis (ASD vs. ADHD) and intervention received (CBM vs. UOT). Paired sample *t*-tests were used to measure change from baseline to endpoint via parent report on the CBCL within each group (Anxiety Problems, Oppositional Defiant, Rule Breaking, Attention Problems, ADHD Problems). Within diagnostic groups, there were no significant differences in age, gender, full-scale IQ, race, income, or percentage of parents attending at least one training across diagnostic groups (see Table 1).

Results: CBM treatment reduced Attention Problems in students with ASD (t=2.91, p=.008) and Attention Problems (*t*=2.06, *p*=.047), Anxiety Problems (*t*=2.43, *p*=.020), and Oppositional Defiant Problems (*t*=-2.08, *p*=.045) in students with ADHD. UOT reduced Rule Breaking (*t*=2.53, *p*=.021) behavior in ASD and Attention (*t*=2.81, *p*=.007) and ADHD Problems (*t*=3.29, *p*=.002) in students with ADHD.

Conclusions: Overall, both treatments were effective in reducing psychiatric symptoms, though the pattern of improvement differed in regards to diagnosis and intervention type. CBM is an evidenced based practice well-known for improving attention in ADHD, and this was replicated in the ASD group in this study. Benefits also extended past improving attention to decreasing anxiety and oppositional behaviors in the ADHD group. UOT, which has been shown to be effective in improving EF in youth with ASD, had a broader impact on externalizing rule breaking in ASD. In the

ADHD group, UOT improved attention-related problems.

227 **146.227** Qualitative Evaluation of a Low Intensity Psychological Intervention for Depression in Adults with Autism: The Autism Depression Trial (ADEPT)

*J. Horwood[1], **K. Cooper**[2], H. Harvey[3], L. Evans[2] and A. Russell[4], (1)University of Bristol, Bristol, United Kingdom, (2)University of Bath, Bath, United Kingdom, (3)Newcastle University, Newcastle, United Kingdom, (4)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom*

Background:
High rates of co-occurring depression are reported in Autism Spectrum Disorder (ASD). Cognitive behavioural interventions adapted for ASD have been effective for anxiety problems. There have been evaluation studies of group CBT for co-occurring depression, but no randomised trials investigating low intensity psychological interventions as recommended in clinical guidelines for mild-moderate depression.

Objectives:

This study was a nested qualitative evaluation of the acceptability and feasibility of the ADEPT pilot randomised controlled trial. Participants (with a prior diagnosis of ASD and current depression as measured by PHQ-9 score ≥ 10) were randomised to Guided Self-Help (GSH): a low intensity psychological intervention based on Behavioural Activation adapted for ASD, or Treatment as Usual (TAU).

Methods:

Interviews in two locations in the United Kingdom were conducted with 18 trial participants and 4 therapists. Purposive sampling was used to select participants in order to capture maximum variation in views and experiences. Data were digitally recorded, transcribed verbatim and analysed thematically supported by qualitative data analysis software NVivo10.

Results:

Trial participants and therapists considered the intervention and trial to be acceptable and feasible. All participants welcomed an ASD focused intervention for depression due to the current lack of provision in mainstream services. For therapists the training and supervision was well received and all felt confident delivering GSH. Therapists felt GSH was appropriate to meet the needs of the majority of trial participants. Trial participants who received GSH appreciated the therapists having a good understanding of ASD and were positive towards the aim and structure of the GSH intervention. Suggested improvements that may have enhanced trial participants' engagement in the GSH therapy included session alterations, more regularly checking progress with therapy goals, and increasing the personalisation and presentation of materials.

Conclusions:

The findings support the proposal to carry out a larger scale randomised controlled trial, and also provide evidence to refine the trial design to increase feasibility and acceptability to both trial participants and therapists.

228 **146.228** Randomized Control Trial of Compass for Improving Transition Outcomes of Students with Autism Spectrum Disorder

***L. A. Ruble**[1], J. H. McGrew[2], C. Snell-Rood[3] and M. Toland[1], (1)University of Kentucky, Lexington, KY, (2)Psychology, Indiana University - Purdue University Indianapolis, Indianapolis, IN, (3)Berkeley, Berkeley, CA*

Background:
Despite federal law that requires public schools to provide a coordinated set of results-oriented activities that lead to successful post-secondary outcomes, research indicates that current processes to ensure a seamless movement from school to post-school activities are insufficient. The postsecondary outcomes of individuals with ASD are significantly worse than peers with other disabilities, including intellectual disability. One problem is the lack of empirically-supported transition planning interventions to guide services and help produce better outcomes.

Objectives:

To determine if COMPASS for transition planning and implementation improves IEP goal attainment outcomes for students with ASD.

To assess consultant fidelity in delivering the modified version of COMPASS and teacher adherence in providing evidence-based instruction in COMPASS.

Methods:

Public school special education teachers and a randomly selected student with ASD (research verified) from their caseloads were recruited. Students' mean age was 18.2 years (*SD* = 1.1). Ninety percent of the students were male, 70% White, 15% Black, 5% Asian, and 10% multi-racial.

A total of 150 teacher-child pairs were assessed for eligibility (Figure 1); 20 teachers and 20 students and their parents participated. Following a baseline assessment, teacher-child dyads were randomized into groups, 11 in the experimental condition and 9 in the placebo condition.

Four measures (cognition, adaptive behavior, social/emotional functioning; autism severity) were administered at Time 1 to verify group equivalency (Table 1).

Three reliable adherence measures were utilized: (a) consultant fidelity to the initial COMPASS consultation and (b) to the teacher coaching sessions; and (c) teacher adherence to the implementation of the teaching plans.

Idiographic assessment using psychometrically equivalence tested goal attainment scaling (PET-GAS) was used to evaluate IEP progress because each student had different goals, different baseline skill levels associated with the goals, and different teaching plans. Interrater agreement (two-way Random) as measured using the sample ICC for single measures was .94 at baseline and .86 at final evaluation. The final evaluator was unaware of group assignment.

The intervention consisted of a 3-hr parent-teacher consultation and four 1-1.5 hr teacher coaching sessions.

All consultations were conducted at the school. Prior to consultation, students (4 out of 11), parents, and teachers completed a COMPASS assessment questionnaire, which was summarized into a joint form used for discussion of post-secondary goals and about the student's personal and environmental challenges and supports associated with social, communication, and independent/adaptive skills at school and home.

Results:

Results replicated findings with younger students with ASD that IEP outcomes were higher for COMPASS compared to the placebo control group (d = 2.1; Table 2). Also, consultant fidelity to the consultation and coaching protocols was high (92%) and teacher adherence improved over time, replicating the importance of ongoing teacher coaching.

Conclusions:

In their critical review of the key elements of the transition process for students with ASD, Wehman and colleagues (2014) were unable to identify any studies that tested a transition planning intervention using experimental methods. Thus, to our knowledge, this is the first experimental trial of a transition planning and monitoring intervention for students with ASD.

229 **146.229** Recall with Concept Mapping: Effects on Young Children's' Responses to Science Text

E. Jackson, *Florida State University, Tallahassee, FL*

Background: Effective reading instruction is vital for children to become independent readers (Boulineau et al., 2004). The high proportion (about 33%) of children with autism spectrum disorder (ASD) who struggle with reading comprehension exceeds that of their typically developing peers (7-10%), (Lucas & Norbury, 2014). An extensive amount of research has been published in reading instruction; however, less published research is available on reading comprehension instruction, particularly for students with ASD. Although some work has been published documenting the effectiveness of RECALL (Whalon, Delano, & Hanline, 2013; Whalon, Martinez, Shannon, Butcher, & Hanline, 2015; Whalon, Hanline, & Davis, 2016), there have been no studies using RECALL with nonfiction text

Objectives: This poster will describe findings from a reversal design study including two participants with ASD ages five using RECALL visuals with concept maps while using science texts. The importance of this study is highlighted by the fact that students with ASD choose majors in science, technology, engineering and math (STEM) at higher rates than students in the general population (Wei et al., 2013).

Methods: During all phases, the interventionist read a science book aloud while asking 5 scripted fact and inference questions. Following the reading, participants responded to a post-test assessment (i.e., a combination of 5 fact and inference based questions). Intervention differed from baseline with the addition of a prompting hierarchy that incorporated RECALL visuals and a concept map (i.e., main topic and four related topics about the book). The dependent variable was the number of correct responses to the five post-test questions without the use of the RECALL visuals or concept map.

Results: Results indicate both participants benefited from the concept map and the use of RECALL strategies to increase their ability to answer fact and inference based comprehension questions relating to science text.

Conclusions: As students with ASD are being included in general education classes with their peers (Kluth & Darmody-Latham, 2003), content area instruction is essential. This pilot study assessed the effect of a concept map on the comprehension of science text for ASD using RECALL strategies with two five-year-old boys. Only one other study has used both concept mapping (Roberts & Joiner, 2007) and science text with individuals with ASD. Therefore, this study adds to our knowledge that the use of visual supports and a visual map with effective RECALL strategies can increase listening comprehension skills of children with ASD.

230 **146.230** Reduced Levels of Anxiety, Depression, and Stress in Parents of Children with ASD Following Participation in Pivotal Response Treatment

C. C. Kautz[1], *R. L. Gruen*[1], *E. A. DeLucia*[1], *A. Pomales*[1], *L. L. Booth*[1] *and P. E. Ventola*[2], *(1)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Parents of children with autism spectrum disorder (ASD) are more susceptible to psychological stress, depression, and anxiety than parents of typically developing children and parents of children with other disabilities (Dunn, Burbine, Bowers, & Tantleff-Dunn, 2001; Miodrag & Hodapp, 2010; Taylor & Warren, 2012). Past research found 33%-59% of mothers of children with autism report depressive symptoms warranting psychiatric evaluation and nearly 40% express clinically significant levels of parenting stress (Feinberg et al., 2014). The prevalence of mental health challenges facing parents of children with autism highlights the importance of evaluating how treatment interventions for children could impact parental mental health.

Objectives: We investigated levels of anxiety, depression, and stress in parents of children with ASD. Then, we evaluated the changes in parents' symptom severity after their children participated in a 16-week trial of Pivotal Response Treatment (PRT).

Methods: Thirty-seven parents, twenty-two mothers, participated in a study of PRT for children with ASD aged 4-8. PRT is a naturalistic behavioral treatment focused on improving children's social communication skills. Treatment included 7 hours of weekly individual work with the child and parent training over 16 weeks. Both at the beginning and end of the 16-week treatment, parents completed the Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), and Parental Stress Index (PSI). Scores greater than 21 indicate moderate anxiety on the BAI. On the BDI, scores above 13 indicate mild depression, and scores of 14-19 indicate moderate depression. Total scores greater than 109 on the PSI indicate high or critically high stress levels.

Results: At baseline, 2.7% of parents showed moderate-level anxiety as measured by the BAI. On the BDI, 16.7% of parents showed mild depression and 13.9% showed moderate depression. The PSI showed 2.7% of parents had stress in the high range and 8.1% had stress in the critically high range. Mothers showed significantly higher symptoms of depression at baseline than fathers (mothers mean=12.00, fathers mean=4.07, p<.05), but did not differ significantly on any other scale at baseline.

Conclusions: These findings indicate that parental anxiety, depression, and stress were significantly reduced following a 16-week trial of PRT. Additionally, with the exception of depression, mothers' and fathers' symptoms did not differ significantly at baseline. These results are promising in that although parents did not receive direct treatment, their wellbeing was improved following the trial. The parent-training component likely provided parents a sense of empowerment, and their symptoms also may have been reduced as a result of their child's improvements in skills and behaviors.

231 **146.231** Reduction in Restricted and Repetitive Behaviors Following Pivotal Response Treatment

A. Pomales[1], *D. G. Sukhodolsky*[2], *E. A. DeLucia*[1], *C. C. Kautz*[1], *R. L. Gruen*[1], *L. L. Booth*[1] *and P. E. Ventola*[2], *(1)Yale Child Study Center, Yale School of*

Medicine, New Haven, CT, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT

Background: Restricted and Repetitive Behaviors (RRBs), one of the central symptoms of autism spectrum disorder (ASD), consist of diverse factors – such as repetitive sensory motor behaviors and insistence on sameness – that interfere with social interactions. Previous research on interventions for RRBs indicates resistance to pharmacological treatments and behavioral interventions (Harrop et al., 2015). Additionally, pharmacological interventions have notable side effects.
Pivotal Response Treatment (PRT) is a naturalistic behavioral treatment targeting social communication and social motivation. Preliminary work demonstrates PRT effectively reduces RRBs (Ventola et al., 2016).

Objectives: The present study evaluated changes in severity of RRBs in children with ASD following a 16-week trial of PRT.

Methods: The sample consisted of 45 children with ASD, 4-7 years-old. Thirty-five children received 16-weeks of PRT, consisting of 7 hours of weekly individual treatment and parental training. The sample was combined from an open-label trial of PRT and a RCT of PRT. Ten children were in a non-treatment control condition. RRBs measures were collected at baseline and endpoint using Repetitive Behavior Scales-Revised (RBS), Aberrant Behavior Checklist (ABC), and Social Responsiveness Scale (SRS). To evaluate changes in RRBs severity, paired-samples t-tests were conducted to compare baseline and endpoint scores on each measure.

Results: Independent samples t-test indicated no significant differences between the PRT and control group at baseline (RBS total: $t(35)=-1.545$, $p=.131$; ABC stereotypy: $t(27)=.775$, $p=.444$; SRS RRB: $t(39)=-1.584$, $p=.121$). Additionally, there were no significant IQ differences at baseline (Differential Abilities Scale, General Conceptual Abilities: $t(42)=-.186$, $p=.854$.)

Paired-samples t-tests revealed a significant overall reduction in RRBs severity following 16 weeks of PRT (RBS total: pre-PRT M=28.71, SD=19.637; post-PRT M=20.11, SD=12.029, $t(27)=3.808$, $p<.001$). This reduction is consistent across RBS subdomains: stereotyped ($p=.002$), self injurious ($p=.014$), compulsive ($p=.020$), ritualistic ($p=.021$), sameness ($p=.005$), and restricted ($p=.009$). Additionally, there was a significant decrease in SRS RRB-subdomain pre-PRT (M=14.80, SD=6.202) and post-PRT (M=12.57, SD=7.496; $t(34)=2.557$, $p=.015$), as well as in ABC stereotypy scores pre-PRT (M=11.97, SD=10.61) and post-PRT (M=8.58, SD=7.97; $t(30)=2.814$, $p=.009$).

Children in the control group did not exhibit significant reduction in RRBs severity during the 16-week period (RBS total: baseline M=41.22, SD=25.528; endpoint M=30.78, SD=15.189, $t(8)=1.584$, $p=.152$). RBS subdomain scores did not change significantly: stereotyped ($p=.059$), self injurious ($p=.128$), compulsive ($p=.300$), ritualistic ($p=.272$), sameness ($p=.684$), and restricted ($p=.081$). Similarly, there were no significant differences in ABC stereotypy at baseline (M=7.75, SD=5.377) and endpoint scores (M=4.75, SD=4.573; $t(3)=1.009$, $p=.387$), and SRS RRB at baseline (M=19, SD=4.382) and endpoint scores (M=18.17, SD=7.33; $t(5)= .362$, $p=.732$).

Conclusions: While PRT focuses on improving social communication skills, it has a secondary effect on RRBs severity. Results suggest a significant reduction in severity across a variety of RRBs following a 16-week PRT trial. This could possibly result from incorporating parent training and using circumscribed interests to motivate, and consequentially, increase reciprocal interactions. Future studies may examine follow-up data to assess the longevity of the effects of PRT on RRBs, as well as use diverse measures to evaluate RRB severity. Additionally, a larger sample is needed to measure generalization of this effect.

232 **146.232** Sex Differences in Outcomes of a Social Skills Intervention for Children with ASD

B. L. Ncube[1], *J. M. Bebko*[2], *M. Thompson*[3], *N. Bardikoff*[3] *and M. Spoelstra*[3], *(1)Psychology, York University, Toronto, ON, Canada, (2)York University, Toronto, ON, Canada, (3)Autism Ontario, Toronto, ON, Canada*

Background: Research is mixed regarding whether or not girls with autism spectrum disorder (ASD) present differently from boys (Lai et al., 2015). Although some studies show no differences between boys and girls with ASD (e.g., Sutherland et al., 2017), other studies have found differences between the two in age of diagnosis and symptom presentation (Lai et al., 2015). Little and colleagues (2017) found that parents of young girls (2- to 11-years-old) reported fewer concerns regarding their children's social difficulties. Importantly, although Hiller, Young, and Weber (2014) found that girls performed better on a number of metrics of interpersonal interaction (e.g., ability to maintain a reciprocal conversation), their ability to maintain friendships remained impaired. Unfortunately, few studies have explored whether girls with ASD have similar outcomes to boys following participation in a structured social skills intervention targeting ASD. Children's Friendship Training (CFT) is a manualized parent-assisted social skills intervention for children with ASD in grades 2 -5. Autism Ontario has been running CFT at sites across Ontario, Canada for the past three years.

Objectives: The present study examines sex-differences in the outcomes of children with ASD who participated in the CFT program.

Methods: Participants were 42 children with ASD (33.3% female) between the ages of 7 and 12 (M = 9.59, SD = 1.40) who participated in the CFT program in Toronto between April 2016 and June 2017. Parents and children were asked to complete a number of measures before and after participation in the program. Measures evaluated social skills (measured by the SSQ-P and SSQ-PU), social anxiety (measured by the SASC-R), and the number of play dates the child hosted or was invited to in the past month. No differences existed between boys and girls in baseline scores on the above measures.

Results: In the male sample, both parent-report ($t(23) = -5.385$, $p < .001$) and boys' self-report ($t(11) = -5.358$, $p < .001$) indicated a significant increase in social skills from pre- to post-CFT participation. By contrast, neither parents of girls ($p = .074$) nor girls themselves ($p = .219$) reported a significant change in social skills from pre- to post-CFT participation. A similar pattern emerged regarding ratings of social anxiety. While parents of boys reported a significant decrease in their child's social anxiety from pre- to post-CFT participation, $t(21) = 2.989$, $p = .007$, parents of girls did not report a significant change in social anxiety ($p = .871$). Neither parents of boys ($p = 1.000$) nor parents of girls ($p = .075$) reported a significant change in how many play dates their child was invited to. However, while parents of boys reported no change in how many play dates their child hosted ($p = .677$), parents of girls reported a significant increase in how many play dates their child hosted, $t(13) = -3.322$, $p = .006$).

Conclusions: Prior to conducting this research, we found no data detailing specific outcomes of girls with ASD in CFT. Our results point to the need for more research on this topic.

233 **146.233** Social Gains Are Maintained at 4-Month Follow-up Evaluation of Pivotal Response Treatment for Children with Autism

R. L. Gruen[1], *C. C. Kautz*[1], *A. Pomales*[1], *E. A. DeLucia*[1], *L. L. Booth*[1] *and P. E. Ventola*[2], *(1)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Pivotal response treatment (PRT) is a naturalistic behavioral approach to treating autism that targets core deficits in social motivation. PRT is an evidence-based treatment which has been shown to foster improvements in social interaction, language skills, and adaptive behavior in children with autism (e.g., L. K. Koegel, Koegel, Harrower, & Carter, 1999; R. L. Koegel, Koegel, & McNerney, 2001). However, there is limited research examining whether these treatment effects are maintained over time, after treatment is concluded.

Objectives: In a sample of children with autism spectrum disorder (ASD) who had participated in a 16-week PRT treatment program, we examined the maintenance of treatment effects 16 weeks following the completion of treatment.

Methods: Twenty children, nine girls, (mean IQ 97.32; SD 19.42; range 55-128) completed a 16-week trial of PRT with a follow-up visit 16 weeks post-treatment. This study was part of a larger randomized controlled trial of PRT, but only a subset of the children--those in the PRT condition--completed the follow-up assessment measures. The trial included 7 hours per week of individual work with the child and parent training. Primary clinical outcome was assessed at baseline, endpoint, and follow-up using the SRS-2, a parent report measure of social communication.

Results: Children gained social communication skills over the course of the trial (baseline to endpoint) and, importantly, gains were maintained through the 16-week follow-up period. Over the course of PRT, children demonstrated significant improvements on the SRS Total Score and the SRS Social Communication scale (SRS Total Score baseline mean=87.471, post-treatment mean=72.235, p<.01; SRS Social Communication baseline mean=32.294, post-treatment mean=25.647, p<.01). Furthermore, skills at follow-up remained significantly improved from skills at baseline (SRS Total Score baseline mean=87.471, follow-up mean=76.118, p<.05; SRS Social Communication baseline mean=32.294, follow-up mean=27.588, p<.05). Gains made from endpoint to follow-up visit were not significant (p>.05). The remaining subscales of the SRS, including Social Awareness, Social Cognition, Social Motivation, and Autistic Mannerisms followed this pattern, but results were not significant (p>.05).

Conclusions: We aimed to investigate maintenance of social communication skills following a 16-week trial of PRT. Children in the trial made significant gains over the course of the treatment, and these gains were maintained at the follow-up time-point (16 weeks after the conclusion of treatment). These results suggest that PRT can have lasting effects on children's development. It is likely that the parent-training component allowed parents to continue to implement PRT principles after participation in the active phase of treatment concluded. There were some limitations to this study; namely, the SRS is a parent report measure of social skills and the control group did not participate in the follow-up portion of the study, as treatment was not delayed this additional period of time.

234 **146.234** Social Game Interactivity Levels As Active Ingredients in Performance-Based Intervention for Adolescents with Autism Spectrum Disorder (ASD)

C. E. Simson[1], *S. L. Sommer*[1], *L. A. Santore*[1], *E. Kang*[1] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: Adolescents with autism spectrum disorder (ASD) have core social deficits that make peer interactions challenging (Picci & Scherf, 2014). Research suggests that non-didactic interventions using intrinsically engaging structured social activities to promote peer interaction (performance-based interventions) may be effective in improving social skills and peer interactions for adolescents with ASD (Corbett, et al., 2017; Lerner et al., 2011). Structured social activities (social games) have also been shown to promote spontaneous *in vivo* peer interactions (Dolan et al., 2016; LeGoff et al., 2006). Social game structures include various interactive components, such as one-to-one or group formats, verbal and/or non-verbal imitation and communication, and physical activity (Guli et al., 2013). Thus, those containing more components require more interactivity – levels of which are a plausible "active ingredient" in such interventions. However, little research has examined such ingredients in performance-based interventions (Lerner et al., 2012), and none has examined relative levels of interactivity in social games as one that may potentiate spontaneous in vivo peer interaction.

Objectives: This study aimed to assess the differential efficacy of levels of interactivity in three social games for eliciting spontaneous peer interactions. We hypothesized social games with higher interactivity levels would elicit more *in vivo* spontaneous peer interactions.

Methods: 25 adolescents (M_{age}= 14.98, SD_{age}= 1.48, 19 male) with confirmed ASD diagnoses (ADOS-2; Lord et al., 2012) completed a performance-based social skills intervention, Socio-Dramatic Affective-Relational Intervention (SDARI; Lerner et al., 2011). Participants were placed in groups of 5-9 and met for ninety-minute sessions once per week for ten weeks where they engaged in targeted social activities (Lerner & Levine, 2007). Groups were video recorded and multiple blinded raters reliably coded participation in three core SDARI activities (ICC = 0.71; 134 observations): Mirror, Round of Applause, and Walkabout (see *Table 1*). A separate team of blinded raters reliably coded peer interactions (SIOS; Bauminger, 2002; ICC = 0.79; 440 observations) during a thirty-minute free-time immediately after the activities. Hierarchical linear modeling analysis (Level 1: within-person between-session; Level 2: between person) were used to examine session-level relations between activity participation and peer interaction.

Results: Increased participation in Walkabout (i.e., high interactivity) significantly predicted increased observer-rated peer interaction (β = 5.23; *p* = 0.001). However, increased participation in Mirror (i.e., low interactivity) significantly attenuated peer interaction (β = -4.29; *p* = 0.032). Round of Applause (i.e., medium interactivity) had no effect on peer interactions (*p* = 0.29; see *Figure 1*).

Conclusions: These results suggest participation in social games with different levels of interactivity elicit varied amounts of spontaneous in vivo peer interactions. These results suggest a linear, bimodal relation between social game activity level and immediately subsequent peer interactions, such that low levels of interactivity may actually exert an iatrogenic effect. This likewise suggests the possibility of an *interactivity threshold effect,* wherein a certain level of interactivity may be required to elicit spontaneous peer interactions. These findings may help explain the heterogeneity in outcomes of social interventions (Gates et al., 2017), and provide guidance to increase their efficacy.

235 **146.235** Social Networks: Supporting College/University Students with High Functioning ASD

B. Cook *and D. Weiss, Communication Disorders, Southern Connecticut State University, New Haven, CT*

Background: Social networks that college students develop with faculty, staff, peers, friends, and mentors are strongly linked to student success, e.g., satisfaction, persistence, etc. (Kuh, Kinzie, Buckley, Bridges & Hayke, 2012). The development of these social networks may be especially challenging for individuals with autism. A number of studies have explored variables related to developing social networks that may impact college success among individuals with autism (Neville & White, 2011). Increasing awareness of autism and related social communication challenges amongst similar aged peers may support an increase in the development of social networks. Additionally, the inclusion of peer

mentors as models and supports in the development of peer social networks is a promising key approach (Hart, Grigal, & Weir, 2010). A specially-designed program to increase opportunities for peer mentors and peer networks was developed and assessed by the authors.
Objectives: Identify outcomes related to social interaction and development of peer networks for both individuals with autism and typical development related to participation in a specially-designed university program consisting of a university-level course and participation in a small group orientation experience.

Methods: *Participants:*Consenting course participants: 19 individuals who self-identified as having autism and 10 individuals who indicated no diagnoses. *Intervention:*Participation in a university-level, 1 credit course with a focus on social communication and cognition. In addition to the course, participants with autism attended small group orientation and experiential activities that targeted objectives related to the use of social communication to navigate various university entities such as the library, registrar, student involvement center, etc.

Results: Data have been collected over 3 iterations via multiple sources: 1) pre- and post- Likert rated surveys related to comfort with individuals with autism and and willingness to develop peer networks; 2) pre- and post-systematic observation of social interaction behaviors between course participants; and 3) focus interviews 6 months post program with all participants to determine the effect of the program on the knowledge, awareness, and acceptance of autism, as well as the changes in social interactions with the members of the class across time. Data are currently being analyzed; preliminary results include: an increase in peers' awareness and greater levels of comfort with interactions among the participants of the course ($p < .05$); a minimum of a 50% increase in observed social interaction behaviors among group members from the first to the final course session; and report of maintained peer connections between some students from each group.

Conclusions: These results provide preliminary evidence of the benefit of developing an inclusive university level course that addresses the key challenge of social interaction and communication faced by individuals with autism. The course provides a context that allows for the development of peer relationships, both as peer mentor/mentee, and can lead to a peer network for the individuals with autism. The addition of the small orientation group appears to enhance these outcomes. The intended outcome of these results is to encourage university faculty and staff to develop a similar program to support individuals with autism.

236 **146.236** Supervising Individuals with ASD in the Workplace: A Managerial Perspective

***V. Martin**, École de psychoéducation, Université de Montréal, Montreal, QC, Canada*

Background: Individuals with ASD often experience difficulties in finding and maintaining employment. Employment specialists can assist employees with ASD and their manager during the initial integration period.
Objectives: The purpose of our study was to examine the experience of managers who supervise employees with ASD receiving services from an employment specialist during the initial integration period.

Methods: We interviewed five managers who hired individuals with ASD from a specialized employment community program and supervised them during at least three months. During 30- to 60-min individual interviews, managers responded to open-ended questions on hiring, training, adjustment, relationship with colleagues, perception of higher management and support from human resource management professionals. We qualitatively analyzed the data within a post-positivist, pragmatic and realist paradigm (Miles & Huberman, 2003). We recorded interviews for coding line by line and then conducted categorization to identify themes. We also wrote narrative cases for each experience. Themes were tabulated to facilitate comparison. A theoretical framework was used to organize the key themes identified. To verify the trustworthiness of the analysis, we compared our results with the scientific literature and presented them to employment specialists for individuals with ASD.

Results: Time was an important theme in all interviews. Employees with ASD required more time to integrate in a new job than the majority of other employees. Managers also devoted more time to their employee with ASD on a day-to-day basis. Another important theme was how managers had to pay attention to the way they communicated information and instructions to their employee with ASD. This change in the manager's behavior led to improvement in their communication skills towards their other employees. To improve the performance of their employee with ASD, managers selected the context they perceived to be a better fit such as shifts when they were fewer customers or when colleagues that were more flexible were present. Most managers had a personal motivation, outside of their work environment, to hire an employee with ASD, such as knowing a person with ASD or the desire to participate in a project that had a social impact. The employment specialist support was instrumental in understanding the employee with ASD and their behaviour, and in resolving issues. The employment specialists provided support to improve the productivity of the individuals with ASD to achieve a sufficient level of work performance. These results felt gratifying for the managers that perceived themselves as better supervisors.

Conclusions: Employment specialists offer essential services to managers to become successful in supervising individuals with ASD. Theses specialists can explain the needs of this population and offer strategies to communicate, preventing and resolving issues related to the ASD in the workplace. Understanding the experience of managers of employees with ASD helps create better services aimed at supporting adults with ASD in long-term employment. Future research should include managers whose experience was negative (e.g., the employee was fired) in order to further our understanding of the experience of managers supervising employees with ASD.

237 **146.237** Supportive School Services for Youth with ASD and Their Relation to ASD Symptoms, Intellectual Functioning, and Co-Occurring Psychiatric Symptoms

***T. Rosen**[1], C. Spaulding[1], J. A. Gates[1], K. Gadow[1] and M. D. Lerner[2], (1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: It is often presumed that greater ASD symptom severity necessitates more intensive supportive school-based services (SSS; e.g., Goin-Kochel et al., 2007). However, ASD symptoms vary in presentation of severity by context, highlighting the need for multiple perspectives to understand complexity of symptom presentation (Lerner et al., 2017). Nonetheless, little research has taken a multi-informant perspective on symptom severity in relation to SSS. In addition, the contribution of intellectual functioning and psychiatric comorbidity to SSS has been relatively understudied (Narendorf et al., 2011; White et al., 2007), though ~32% of youth with ASD have intellectual disability (Christensen et al., 2016), and ~70% have co-occurring psychiatric conditions (Simonoff et al., 2008). Moreover, no study has examined the relation of ASD severity, intellectual functioning, and psychiatric comorbidity in tandem to parse their relative and joint contributions to SSS delivery.

Objectives: Examined the relative contributions of parent, teacher, and clinician ratings of ASD symptom severity and psychiatric comorbidity, and IQ, in relation to SSS for ASD youth.

Methods: 283 youth (233 males) ages 6-18 ($M_{age} = 10.5$) with ASD were assessed with parent and teacher versions of the Child and Adolescent Symptom Inventory-4R (Gadow & Sprafkin, 2005), and clinical evaluation via the ADOS, to index co-occurring psychiatric and ASD symptom severity. FSIQ scores were obtained from case record review. Parents reported on SSS; *Presence* of common SSS refers to receipt of ≥1 of three SSS ASD youth most commonly use (Goin-Kochel, et al., 2007; speech/language, occupational therapy, social skills training). *Total* SSS includes both common SSS *and* any other SSS (e.g., adaptive physical education, counseling, etc.). *Frequency* of services refers to average weekly SSS receipt.

Results: Parent, teacher, and clinician ratings of ASD severity correlated with common ASD and total SSS frequency (see Table 1). Importantly, when controlling for all 3 sources of severity and age, only clinical evaluation related to common SSS presence ($OR = 1.19$, $p < .01$), whereas both clinical evaluation and teacher-report of ASD severity related to common (both $B = .04$, $p < .05$) and total SSS frequency ($B_{Clinical\ Evaluation} = .07$, $p < .001$; $B_{Teacher\text{-}report} = .02$, $p < .05$).

IQ was negatively associated with common and total SSS frequency, whereas parent-reported internalizing symptoms were negatively correlated with common SSS frequency (Table 1). After accounting for IQ and psychiatric comorbidity, clinical evaluation related only to total SSS frequency ($B = .04$, $p < .05$), whereas teacher-report related only to common SSS frequency ($B = .03$, $p < .05$). Moreover, lower IQ predicted higher frequency of common ($B = -.02$, $p < .01$) and total SSS ($B = -.01$, $p < .05$), while parent-reported externalizing symptoms predicted lower likelihood of common SSS presence ($OR = .93$, $p < .01$).

Conclusions: Overall, clinical evaluation and teacher-report of ASD severity showed the strongest and most consistent associations with SSS frequency. Results highlight the importance of indexing ASD severity via multiple sources, and accounting for intellectual functioning and psychiatric comorbidity, when examining correlates of SSS for youth with ASD.

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146.238 The Effect of TUNE-in Treatment on Naturalistic Conversation in Adults with ASD: Speaking Rate Is a Temporal Marker of Rapport

J. Parish-Morris[1], *A. A. Pallathra*[2], *E. F. Ferguson*[3], *L. Bateman*[3], *M. Cola*[1], *S. Uh*[1], *Z. M. Dravis*[1], *A. Zoltowski*[4], *A. Pomykacz*[5], *K. Bassanello*[1], *J. Day-Watkins*[6], *B. B. Maddox*[7], *J. S. Miller*[8], *G. S. Dichter*[9], *J. Connell*[10], *D. S. Mandell*[11] *and R. T. Schultz*[1], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Department of Psychiatry, Catholic University of America, Washington, DC, (3)The Center for Autism Research/CHOP, Philadelphia, PA, (4)Vanderbilt University, Nashville, TN, (5)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (6)Drexel University, Philadelphia, PA, (7)University of Pennsylvania, Philadelphia, PA, (8)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (9)Psychiatry, University of North Carolina, Chapel Hill, NC, (10)AJ Drexel Autism Institute, Philadelphia, PA, (11)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Social communication impairment is a core feature of autism spectrum disorder (ASD; APA, 2013) but contributors to natural conversation problems in adults with ASD remain poorly understood. For example, individuals with ASD are more likely to use unusual words (Volden & Lord, 1991), and engage less in shared conversational topics (Adamson, Bakeman, Deckner, & Nelson, 2012) than typical individuals, potentially leading to unnatural conversational flow. Beyond word-level differences, sometimes the *sound* of speech is off; individuals with ASD may talk too slowly, produce unusual pitch characteristics, or pause differently than typical peers (Parish-Morris et al., 2016a,b). These differences, while subtle, may contribute to the feeling of an odd conversational interaction. In this study, we test whether one subtle temporal feature that has been associated with ASD – slower than average speaking rate – improved after a 17-week cognitive-behavioral intervention.

Objectives: Determine whether Training to Understand and Navigate Emotions and Interactions (TUNE-In) treatment improves speaking rate during natural conversation in adults with ASD.

Methods: Twenty-one adults with ASD (age M=28y, IQ M=104) underwent Training to Understand and Navigate Emotions and Interactions (TUNE-In), which consists of components to improve social motivation, anxiety, social cognition, and social skills (Pallathra et al., 2017). At pre- and post-intervention visits, participants were given the Contextual Assessment of Social Skills (CASS, Ratto et al., 2011). The CASS includes two 3-minute conversations with undergraduate students (confederates) acting interested or bored. Here we report results from the “interested” condition only. Eleven different confederates contributed to the “interested” condition, and participants never spoke to the same confederate twice. Videotaped conversations were scored for overall rapport (e.g., combined effect of positive affect, social affect, involvement, vocal expressiveness, etc), by independent evaluators blinded to intervention status. The primary dependent variable of interest, speaking rate, was calculated by dividing the sum of all speech segments (not including inter-turn or intra-turn pauses) by the total number of words produced by each speaker. Speaking rate indexes how quickly a person says words, and has been found to be low in participants with ASD relative to typical controls (Parish-Morris et al., 2016a,b).

Results: Two separate linear mixed-effects regression models with participant ID and confederate ID as random effects and intervention stage (pre/post) as fixed effects revealed significant increases in speaking rates from pre- to post-intervention in participants with ASD, but not in confederates (Table). Participants who spoke more quickly post-intervention were rated as having significantly better rapport with confederates by independent evaluators (Spearman $r = .65$, $p = .002$; Figure).

Conclusions: Natural conversation is a significant challenge for individuals with ASD, but the specific contributors to awkward conversations are subtle and may be hard to specify. In this study, we found that one temporal feature of conversation, speaking rate, increased after TUNE-In and was associated with improved conversational rapport in adults with ASD. Speaking rate may thus be a feature that indexes the “goodness” of natural conversations, and may hold promise as a yardstick for evaluating the effectiveness of social skills interventions.

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146.239 The Effects of a Peer Supported Physical Activity Intervention for College Students with Autism Spectrum Disorder

N. Miodrag[1], *T. Todd*[2], *S. Colgate*[3], *E. V. Perez*[4], *M. Salazar*[5] *and B. Endinjok*[5], *(1)Child and Adolescent Development, California State University Northridge, Northridge, CA, (2)Kinesiology, California State University, Northridge, CA, (3)California State University Northridge, Northridge, CA, (4)Psychology, California State University Northridge, Northridge, CA, (5)Kinesiology, California State University Northridge, Northridge, CA*

Background: A growing body of evidence shows that individuals with Autism Spectrum Disorder (ASD) often lead sedentary lives and have a higher prevalence of being overweight and obese than the general population. Engaging in regular physical activity (PA) can improve health and help prevent obesity (US Department of Health and Human Services). Physical activity levels decrease in adolescence and remain low throughout adulthood. To date, there is a lack of PA interventions for young adults with ASD. As the number of adults with ASD increases, it is important to develop evidence-based interventions that improve physical activity and fitness before chronic health issues become a major burden for individuals, families, and public health.

Objectives: The aim of this study was to engage college students with ASD in regular, sustained PA and increase levels of fitness. Specifically, we examined the effects of a 10-week exercise program on cardiovascular fitness, muscular endurance, flexibility, as well as perceived anxiety and motivation to participate.

Methods: IFiT (*I*nto *Fi*tness *T*ogether) is a 10-week, individualized peer supported physical activity program tailored to address the motor and social barriers to PA among college students with ASD. A total of 16 participants with ASD (13 males, 3 females) between the ages of 18 and 28 years ($M = 22.38$) participated in this study. Each student was paired with a college Kinesiology student (i.e., Peer Mentor). Dyads met twice a week for 10 weeks for a minimum of 120 minutes of PA of their choice and 30 minutes to plan activities for the coming week. Anthropometric, fitness, anxiety, and motivation measures were taken at pre- and post-intervention. Fitness measures included the timed 1-mile walk for VO^2 max (the maximum amount of oxygen used during intense physical activity), sit-ups and push-ups for muscular endurance, and flexibility assessed using the sit and reach box. Self-reported anxiety was measured using the Beck Anxiety Inventory and motivation using the MPAM-R.

Results: Fifteen of the sixteen participants had BMI scores in the overweight to obese range. The results for cardiovascular fitness (1-mile walk) showed significant differences in VO^2 from pre ($M = 32.58$) to post-intervention ($M = 36.97$), $p < .05$. There was a significant increase in sit and reach post scores ($M = 10.78$) compared to sit and reach pre scores ($M = 9.66$), $p < .05$. Muscular Endurance was assessed using the push-up test measuring endurance in the upper extremity muscles, while the YMCA half sit-up test measured endurance in the core muscles. A statistically significant increase was found in the push-up post scores ($M = 16.0$) compared to the push-up pre scores ($M = 12.81$), $p < .05$. Significance was not found in core muscular endurance measured by sit-ups. There were no significant changes from pre- to post-intervention for perceived anxiety or motivation to participate.

Conclusions: Regular participation in a 10-week peer supported physical activity program resulted in significant fitness benefits to college students with ASD. These findings indicate that participants with ASD sustained PA to meet national guidelines with peer support.

240 **146.240** The Effects of Social Training Games on Visual Gaze to Social Stimuli

G. A. Alvares[1]*, N. T. Chen*[2,3]*, L. Notebaert*[2]*, J. Granich*[4] *and A. J. Whitehouse*[1]*, (1)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (2)School of Psychological Sciences, University of Western Australia, Perth, Australia, (3)School of Psychology and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (4)Telethon Kids Institute, Telethon Kids Institute, Subiaco, Australia*

Background: There is accumulating interest in the gamification of social-communication skill development for children with autism spectrum disorder (ASD). To date, many games have targeted older individuals with average to high-average cognitive/language abilities, or have limited experimental controls. Our previous research has found that a more inclusive game rewarding attention to faces over objects increased eye-gaze to faces in children after 15 minutes of gameplay. However, it is unknown whether extended gameplay can maintain this effect.

Objectives: This study tested the effects of social training games on visual attention in children with ASD.

Methods: Participants included 65 children (10 females) diagnosed with ASD (mean age=8.59, SD=2.16, range=5-12 years) randomly allocated to play either a training (n=33) or control (n=32) set of games. No exclusion criteria related to cognitive, language, or functional ability were applied. Children were asked to play the games for at least 15 minutes/day for seven days. In each game, children were rewarded for correctly sorting emotions (Emotion Recognition), following a character's eyes (Joint Attention), or selecting faces over objects (Social Attention). Each game embedded these socially-oriented goals into a child-friendly format, with visual rewards and sounds to maintain engagement, and no written or verbal instructions to enable accessibility for children with minimal receptive language. A control version was designed to ensure equivalent exposure to the visual game components, but without active training contingencies programmed. Children completed eye-tracking pre- and post-gameplay, measuring attention to (1) eye regions of faces, (2) directed eye gaze, and (3) faces relative to objects. Qualitative data from children were collected on their game experiences.

Results: On average, children played an equivalent amount of time in either condition ($t(63)=0.46$, $p=.65$), however control games were passed significantly more frequently; suggesting that control games were easier, but time engaging in games were relatively comparable. Compared to before playing the game, children in the training group exhibited no significant changes in visual attention across all eye-tracking tasks after playing the game, relative to the control group (all p values>.05). Daily game usage indicated that 16 (24.6%) children did not engage in one or more of the games for more than one day after returning home; once these children were excluded pair-wise from eye-tracking analyses, there was a borderline significant interaction in gaze following ($F(1, 47)=4.15$, $p=.05$, partial $eta^2=.08$); this indicated that children playing the Joint Attention training game significantly increased the speed at which they could follow gaze directed to an object post-gameplay. No other changes in eye-gaze were observed. Qualitative data indicated that the games were well received, with high acceptability ratings.

Conclusions: Games represent an acceptable format to engage children with ASD in social-communication development. Our results suggest that, while engagement with these games was acceptable, specific transfer to changes in visual gaze was limited. These results may be partially influenced by the heterogenous nature of the sample included and variability in gameplay. However, qualitative data supported overall acceptability and highlighted feasibility of designing games for a range of functional, cognitive, and language ability levels.

241 **146.241** The Positive Effects of Assistance Dogs in Families of Children and Adolescents with ASD

V. Simard[1]*, M. A. Aubry-Guzzi*[1]*, I. Chapleau*[1]*, M. Carrier*[1]*, F. Zerrouki*[1]*, M. M. Blouin*[1] *and N. Champagne*[2]*, (1)Universite de Sherbrooke, Longueuil, QC, Canada, (2)Mira Foundation, Sainte-Madeleine, QC, Canada*

Background: Sleep disorders are highly prevalent among children and adolescents with an autism spectrum disorder (ASD). Two studies (Fecteau et al., 2017; Viau et al., 2010) have reported the effect of assistance dogs on the cortisol awakening response of children with ASD and of their parents. They have explained their findings by an effect of the dog on sleep, although they did not measure this variable.

Objectives: To assess the effect of well-trained assistance dogs on 1) sleep of the child/adolescent with ASD and of their parents, and on 2) autonomy and 3) sensory modulation of the child/adolescent.

Methods: This study follows a pre-test/post-test pre-experimental design. Thirteen families with a child/adolescent with ASD (5 to 16 years old; 9 boys) participated in two home visits, the first within one month of receiving the assistance dog (pre-test) and the second, two months after it's arrival (post-test). The sleep of the child/adolescent was assessed using both actigraphy (wrist-worn accelerometer) and mother-reported sleep diary. The sleep of parents was assessed using self-reported sleep diaries. All sleep measures were taken on five consecutive 24-hour periods. Autonomy was assessed with the corresponding subscale of the ABAS-II (Harrison & Oakland, 2003), and sensory modulation, with the Sensory Profile (Dunn, 1999). All measures were taken at pre-test and post-test. One week after each visit, a research assistant collected at home the actigraph, and the completed sleep diaries and questionnaires.

Results: Most (63.6%) children and adolescents were sleeping with the dog in their room every night, and 45.5% were even bed-sharing every night. Sleep of the child/adolescent and of the father did not significantly improve after the dog's arrival. However, self-reported nighttime sleep duration of the mother improved between pre-test (M=6.36±.80 hours) and post-test (M=7.01±.64 hours; F(1, 12)=5.56, p=.036), representing a large effect size (η^2=.32). A shorter pre-test sleep duration of the mother was associated with a greater increase in this parameter between time points (r(11)=-.79, p=.001). Autonomy of the child/adolescent also significantly improved after the dog's arrival in the family (t(12)=-2.26, p=.045), a greater improvement in autonomy being associated with a greater proportion of nights of room-sharing (r_s(11)=.75, p=.013) or bed-sharing (r_s(11)=.69, p=.029) with the dog. Finally, the introduction of the assistance dog was associated with increased socio-emotional responsiveness (F(1, 12)=6.34, p=.03) and attention (F(1, 12)=7.93, p=.017) on the Sensory Profile, with large effect sizes (η^2=.37 and .42).

Conclusions: Results from this ongoing study provide preliminary evidence that an assistance dog, trained specifically for work with youngsters with ASD, may have several benefits. The dog's arrival was associated with increased sleep duration of mothers, especially for those who were more sleep deprived. It also appears to benefit youngsters in their socio-emotional and everyday functioning. Moreover, a greater proximity of the child/adolescent with the dog (i.e., room-sharing) was associated with increased benefits in terms of gained autonomy, suggesting that the better the child-dog bonding, the better the outcome. The limited sample size may have prevented the finding of other clinically significant benefits of the assistance dog.

242 **146.242** Use of Positive Reframing to Reduce Negative Statements in Adolescents with ASD - 1 Year Follow up

***J. Hai**, Education, UC Santa Barbara, Santa Barbara, CA*

Background:

Individuals with Autism Spectrum Disorder (ASD) often experience impaired social communication skills. With these difficulties, social isolation can occur which may lead to comorbid disorders such as depression and anxiety (Shtayermman, 2006; Ryden & Bejerot, 2008). Current research indicates that children with ASD are also susceptible to comorbid disorders such as depression and anxiety (Strang, J., F., Kenworthy, L., Daniolos, P., Case, L., Wills, M., C., Martin, A., & Wallace, G., L., 2012). Very few studies target these comorbid disorders in this younger population (Simonoff, E., Pickles, A., Charman, T., Chandler, S., Loucas, T., Baird, G., 2008). These increased levels of negative affect and commenting may create difficulties in social conversation and establishing meaningful relationships. Positive reframing is the ability to perceive something previously viewed as negative in a positive light (Lambert, Fincham, & Stillman, 2012). It is empirically validated as a beneficial treatment for a range of psychological conditions, including; Depression (Lambert, 2010), Anxiety disorders (Goldin et al., 2012), Depression/anxiety in parents of children with ASD (Benson, 2010).

Objectives:

To use positive reframing to effectively decrease the use of negative statements while reframing into neutral or positive statements during social conversations for adolescents with ASD. A second objective included if collateral improvements would be gained in affect/interest during social conversation.

Methods:

Participants included 3 adolescents, ages 9, 11, and 14, diagnosed with ASD. Selection criteria included making excessive negative comments to conversational partner during at least 20% of intervals in 10-minute conversational probes. A multiple baseline design was used along with partial interval recording. Behavioral measures included; negative/positive/neutral statements and affect. Self-report measures included: The beck depression inventory for youth, the beck anxiety inventory for youth, and social validity measures. For intervention, a combination treatment package was implemented. This included defining reframing, in-vivo prompting from a clinician and self-management of reframing.

Dependent Measures

Negative statements: utterances made by participant that reflected, sadness, anger, or anxiety (i.e., "I can't wait for school to be over"). For each 30-second interval in social conversation, a plus (+) was recorded if there was a negative statement in the interval, and a minus (-) was recorded if there were no negative statements made. The percentage of intervals with negative statements for the 15-minute conversation probe was then calculated.

Positive statements: utterances made by participant that reflected happiness or excitement in the content of speech, independent of affect. Neutral statements were defined as utterances made by the participant that reflected an absence of negative or positive content of speech, independent of affect. Positive or neutral statements were merged into one variable for comparison to negative statement purposes.

Results: Findings indicate that it is possible for each adolescent with ASD to effectively decrease the use of negative statements while reframing during social conversation with peers (Ex. Participant 1 neg statements 24% with mod depression/severe anxiety decreased to 5% and increased pos from 0% to 14%). One year follow-up data was also collected and found generalization of new skills.

Conclusions: N/A

243 **146.243** Using Multiple Schedules to Decrease Vocal Stereotypy of Students with ASD in Classroom Settings

***B. Cavanaugh**[1], S. Iadarola[1], R. J. Martin[2], C. M. Anderson[2], R. Iovannone[3] and T. Smith[1], (1)University of Rochester Medical Center, Rochester, NY, (2)May Institute, Randolph, MA, (3)University of South Florida, Tampa, FL*

Background: Stereotyped behaviors such as repetitive vocalizations are a defining feature of autism spectrum disorder (ASD) and can disrupt classroom instruction. Behavioral interventions have been shown to reduce stereotypy but are seldom implemented in schools because they are often designed for one-to-one settings and involve specialized teaching techniques. Structured, collaborative coaching models for teachers may help bridge this research-to-practice gap. Students with Autism Accessing General Education (SAAGE) is a modular intervention approach to address core features of ASD in educational settings. Within SAAGE, teachers are presented with guidelines for selecting and individualizing interventions (via individual “modules”), and receive coaching to implement these interventions. One SAAGE module focuses on vocal stereotypy, with intervention options that include a “Now/ Not Now” intervention, which aims to bring stereotypy under stimulus control using multiple schedules of reinforcement (e.g., Rapp et al., 2009).
Objectives: (1) Evaluate the effectiveness of a teacher-implemented multiple schedule intervention package for reducing vocal stereotypy. (2) Evaluate teacher fidelity within naturally occurring, academic instructional periods.

Methods: Two teachers worked collaboratively with their SAAGE coach to create a “Now/Not Now” intervention package for two students with ASD. For student 1, intervention included the following components: (a) visual instructions of the intervention, (b) multiple schedule visual (red/green card), (c) differential token reinforcement of low-rate (DRL) behavior during the “not now” condition, and (d) response interruption during the “not now” condition. For student 2, intervention included: (a) a social story, (b) multiple schedule visual, and (c) response cost with a visual during the “not now” interval. Following intervention development, the coach provided in-vivo skills-training to teachers and collected teacher fidelity data. Teachers observed the frequency of vocal stereotypy during academic instruction and completed the 29-item Usage Rating Profile (URP), rated from 1 (strongly disagree) to 6 (strongly agree), which assessed teacher perception of the SAAGE intervention. We used a quasi-experimental interrupted time series design (with reversal for student 2) to evaluate the intervention.

Results: For student 1, vocal stereotypy decreased to 0 during the “not now” interval and the interval was successfully increased to 5 minutes. For student 2, vocal stereotypy decreased to near-zero rates and the “not now” interval was successfully increased to 30 minutes. Teacher intervention adherence and quality were 85.19 and 100 percent for student 1, respectively, and M(SD)=88.19(10.29) and M(SD)=93.06(12.19) percent for student 2. On the URP, mean ratings for teacher 1 and teacher 2, respectively, were 6.00 and 5.67 for Acceptability, 6.00 and 6.00 for Understanding, and 6.00 and 5.67 for Feasibility.

Conclusions: Both multiple schedule intervention packages brought vocal stereotypy under stimulus control and decreased stereotypy to zero or near-zero rates during the “not now” intervals. Teachers selected the intervention over other intervention options and implemented it with fidelity. They also rated the SAAGE process as acceptable and feasible. Results provide preliminary evidence that teachers can learn to use behavioral interventions for stereotypy and that, with teacher input, the interventions can be practical to implement throughout the classroom routine, making this a potentially effective and feasible intervention option.

244 **146.244** Visual Supports at Home for Children with ASD: Using Parent and Staff Experiences to Develop and Pilot a Brief Intervention

M. Rutherford[1,2]*, J. Baxter*[3]*, L. Johnston*[3] *and Z. Grayson*[2]*, (1)Health Sciences, Queen Margaret University, Edinburgh, United Kingdom, (2)Speech and Language Therapy Department, NHS Lothian, Edinburgh, United Kingdom, (3)Additional Support for Learning Service, City of Edinburgh Council, Edinburgh, United Kingdom*

Background:
Visual Supports are one of the evidence based psychosocial interventions recommended in clinical guidelines for ASD and commonly used in school settings to support individuals with ASD to understand expectations, to reduce anxiety and to participate purposefully in daily life. Their use is reported across intervention paradigms. However, there is very little evidence about how parents and carers of children or adults with ASD are or should be, supported to access and use these at home or in the community. There is also a lack of comprehensive, evidence based guidance or ready-made resources for professionals.

Objectives:
We aim to:

1. explore experiences of parents, carers and staff in relation to access to relevant visual supports
2. explore how practical knowledge of home visual supports is shared with families in ways that enables use
3. develop and evaluate a *Home Visual Support Project* model for practice

Methods:
Following a systematic literature review, questionnaires and focus groups were conducted with parents/ carers of children with ASD (aged 2-12 years) and a multi-professional group of staff working in specialist roles with children with additional support needs and their families (n=22).

The results of the questionnaires (n=101) informed the content of the focus group discussion. This centred around challenges and solutions related to timely access to the right visual supports and reasonable support to start and maintain their use. Focus group data were transcribed and thematic analysis undertaken. Outcomes were used to develop resources and a model for practice, which could be easily delivered within current UK public service provision.

Results:

1. Key themes generated between families and professionals were remarkably similar and were:

- Participation focussed
  - Considering child’s opportunities and motivation
  - Providing supports relevant to the child within their environment
- Knowledge and understanding
  - Information
  - Training for families and staff

- Resources
    - Accessibility of a range of visual supports
    - Means of creating individualised resources
    - Need for a forum to discuss how to adapt to needs as they change over time
- Support to families
    - Individualised support and planning
    - Timely support
    - Structured processes to gather information
    - Developmentally appropriate visual supports, linked to current priorities for the child and family
    - Consistency between home, school and community settings

2. Parent and Staff resources (for 3 stages of development) and a model for practice were developed and these will be available for demonstration at the conference.

3. Pilot evaluation results for 30 parents using qualitative and quantitative parent measures will be reported.

Conclusions:

The mixed methodology provided an effective means of identifying challenges and solutions to the mismatch between provision of visual supports in home, school and community settings. Key themes generated were used to develop resources for practice, which were participation focussed; share knowledge and information; provide access to practical resources and support to families. The methodology and results from this research may be used to inform low-cost service provision in other countries.

245 **146.245** 'Gaming Seriously!': A Systematic Review and Meta-Analysis of the Influence of Serious Game Elements on the Effectiveness of Social-Emotional Computer Based Interventions in Autism

J. Tang[1,2]*, N. T. Chen*[3,4]*, M. Falkmer*[5,6,7]*, S. Bolte*[8,9,10,11] *and S. J. Girdler*[2,4]*, (1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (3)School of Psychological Sciences, University of Western Australia, Perth, Australia, (4)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (5)Curtin University, Bentley, Australia, (6)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (7)School of Education and Communication, CHILD programme, Institute of Disability Research, Jönköping University, Jönköping, Jönköping County, Sweden, (8)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (9)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (10)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia, (11)Child and Adolescent Psychiatry, Center for Psychiatry Research, Stockholm County Council, Sweden*

Background:

The utility of Serious Games as a tool to target social emotional skills of individuals on the autism spectrum is increasingly explored in research. Current application of Serious Game features in computer-based interventions (CBI) in autism are heterogeneous, likely attributed to the limited frameworks outlining the most salient autism specific design features. Further understanding is required to examine the potential application of Serious Game design principles in improving the effectiveness of social emotional CBI for individuals on the autism spectrum.

Objectives:

This review aimed to evaluate the potential impact of Serious Game design in enhancing the effectiveness of social emotional CBI in autism. The objectives were to (1) develop an assessment tool to quantitatively evaluate the design of Serious Games based on an existing framework by Whyte et al. (2014), (2) provide a conceptual systematic review of the design quality of social emotional CBI in autism, (3) and to evaluate the potential moderating influence of Serious Game design principles in improving social emotional outcomes for individuals on the autism spectrum.

Methods:

The Serious Game Assessment Tool was developed through reviewing the five Serious Games principles previously outlined by Whyte et al. (2014). The five principles included motivating storyline, goal-directed learning, rewards and feedback, progression in levels of difficulty and individuation. Operational definitions and a grading system for each Serious Game principles were developed and tested for reliability. Five electronic databases were then searched with the main keywords "autism", "social", "emotion", and "computer" to retrieve relevant experimental studies evaluating social emotional CBI for individuals on the autism spectrum. With the developed Serious Game Assessment tool, a conceptual review and summary of the design features of social emotional CBI was conducted. Dependent measures relating to social emotional outcomes; close generalisation, distant generalisation, transferability to other skills, maintenance and engagement were extracted. Effect sizes were calculated and analysed using random effects model. Meta-regressions were conducted to examine the moderating influence of Serious Game design principles on social emotional outcomes.

Results:

A total of 28 experimental designs evaluating 18 existing CBI were retrieved. The application of Serious Game design was heterogeneous between interventions and few consistently incorporated Serious Game design elements (average percentage of Serious Game design application was 47%). Fifteen experimental design studies with a control group were retrieved for meta-analysis. Results indicated significant effects for CBI improving the social emotional skills for individuals on the autism spectrum (close generalisation: g = 0.69, CI =0.49-0.88, p<.001; distant generalisation: g = 0.48, CI =0.11-0.85, p<.001; transferability: g = 0.36, CI =-0.00-0.72, p=.05). Of central interest, a moderating influence of Serious Game design principles enhancing CBI-related distant generalisation outcomes was found (g = 0.33, p =.03).

Conclusions:

The findings demonstrate the importance of considering Serious Game design principles for the development of CBI in autism. The Serious Game Assessment Tool developed as part of this review may provide helpful guidance for the systematic evaluation of existing CBIs and for the prospective development of social emotional interventions.

Oral Session - 6A
Social Cognition and Social Behavior
149 - Novel quantifications of social behavior and response
1:45 PM - 2:35 PM - Grote Zaal

1:45 **149.001** Heart Rate Orientation Responses to the Shifts in Gaze Direction - a Follow-up Study of Low-Functioning Young Children with ASD

T. M. Helminen[1]*, M. Muuvila*[2]*, J. Lauttia*[3]*, J. M. Leppanen*[1]*, K. Eriksson*[4] *and A. Kylliainen*[1]*, (1)Tampere University, Tampere, Finland, (2)Tampere University Hospital, Tampere, Finland, (3)University of Tampere, Tampere, Finland, (4)Tampere University and Tampere University Hospital, Tampere, Finland*

Background: Reduced use of eye contact is a prominent characteristic of individuals with autism spectrum disorder (ASD). In a recently published study (Helminen et al., 2017) we showed that while young, 2-5-year-old children without ASD showed stronger heart rate deceleration response, indicative of physiological orientation, to gaze shifts to direct vs averted direction, young low-functioning children with ASD did not. The result indicated that direct gaze (or gaze shifts in overall) does not attract the attention of the children with ASD, which could lead to reduced eye contact behavior.
Objectives: The objective was to follow-up the developmental course of the heart rate orientation response to direct vs. averted gaze over the 2-year period in children with and without ASD. Furthermore, the study aimed at investigating whether the heart rate orientation response could be used as a psychophysiological outcome measure for interventions aiming at increasing the children's ability to use the eye contact in social interaction.

Methods: Twenty children with ASD (2.5 – 5.3 years, developmental age 1.2 – 4.2 years), 20 typically developing children and 18 children with developmental delay participated in the original study, and 18 ASD, 17 typically developing and 12 developmentally delayed children in the follow-up after two years. A series of facial pictures creating an illusion of dynamic gaze shifts to direct and averted gaze directions were presented, while the heart rate and eye movements were recorded. After the initial measurement, half of the children in the ASD group received a 4-months intervention based on parental guidance, aiming at increasing the children's motivation to use the eye contact in social interaction. The experiment was repeated after intervention and after a two-year follow-up period with the same participants.

Results: In the first follow-up, the control children responded to both gaze directions with a heart rate deceleration, while the ASD children showed no heart rate deceleration to either gaze condition [ANOVA Gaze x Time after gaze shift x Group, main effect of the Group p=.009). However, according to our preliminary analysis, the children with ASD in the intervention group showed a tendency to respond to gaze shifts with a heart rate deceleration after the intervention (ANOVA Session x Time x Intervention, p=.076). In the two-year follow-up, the ASD group as a whole showed similar orientation responses to shifts in gaze direction as the non-ASD control children (ANOVA Gaze x Time x Group, main effect of time p=.003, no effects of Group).

Conclusions: The preliminary results indicated that the effect of short-term eye contact intervention might be seen in enhanced psychophysiological orientation response to the shifts in gaze direction in young children with ASD. In addition, during the course of development, also the children with ASD who receive treatment as usual, might start to show similar orientation responses to the shifts in gaze direction as non-ASD children with or without developmental delay. The potentiality of the heart rate orientation response as a psychophysiological outcome measure in the intervention studies will be discussed.

1:57 **149.002** Social Attention in ASD Females: The Same, Yet Different

C. Harrop[1]*, D. R. Jones*[2]*, S. Nowell*[3]*, S. Zheng*[4]*, R. T. Schultz*[5] *and J. Parish-Morris*[5]*, (1)University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)University of Texas at Dallas, Richardson, TX, (3)University of North Carolina at Chapel Hill, Carrboro, NC, (4)Psychiatry, University of California, San Francisco, San Francisco, CA, (5)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Differences in attention to social stimuli are a hallmark feature of ASD and have been extensively studied using eye-tracking. Chevallier et al. (2015) found that some stimuli are better at capturing social attentional differences in children with ASD than others, with dynamic videos generating the largest group differences.
Due to a sex imbalance in ASD diagnoses, very few studies have used eye-tracking to examine sex differences in social attention. Emerging literature suggests that girls with ASD socialize differently than boys (Dean et al., 2017) and experience heightened social motivation (Sedgewick et al., 2016), mirroring some of the differences found in typically developing girls and boys. Therefore, a dynamic eye-tracking paradigm may reveal differences in social attention and motivation in girls with ASD.

Objectives: The purpose of this study was to examine whether behavioral and clinical differences in ASD males and females were mirrored in their distribution of attention to social, dynamic stimuli – particularly faces – using a validated eye-tracking paradigm.

Methods: 65 children aged 6 to 10 years were included in the study [37 ASD (16 female); 28 typically developing (TDC; 14 female). Children completed a Visual Exploration eye-tracking paradigm that included 22 silent video clips of 11 sibling pairs of school-aged children playing together (Joint condition) or in parallel (Parallel condition; Chevallier et al., 2015). Our primary dependent variable of interest was the proportion of gaze duration to faces relative to gaze duration toward the full screen, overall and by condition. We also compared the proportion of gaze duration to hands playing with objects, background objects, and the "space between" people and objects, overall and by condition.

Results: Diagnosis (ASD vs. TD) and sex (Male vs. Female) predicted a number of indices of social attention. Children with ASD spent proportionally less time attending to faces overall and across conditions (Joint and Parallel; all ps <0.02, η^2_p .08 to .17). However, sex also differentiated fixation to faces overall and in the joint play condition (ps <.05, η^2_p .06 & .08) with females allocating proportionally more attention to faces than males. Within the ASD group, ASD females spent proportionally more time attending to faces (t= -2.24, p =.03), particularly in the parallel play condition (t=-2.51, p =.01). Diagnostic groups looked equally at background objects and hands with toys, but the ASD group gazed longer at the "space between" AOIs than the TD group (ps<.01, η^2_p .07 to .15; no effect sex or interaction).

Conclusions: Using a validated, ecologically valid, eye-tracking paradigm we found both similarities and differences between ASD males and females. Our data reveal that while ASD females demonstrate enhanced social attention compared to boys with ASD, their overall pattern of attention, particularly to areas of the scene not portraying social or non-social information (“space between”), was comparable to their male counterparts. This disjointed pattern of attention aligns with clinical and behavioral reports of ASD females, with reported heightened social motivation and desire for friendships, yet similar rates of actual friendships and social success to ASD males.

2:09 **149.003** Interpersonal Coordination and Its Role in Social Functioning in ASD

C. J. Zampella[1] *and L. Bennetto*[2]*, (1)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Clinical and Social Sciences in Psychology, University of Rochester, Rochester, NY*

Background: Interpersonal coordination (IC) is the tendency for social partners to nonconsciously align their behaviors. It is a well-established phenomenon from infancy, and has been shown to foster connectedness, enhance processing of social cues, and play an important role in development. A small body of research has begun to suggest atypical IC in autism spectrum disorder (ASD). This study augments that research by evaluating differences in both nonverbal and verbal IC as contributors to social symptoms in ASD.

Objectives: (1) To quantify the degree to which children with and without ASD engage in IC; (2) To identify the extent to which engaging in IC relates to aspects of social functioning impaired in ASD.

Methods: Participants were 20 well-characterized children (ages 9-16) with ASD and 17 matched typically developing controls (TDC). Children participated in conversational tasks with their mothers and an unfamiliar research assistant. IC during these tasks was coded from recordings by blinded raters, using two established coding systems. The first captured temporal coordination among interaction partners’ movements (*movement coordination)*; the second captured IC in terms of the verbal content of interactions (*content coordination;* e.g., mutual focus, conversational equality). Interrater reliability was adequate for all codes (*ICC*s .77-.96). Children’s everyday social functioning was also assessed with standardized measures completed by mothers, in the domains of general social skills, communication skills, empathy, and perspective-taking.

Results: Movement and content coordination were analyzed separately with mixed design ANOVA. There was a significant main effect of group for both movement coordination, $F(1,34)=17.65$, $p<.001$, $\eta_p^2=.34$, and content coordination, $F(1,34)=7.21$, $p=.01$, $\eta_p^2=.18$. In both cases, children with ASD were rated as displaying significantly less IC with their interaction partners than TDC children. Neither within-subjects effects of familiarity level nor interaction terms were significant. Within the ASD group, both movement coordination, $r(17)=-.64$, $p=.003$, and content coordination, $r(17)=-.59$, $p=.01$, were significantly correlated with symptom severity as measured by ADOS-2 calibrated severity scores. Linear regression analyses across all children indicated that movement coordination predicted scores on standardized measures of general social skills, communication skills, empathy, and perspective-taking, even when controlling for content coordination (all $\beta s \geq .39$; $ps<.05$). Content coordination, however, did not predict any social outcome domain when controlling for movement coordination (all $\beta s \leq .15$; $ps>.05$). Finally, movement coordination partially mediated the relationships between diagnostic status and both general social skills and communication skills.

Conclusions: Results demonstrate reduced nonverbal (movement) and verbal (content) IC in children with ASD, suggesting atypicality in their ability to engage in a social process that is automatic and fundamental in normative development. Results also strongly link IC to primary areas of social impairment in ASD. Lower IC was associated with more severe ASD symptoms, suggesting a relationship with core diagnostic deficits. Moreover, movement coordination specifically predicted functioning across several key social domains, raising the possibility that a failure by individuals with ASD to coordinate movements with social partners may help explain social difficulties. Findings thus highlight atypical IC as an important, understudied process in ASD, which may be a mechanism driving social and communication impairments.

2:21 **149.004** Characterizing Temporal-Contextual Effects on Social and Object-Directed Attention in ASD Via High-Density Video Coding

A. Rozga[1]*, A. Southerland*[1]*, M. McCall*[1]*, E. A. Stubbs*[1]*, M. R. Silverman*[2]*, E. Ajodan*[2]*, K. Chanda*[1]*, E. Chong*[1]*, J. Rehg*[1] *and R. M. Jones*[3]*, (1)Georgia Institute of Technology, Atlanta, GA, (2)Sackler Institute for Developmental Psychobiology, New York, NY, (3)Weill Cornell Medicine, New York, NY*

Background: Atypical patterns of gaze in social interactions remain among the earliest behavioral red flags for autism and are commonly targeted in treatment. Observational studies typically examine global frequencies of behaviors such as eye contact and joint attention. Eye-tracking technologies have enabled more detailed characterization of gaze dynamics in laboratory “screen tasks,” but such high-density measurements have rarely been applied to more ecologically valid “live” social interactions.

Objectives: We used high-density video coding to characterize patterns of social and object-directed gaze, along with temporal-contextual factors, during live play interactions in children with autism (ASD) and typically developing (TD) children.

Methods: 56 ASD and 58 TD children were administered the Early Social Communication Scales, videotaped with a camcorder as well as a camera embedded in a pair of glasses worn by the examiner that captured the child’s looks to the examiner’s eyes. A subset of the sessions – the six ESCS toy-spectacle tasks for 21 ASD (mean age 45.1mo, SD=10.6; mean VIQ=74, SD=33; 71% male) and 38 TD (mean age 27.4mo, SD=5.3; 63% male) participants – were coded at the frame level for the onset/offset of each instance of (1) child looking to the examiner’s eyes; (2) child looking at the toy; (3) examiner activating the toy, (4) the toy inactive and out of the child’s reach, and (5) the toy in the examiner’s vs. child’s possession.

Results: Dependent variables were not normally distributed; hence, we report the results of nonparametric tests. Compared to TD children, the ASD children spent less time making eye contact with the examiner when the toy was inactive (p=.001) and in their possession (p=.01), with no group differences during toy active periods (p=.06). The ASD group produced fewer shifts of attention from the toy to the examiner’s eyes across toy active (p=.01), toy inactive ($p<.001$), and child possession (p=.005) periods. Within-group analyses indicated that during periods of examiner toy possession, both groups spent more time making eye contact with the examiner and less time looking at the toy when it was inactive compared to when it was active (all p’s<.0001). They also engaged in more attention shifts when the toy was inactive compared to when it was active (ASD p=.-001; TD p<.0001). Children in both groups spent more time looking at the toy when it was in their possession vs. the examiner’s possession (p’s <.0001), with no effect of possession on amount of eye contact and rate of gaze shifts (p’s>.1).

Conclusions: These results confirm previous findings of decreased eye contact and lower rates of joint attention gaze shifts in children with ASD, but indicate that temporal context matters for the pattern of group differences observed. Importantly, our analyses revealed that children with ASD modulated their gaze across toy active/inactive and child/examiner possession periods similarly to TD children, indicating they were sensitive to the temporal context of the interaction. These results have implications for measurement of social and object attention in research studies aiming to characterize early behavioral markers of ASD, and for treatment outcome measures.

Oral Session - 6B
Social Cognition and Social Behavior
150 - Human-robot interactions and ASD
2:40 PM - 3:30 PM - Grote Zaal

2:40 **150.001** Could Human-Robot Interactions Facilitate Joint Attention of Children with Autism Spectrum Disorder (ASD)?

W. Cao[1], W. Song[2], X. Li[3], S. Zheng[4], G. Zhang[5], Y. Wu[3], S. He[2], ***H. Zhu***[6] *and J. Chen[7], (1)South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (2)Centre for Optical and Electromagnetic Research, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (3)School of Psychology, South China Normal University, Guangzhou, China, (4)School of Physics and Telecommunication Engineering, South China Normal University, Guangzhou, China, (5)Caihongqiao children rehabilitation and service center of Panyu district, Guangzhou, China, (6)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, Guangzhou, China, (7)School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden*

Background:
Impaired social communication is one of the core symptoms of the autism spectrum disorder (ASD). Some studies have shown that the children with ASD might have developmental deficits on joint attention, which was one of the basic forms of social interactions. Meanwhile, in recent years humanoid robots showed a potential to be a social partner of ASD and were introduced to involve in interventions. Nevertheless, few researches have focused on the difference of interacting with human agents and robots within ASD population. It remains a question whether human-robot interactions facilitate joint attention of children with ASD.

Objectives:

To address the aforementioned question, the study aimed to investigate the difference between the ASD and typically-developing (TD) children when viewing human-robot interactions compared to human-human interactions. By combining a commercial humanoid robot NAO with the Tobii X3-120 eye-tracker system, this study measured the eye movement patterns towards the interactions between two figures, including two types, namely human-robot vs. human-human.

Methods:

6 ASD (mean age: 4.84±0.41) and 12 age-matched TD children (4.63±1.05) participated in the eye-tracking tests. Video stimuli depicted the interaction between one female and one agent (a male or a robot). Each video clip contained four stages: Greeting (two figures say “Hi” towards the screen); Looking at each other (two figures looked at each other); Leading by gazing (two figures turned their head towards the common target); Leading by pointing (two figures moved their fingers to point towards the target). First fixation time, total fixation duration and fixation time percentage were collected to measure the attention distribution among different areas of interests (AOIs): head, body, hand, target and background.

Results:

Data analysis showed that participants fixated faster in the human-human interaction condition in the stage with leading by gazing, but the total fixation time was shorter in the human-robot interaction condition. On the other hand, in the stage with leading by pointing, the participants made faster fixation in the human-robot interactions, but the total fixation time was shorter during human-human interactions. Meanwhile, compared to the human-robot interaction condition, in the human-human interaction condition the participants spent less time on the agent’s head, but spent more time on head and hand of the agent in the stage with leading by gazing, and on the target in the stage with leading by gazing. Furthermore, ASD spent more time on the male body, TD spent more time on human hand in leading by pointing stage of human-human interaction condition, but TD spent more on human body in leading by gazing stage, more on human head in leading by point stage of human-robot interaction condition.

Conclusions:

This research showed that the human-robot interaction might have a different feature compared to the human-human interaction. Although the robot could attract the attention of ASD children in some conditions, the children with ASD could not well understand and follow the intentions of social robots, which implied that the social robot might have difficulty to facilitate the education or intervention of ASD children.

2:52 **150.002** Robot-Assisted Learning-By-Teaching Pedagogy for Improving Social Skills

L. Boccanfuso[1]*, E. Barney[2], M. Mademtzi[3], C. Foster[3], Q. Wang[3], B. Scassellati[4], P. E. Ventola[5] and F. Shic[2], (1)Vän Robotics, LLC, Irmo, SC, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Yale University, New Haven, CT, (5)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background:
An increasing number of children with autism spectrum disorder (ASD) are attending mainstream schools. The majority of these children receive regular interventions that provide opportunities to practice social skills within group settings, one-on-one intervention with an educator or targeted therapy with a specialist. However, it is still uncommon for a child with autism to have the opportunity to develop the social skills acquired during interventions and foster a deep, generative understanding of these skills by engaging others in peer tutoring. The learning-by-teaching pedagogy offers these children a number of potential social benefits that may facilitate long-term learning and improved outcomes but there are numerous challenges make the deployment of peer tutoring difficult in practice.

Objectives: In this first study, we evaluated the potential benefits of a novel robot-assisted, learning-by-teaching approach for advancing social skills using a set of well-defined social skills tasks for school-aged children with ASD. We investigated the feasibility and comparative benefits of implementing the paradigm in a child-to-robot context versus a child-to-human-confederate scenario. Further, we examined the relative differences in engagement between conditions and potential performance implications correlated to higher engagement in each study condition.

Methods: Ten children between 6-10 years of age (*m=8.75 yrs.*) who were diagnosed with ASD based on evaluation with gold standard DSM-5 criteria and met or surpassed a minimum threshold (>=80) for IQ, as determined by the Differential Ability Scales-General Conceptual Ability (DAS-GCA) assessment (*m=107.5*), were invited to participate in this randomized control trial. We empirically evaluated performance on a set of social

skills tasks and engagement level during two study conditions: robot and human-confederate. We computed Pearson bi-variate correlations to evaluate potential connections between IQ, performance and engagement and performed Fisher's z-transformation on correlations to investigate the significance of differences between resulting correlations. Finally, we conducted multiple linear regression to examine the predictive value of age, IQ and engagement for predicting performance in both study conditions.

Results: Results show that 80% of study participants performed better in the robot condition (*mean performance: robot=63%, confederate=37%*) and 90% of all participants were significantly more engaged in the robot condition (*mean engagement: robot=61%, confederate=32%*). Verbal IQ and IQ were significantly correlated with overall performance in the confederate condition (*r=0.794, p<0.05 and r=0.726, p<0.05, respectively*), but no correlation resulted in the robot condition between Verbal IQ/IQ and overall task performance or in any individual script. Multiple linear regression was conducted to predict overall performance from IQ, age and engagement. Although age, IQ and overall engagement did not predict performance in the confederate condition, these variables statistically significantly predicted overall performance in the robot condition, F(3,6)=5.399, p<0.05, R2=0.730.

Conclusions: Results from this study confirm the feasibility of this new robot-assisted intervention and support the significant potential of this approach for promoting social skills. These findings further underscore the attentional value of employing a robot in an autism intervention and the potential therapeutic benefit of employing a social robot as a peer student.

3:04 **150.003** Do Children with Autism Spectrum Disorder Learn to Distrust and Deceive a Social Robot?

Y. Zhang[1]*, W. Song*[2]*, Z. Tan*[3]*, J. Chen*[4]*, H. Zhu*[5] *and* ***L. Yi***[6]*, (1)Peking University, beijing, China, (2)Centre for Optical and Electromagnetic Research, South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (3)South China Academy of Advanced Optoelectronics, South China Normal University, Guangzhou, China, (4)School of Electrical Engineering and Computer Science, KTH Royal Institute of Technology, Stockholm, Sweden, (5)Child Developmental & Behavioral Center, Third Affiliated Hospital of SUN YAT-SEN University, Guangzhou, China, (6)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

Background:

Children with autism spectrum disorder (ASD) display difficulty in understanding other people's mental states (Baron-Cohen, 2001) and learning complex social rules in interpersonal interaction (Jones et al., 2013). For example, children with ASD showed difficulty in learning the social rules to distrust and deceive an adult who repeatedly deceive them (Yi et al., 2014). However, little is known about how children with ASD learn social rules from social robots.

Robots can offer children with autism spectrum disorder (ASD) a safe and predictable environment and help develop social skills (Dautenhahn et al., 2004). Studies on using interactive robot in therapy that helps children with ASD learn social skills have shown promising outcomes (Feil-Seifer et al., 2008; Kozima et al., 2007; Stanton et al., 2008). In our study, we attempt to use social robot to teach hidden social rules to children with ASD in the trust and deception games.

Objectives:

To examine how children with ASD learn social rules to distrust and deceive a social robot.

Methods:

Twenty-one 5 to 8-year-old children with ASD and 21 age-matched typically-developing (TD) peers participated in the trust and deception tasks with a social robot to try to win as many tokens as possible. In the trust task, children were asked to find a token in three identical cups, while the robot providing misleading information about the location of the token (pointing to an empty cup). This procedure repeated for 10 trials. In the deception task, children were asked to switch the roles with the robot, i.e., the children hid the token and the robot looked for it. With this manipulation, we aimed to investigate whether children would deceive the robot. Children had to hide the token and then indicate a location of the token for the robot to find over another 10 trials.

Results:

The analysis of the overall performance across 10 trials indicated that: (a) children with ASD showed a trust bias towards the robot (t = -3.77, p = .001); (b) they were also less likely to deceive the robot (t = -2.47, p = .02). This finding replicated the difficulty of children with ASD in distrusting and deceiving a human experimenter in the previous research (Yi et al., 2014).

The survival analysis based on the trial-by-trial data, as shown in Figure 1, further indicated the learning process over the 10 trials in both groups. Results showed that in the trust task, the ASD group learned slower than the TD group to distrust the robot (p < .001). The group difference in the deception task were marginally significant (p = .064).

Conclusions:

Our study indicated that when confronting the social robot, children with ASD showed a trust bias and difficulty engaging in deception compared to the TD children. However, it does not mean inferring mental states from the robot is more difficult than that from the human. Therefore, it might still be promising to develop intervention protocol using robots based on this paradigm to teach the social rules to children with ASD.

3:16 **150.004** A Randomized Controlled Trial of the Effectiveness of Pivotal Response Treatment with and without Use of a NAO Robot in Young Children with ASD

I. Smeekens[1,2]*, M. De Korte*[2,3]*, M. Van Dongen - Boomsma*[2]*, J. C. den Boer*[4]*, I. J. Oosterling*[2]*, J. K. Buitelaar*[5,6]*, W. G. Staal*[1,2,7]*, E. I. Barakova*[8]*, T. Lourens*[9] *and J. C. Glennon*[3]*, (1)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (2)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (3)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen Medical Centre, Nijmegen, Netherlands, (4)Karakter Child and Adolescent Psychiatry, Ede, Netherlands, (5)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (6)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (7)Institute for Brain and Cognition, Leiden University, Leiden, Netherlands, (8)Faculty of Industrial Design, University of Technology, Eindhoven, Netherlands, (9)TiViPE, Helmond, Netherlands*

Background: Pivotal Response Treatment (PRT) is a promising intervention effective in promoting "pivotal skills" in children with autism spectrum disorder (ASD) (Bozkus-Genc & Yucesoy-Ozkan, 2016). However, evidence is lacking on which treatment components contribute to higher gains in generalized social communication skills and general clinical functioning and to diminished ASD symptoms. The use of robots within the treatment of ASD is hypothesized to contribute to higher treatment gains, since robots are intrinsically appealing to many children with ASD and robots may generate motivation for social interaction (Scassellati, 2007) and engagement in interventions (Boccanfuso et al., 2017). However, contemporary research on using robots in ASD interventions often lacks 1) methodological rigor (Begum, Serna, & Yanco, 2016), 2) evidence on generalization of treatment effects and follow-up (Pennisi et al., 2016) and 3) insight into how robots can be of additional value to established interventions (Diehl, Schmitt, Villano, & Crowell, 2012).

Objectives: The present study aims to examine the effectiveness of using a humanoid (NAO) robot within parent-mediated PRT for diminishing ASD-related symptoms and improving general clinical functioning in young children with ASD compared with PRT (without robot) and treatment-as-usual (TAU).

Methods: A randomized controlled trial (RCT) design was used to compare 1) parent-mediated PRT with using the NAO robot (PRT+robot), 2) parent-mediated PRT, and 3) TAU in 74 young children (3-8 years) with ASD. PRT consisted of 20 weekly therapy sessions, including 14 parent-child sessions and 6 parent sessions. In both PRT conditions, parents were trained in use of the PRT techniques and in the PRT+robot condition, the robot was added in all parent-child sessions to train the child with programmed scenarios incorporating PRT techniques. At baseline, week 10, 20 and 3-month follow-up, the child's ASD-related symptoms were assessed with the Social Responsiveness Scale (SRS, Roeyers, Thys, Druart, De Schryver, & Schittekatte, 2011) completed by parents and teachers. Clinically significant improvement was examined using the Clinical Global Impression-Improvement Scale (CGI-I, Guy, 1976) completed by a blinded child psychiatrist.

Results: Repeated measures analysis using the GLM approach indicated a significant main effect of time ($F(3,147) = 14.53$, $p < .001$) and a time x group interaction effect ($F(6,147) = 2.78$, $p = .018$) on the SRS completed by parents, reflecting steeper decrease of ASD-related symptoms over time in the PRT+robot condition (see Figure 1). Furthermore, the percentage clinical responders (*much* and *very much improved* on the CGI-I) was significantly higher in the PRT+robot condition (66.7%) compared with both the PRT (36.4%) and TAU condition (36.4%) ($\chi^2(1) = 4.22$, $p = .040$) at week 20, but not at follow-up (PRT+robot (63.2%) vs PRT (50.0%): $\chi^2(1) = 0.67$, $p = .408$; PRT+robot (63.2%) vs TAU (40.0%): $\chi^2(1) = 2.09$, $p = .148$).

Conclusions: Results of this study provide a first indication that the use of robotics in PRT may be an effective treatment component in diminishing ASD-related symptoms and improving general clinical functioning in young children with ASD. Implications for clinical use of robotics in PRT and future research will be discussed.

Oral Session - 7A
Family Issues and Stakeholder Experiences
151 - Family Issues and Stakeholder Experience
1:45 PM - 2:35 PM - Willem Burger Zaal

1:45 **151.001** Play with Me: Sibling Interactions of High-Risk Infants with Their Older Brother or Sister with Autism Spectrum Disorder

P. Warreyn[1]*, C. Bontinck*[2]*, E. Demurie*[1]*, S. Van der Paelt*[1] *and H. Roeyers*[1]*, (1)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Gent, Belgium*

Background:

The social experience and social context of infants in their first years of life play an important role in shaping their future social interactions. In infant siblings of children with ASD, who have an increased risk of developing ASD or related social-communicative problems themselves, these social interactions may be even more important. Recently, there is increased attention for parent-child interactions in these high-risk (HR) siblings. Another important aspect of early social experience has however been largely overlooked so far: the interaction with older siblings. In the case of HR siblings, at least one of these older siblings has ASD, which will have an impact on the interaction between both children, and most probably also on the social learning opportunities of the youngest child. Therefore, this study was the first to focus on sibling interactions between HR siblings and their older brother or sister with ASD, in a longitudinal design.

Objectives:

1) To compare sibling interactions of HR siblings and their older sibling with ASD with those of low-risk (LR) control dyads and 2) to explore the possible predictive value of these interactions for the later development of HR infants.

Methods:

28 HR dyads and 34 LR dyads were seen when the youngest sibling was 18, 24 and 36 months old, as part of a larger follow-up study. Sibling interactions were observed during a naturalistic free-play session filmed at home, and positive and negative initiatives and responses of both interaction partners were coded afterwards. At 24 and 36 months, the Mullen Scales of Early Learning and the ADOS-2 were administered.

Results:

At 18 months, HR siblings responded more often in a negative way to the initiatives (both positive and negative) of their interaction partners, and so did their older brother or sister with ASD. There was no difference in the amount of positive initiatives or responses. At 24 months, HR siblings made fewer initiatives, especially positive ones, compared to the LR infants. By 36 months, the number of initiatives did not differ anymore between the groups, but both HR infants and their older sibling with ASD responded less often positive to an initiative of the interaction partner. In general, infants of both groups showed more initiatives at 36 months than at 18 and 24 months. Responsiveness of the HR infants decreased over age, while this was not the case in LR infants.

A lower number of initiatives made by the HR infants (and a lower number of responses by their older sibling with ASD) at 18 months predicted a higher ADOS score at 24 months.

Conclusions:

Sibling interactions of HR infants with their older brother or sister were characterised by more negativity and/or less positivity. In addition, in HR infants there was a decrease in responsivity over time. Sibling interaction at 18 months predicted ADOS scores at 24 months in the HR group. 36-

month outcome is currently being collected, and the extent to which this is predicted by peer interaction variables will also be presented at the meeting.

1:57 **151.002** Mental Healthcare Experiences of Autistic Adults: Using First-Hand Perspectives to Inform a Clinician Training Program

B. B. Maddox[1], *S. R. Crabbe*[1] *and D. S. Mandell*[2], *(1)University of Pennsylvania, Philadelphia, PA, (2)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Many autistic adults struggle with psychiatric disorders; however, little is known about their personal experiences navigating the mental healthcare system and their satisfaction with services. Oftentimes, these adults face a “services cliff” when they exit high school, with limited options for treatment. A shortage of trained clinicians is one of the most commonly reported barriers to quality mental healthcare for adults on the spectrum. No prior studies have interviewed autistic adults about their recommendations for improving the mental healthcare system to meet their needs.

Objectives: The objective of this community-partnered study is to learn from autistic adults about their experiences with mental healthcare, in order to inform a training program for clinicians working with this population. We aimed to obtain an in-depth understanding of specific clinician characteristics and actions that contribute to negative or positive mental healthcare experiences for adults on the spectrum.

Methods: To date, we have completed semi-structured interviews with 15 autistic adults spectrum (12 male; mean age 36 years, age range 19-56 years). By December 2017, we will have a final sample of 20 adults; this target sample size is considered more than sufficient to reach thematic saturation in qualitative research. All participants are age 18 years or older with the verbal abilities to complete a one-hour interview. The interview questions ask about the adult’s experiences and needs related to mental health treatment, along with recommendations for training clinicians to better serve this population. All interviews are audio-recorded and professionally transcribed for analyses. Analyses are guided by grounded theory, which provides a rigorous, systematic approach to collecting and analyzing qualitative data.

Results: Participants expressed varying degrees of satisfaction with their mental healthcare experiences. Preliminary data provide important insights into difficulties with finding quality psychiatric treatment, particularly in community mental health settings. A common theme is the perception that clinicians rely too much on pharmacological treatment. Participants offered recommendations for clinicians to improve their interactions with adult clients on the spectrum, including modifying the environment to account for sensory sensitivities, using concise and direct language, being comfortable with silence as the client may need additional time to process information, and providing more psychoeducation about emotions. Almost every participant shared stories about not feeling understood, validated, or respected by mental health providers. For example, according to one young woman: “I think a lot of people that I know on the spectrum have this experience of feeling really invalidated. The therapist thinks that the way to go is to make us more typical. . . That's not helpful.”

Conclusions: This study is one of the first to obtain first-hand perspectives from autistic adults about navigating the mental healthcare system. These findings directly inform priority training needs for clinicians working with this population, with a focus on better understanding how core autism symptoms affect in-session interactions and treatment progress. Effective mental health services could significantly improve the quality of life for many adults on the autism spectrum.

2:09 **151.003** Videogame (Over)Use in Children and Adolescents with Autism: Exploring Parental Concerns, Attitudes, and Mediation Strategies

S. S. De Pauw[1], *J. Van Brabandt*[1], *L. Tiberghien*[1], *L. De Clercq*[1] *and L. M. Dieleman*[2], *(1)Department of Special Needs Education, Ghent University, Ghent, Belgium, (2)Department of Developmental, Personality, and Social Psychology, Ghent University, Ghent, Belgium*

Background:

Playing videogames is one of the most favourite leisure activities for many children and adolescents with Autism Spectrum Disorder (ASD). Their parents, however, frequently have mixed feelings about these screen-based activities and their children’s level of engagement with it. On the one hand, accumulating studies suggest that youth with ASD is at significantly greater risk of problematic use of videogames, compared to peers without ASD or with other disabilities. On the other hand, many parents also endorse that videogames serve a significant number of emotional, social, and intellectual needs of their child with ASD.

Objectives:

Given the parents’ pivotal role in accommodating their child’s leisure behaviours, this study aims to better understand (1) videogame (over)use in Flemish youth with ASD, (2) the concerns and attitudes of parents about this videogame (over)use, and (3) the mediation parenting strategies that parents adopt to manage their children’s screen-based activities.

Methods:

Parents of 244 children and adolescents with ASD (M_{age} child= 12.03, 7-17 year olds) completed a comprehensive online survey. In the first part, parents reported on the frequency, duration, game characteristics and child preferences, and measures evaluating both the negative (Problem Videogame Playing Test, PVGT; obsessive passion; concern about gaming; negative evaluation of life domains, ill-being) and positive (harmonious passion; positive evaluation of life domains; social engagement; well-being) impact of videogame use. In the second part, parents reported on their use of active, restrictive or social strategies in parental game mediation, and on the extent these mediations are exerted in an autonomy-supportive or controlling manner. Parents also evaluated their own attitudes and concerns about the videogaming of their child, in addition to dimensional ASD-symptoms of the child (Social Responsiveness Scale).

Results:

In line with international estimates, Flemish youth with ASD spent an average of 2.45 hours/day playing videogames. However, Flemish parents reported significantly higher PVGT-scores on their children (M=56.6) than similar research in the U.S. (M=41.2; Mazurek & Engelhardt, 2013; d=1.2). Gender (boys) and a preference for the most popular genres (adventure, action, and violence) were associated with more negative outcomes. The quality of passion for gaming, however, yielded two separate patterns: a problematic, obsessive passion-pattern (with excessive PVGT-scores, more ill-being, parental concerns and negative attitude towards gaming) versus a non-problematic, harmonious passion-pattern (more hours/day, but not related to ill-being, parental concerns or negative outcomes). Surprisingly, no associations between gaming and positive outcomes were

found.

Parents of younger children exerted more social, active and restrictive mediation than parents of older children. Notably, we did not find associations between parental concerns or negative perceptions and restrictive or controlling mediation strategies. Social mediation (i.e., playing together), however, turned out to be significant 'buffering' factor for negative gaming outcomes. Moreover, an autonomy-supportive style fostered harmonious passion for gaming.

Conclusions:

This study demonstrates the importance of distinguishing obsessive versus harmonious passion for gaming in youth with ASD. It also gives practical tools, suggesting that playing together (i.e., social mediation) and an autonomy-supportive parental style may protect children with ASD from the negative outcomes of excessive gaming.

2:21 **151.004** The Bi-Directional Association between Sleep Problems and Autism Spectrum Disorder Symptoms: A Population-Based Cohort Study

*M. E. Verhoeff[1], L. Blanken[2], D. Kocevska[3], V. Mileva-Seitz[4], V. Jaddoe[5], T. White[6], F. Verhulst[3], **M. Luijk**[7] and T. Henning[8], (1)Department of Child and Adolescent Psychiatry/Psychology, Erasmus University Medical Center Rotterdam, Rotterdam, Netherlands, (2)Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands, (3)Department of Child and Adolescent Psychiatry/Psychology, Erasmus University Medical Center–Sophia Children's Hospital, Rotterdam, Netherlands, (4)Department of Child and Adolescent Psychiatry/Psychology, Erasmus Medical Center, Rotterdam, Netherlands, (5)Department of Pediatrics, Erasmus University Medical Center –Sophia Children's Hospital, Rotterdam, Netherlands, (6)Child and Adolescent Psychiatry, Erasmus University Medical Centre, Rotterfdam, Netherlands, (7)Department of Psychology, Education and Child Studies, Erasmus University Rotterdam, Rotterdam, Netherlands, (8)Department of Psychiatry, Erasmus MC-University Medical Center, Rotterdam, Netherlands*

Background:

Sleep difficulties are prevalent in children with Autism Spectrum Disorder (ASD), occurring in 40-80% of cases across all ages. The association between sleep problems and ASD can be of two forms. First, sleep problems may precede and worsen the behavioural outcome of ASD. Second, sleep problems may occur as a consequence of the underlying disorder. Because longitudinal studies are lacking, the temporal nature of the association between sleep problems and ASD is unclear.

Objectives:

Our aim is to clarify whether sleep problems precede and worsen autistic traits and ASD or occur as a consequence of the disorder. This enables us to gain more insight in the course of sleep problems in children with ASD over time which can be beneficial for parents and for clinical practice.

Methods:

Repeated mother-reported sleep measures were available at 1.5, 3, 6, and 9 years of age in 5151 children participating in the Generation R Study, a large prospective birth cohort in the Netherlands. Autistic traits were reported by the mother using the Pervasive Developmental Problems score (PDP) of the Child Behavior Checklist (CBCL) at 1.5, 3, and 6 years and the Social Responsiveness Scale (SRS) at 6 years. This cohort included 81 children diagnosed with ASD by a clinician who we compared with the rest of the sample.

Results:

Sleep problems in early childhood were prospectively associated with a higher SRS score, but not when correcting for baseline PDP score. By contrast, a higher SRS score and an ASD diagnosis were associated with more sleep problems at later ages, even when adjusting for baseline sleep problems. Likewise, a trajectory of increasing sleep problems was associated with ASD.

Conclusions:

Sleep problems and ASD are not bidirectionally associated. Sleep problems do not precede and worsen autistic behaviour, but rather co-occur with Autistic traits in early childhood. Yet, as supported by our trajectory analyses, the severity and frequency of sleep problems decreases in typically developing children, whereas sleep problems worsen over time in children with ASD. This strongly suggests that the pathology underlying ASD on the behavioural sequelae, determines the development of sleep problems. A possible mechanism for why sleep problems in children with ASD persist could be that social problems associated with ASD may worsen the day-night rhythm in these children and play a crucial role in the development of sleep problems. Socialization of day-night rhythm by parents, such as bed time routines, night time rituals, and family regularity, are important in young children as they can act as social zeitgebers and thereby contribute to the development of a healthy sleep pattern and the prevention of the occurrence of sleep problems. Children with ASD have difficulty to adequately respond to the social zeitgebers and therefore may struggle to develop a healthy sleep pattern. More research is needed to unravel the socialization of day-night rhythm in children with ASD and the linkage with the development of sleep problems. Future studies should emphasize bed time routines and family regularity when investigating children with ASD and sleep problems.

Oral Session - 7B
Family Issues and Stakeholder Experiences
152 - Involving Autistic People and their Families in Autism Research
2:40 PM - 3:30 PM - Willem Burger Zaal

2:40 **152.001** Including Autistic People and Relatives in Planning, Designing and Undertaking Longitudinal Research: An Evolution from Consultation and Advice to Participatory Research

***J. R. Parr**, Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background: Little guidance exists regarding ways for autistic people and researchers to work together effectively. During the first years of the Autism Spectrum Cohort-UK (ASC-UK) longitudinal cohort project, and the broader Autism Lifecourse and Ageing research programme, we worked with autistic adults in various ways.

Objectives: 1. To disseminate information about how a stakeholder-informed research approach moved toward participatory research in a longitudinal cohort study and research programme; 2. Show how this process benefitted researchers and autistic people – and what might have been done differently.

Methods: The participatory research approach evolved over 5 years. Initially around 50 autistic adults and relatives advised on their research priorities, and project methods and materials. From 2014, autistic people and relatives were consulted and advised on the research process. The team then moved toward an approach where autistic people and relatives were part of the research team, and named on funding applications. Later discussions focussed on the positive experiences, and the limitations of people's roles, and how in retrospect autistic people might have been involved differently from the outset. This informed the next phase participatory research regarding ASC-UK, and associated projects.

Results: *Consultation before and during initial research phases*: Initial involvement of autistic people involved three autistic adults attending a research prioritisation meeting, being paid as research advisors, and a relative being recruited to the research team. A broader group of autistic people and relatives (30 people) attended separate larger consultation meetings about methods and materials. Autistic people supported the research team to develop appropriate strategies for before, during and after meetings. For example, telephone conferences were discounted, and meetings were face-to-face. Materials were sent well before the meeting, with clear topics for discussion on an agenda that was not altered subsequently. Opportunities to make the environment appropriate were an additional focus (e.g., discussion about the room to be used, accepting low natural light surroundings). A 'model' of how to conduct meetings with autistic advisors, and those attending consultation groups was created so each type of meeting was undertaken similarly. Payments for autistic advisors time were agreed; the research team arranged and funded travel and accommodation.

Moving from consultation and advice to participatory research: During the research, as new projects commenced, the research team and autistic people discussed opportunities for them to be research collaborators and co-applicants. Other autistic people joined project-based research groups, and became part of community-based participatory research. Autistic people gained a greater understanding of the different research roles and responsibilities (for example, consultant, advisor, collaborator, and co-investigator). The importance of a 'menu' of roles for people working with the research team was discussed. Most recently, research workshops including autistic people, relatives and researchers led to refinement of community research priorities.

Conclusions: Autistic people and researchers initially used an advisory model, and through shared mutual respect, evolved into an effective participatory research team; the journey continues, and new ways of working together will continue to be identified. This approach has resulted in effective research with significant impact.

2:52 **152.002** Predicting Attrition in a Longitudinal Study of Children with Autism Spectrum Disorder

A. E. Richard[1], *I. M. Smith*[2], *E. Duku*[3], *M. G. Hayes*[4], *T. Vaillancourt*[5], *C. Waddell*[6], *J. Volden*[7], *P. Mirenda*[8], *L. Zwaigenbaum*[7], *T. Bennett*[9], *S. Georgiades*[3], *M. Elsabbagh*[10], *W. J. Ungar*[11] *and P. Szatmari*[12], *(1)Autism Research Centre, IWK, Halifax, NS, Canada, (2)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (3)McMaster University, Hamilton, ON, Canada, (4)Dalhousie University, Halifax, NS, Canada, (5)University of Ottawa, Ottawa, ON, Canada, (6)Simon Fraser University, Vancouver, BC, Canada, (7)University of Alberta, Edmonton, AB, Canada, (8)University of British Columbia, Vancouver, BC, Canada, (9)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (10)McGill University, Montreal, PQ, Canada, (11)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (12)Centre for Addiction and Mental Health, Toronto, ON, Canada*

Background: Attrition is considered an inescapable reality of longitudinal studies. Nonetheless, little research has carefully examined predictors of attrition in studies of children, in which an interplay of child and parent variables may influence participation. Notably, attrition has not been systematically explored in longitudinal observational studies of children with neurodevelopmental disorders such as autism spectrum disorder (ASD). Identifying predictors of attrition in such studies may improve quality of research as well as families' experiences of participation.

Objectives: We examined how the rate of attrition varied across assessment points in an inception cohort of preschoolers with ASD followed over a nine-year period, and investigated which child and parent characteristics predicted attrition.

Methods: Data were drawn from the multi-site Canadian Pathways in ASD study, which followed 421 children with ASD and their caregivers. This study was divided into two phases. Phase I followed participants from diagnosis at age 2 to 4 years (M_{age} = 38.2 months [SD = 8.7]; M_{IQ} = 50.9 [SD = 28.7]; M:F = 356:65) until age 6 years, and Phase II, from the age of 7.5 to 11 years. Participation involved psychometric assessment of children and completion of interview and questionnaires by parents and teachers to identify child, family, and community predictors of child outcome. We used discrete-time survival analysis to identify baseline predictors of attrition.

Results:

One hundred and eighteen families (28%) ceased participation over nine years in this longitudinal study. The attrition rate was relatively stable in Phase I, with 2-6% of participants ceasing participation at each assessment point. Participant loss peaked at the start of Phase II, with 10% of participants not consenting to this second phase. Interestingly, of those who consented to Phase II, only 3% left the study over the subsequent three-year period. Competing discrete-time survival analysis models were fit and compared based on AIC and BIC. The final model included age of the primary caregiver, family income, general distress of the parent, a measure of severity of child's restricted and repetitive behavior, and child IQ, as predictors of attrition ($\chi^2_{model}(18) = 103.1$, $p < 0.001$). Age of the caregiver (Wald statistic(1) =8.24, p =0.004), family income (Wald statistic(1) =7.02, p =0.008), and severity of restricted and repetitive behaviour (Wald statistic(1) =7.19, p =0.007) were the most important predictors. Whereas lower family income, younger age of the parent, and lower IQ of the child *increased* the risk of attrition, self-reported general distress of the parent and more severe ASD symptoms were associated with a *reduced* risk.

Conclusions:

The rate of attrition in this study of children with ASD was commensurate with observational studies of children at risk for, or with, a medical condition, and influenced by both child and parent variables. These findings suggest that addressing parent-perceived challenges to participation and emphasising relevance of participation may improve retention rates and thereby increase the representativeness of longitudinal data. In particular, reviewing the study aims and renewing participants' commitment may offer a compelling approach to increasing participant retention.

3:04 **152.003** A View through a Different Lens: Capturing the Sibling Experience of Children with a Diagnosis of Autism Via Photo Narratives

G. Pavlopoulou[1] *and D. Dimitriou*[2], *(1)Lifespan Learning and Sleep Lab, UCL.IOE,Lilas Lab, london, United Kingdom of Great Britain and Northern*

Ireland, (2)Lifespan Learning and Sleep Laboratory (LILAS) UCL, Institute of Education, London, United Kingdom

Background: Much of siblings' research has focused on siblings' adjustment and relies on parental reports. Although researchers have started exploring typically developing siblings' perspectives on their relationships with a brother or sister with autism, there is still a lack of research on the perspective of the child with a diagnosis of autism.
Objectives: This is the first study to utilise, a modified version of a participatory methodology, Photovoice, combined with phenomenology to understand siblings' everyday lived experience and to investigate opportunities for wellbeing in the environment of their families, schools and the wider local community.

Methods: 10 autistic siblings were recruited, aged 7 to 11, from 3 rural counties in Greece. Background information were collected using a number of psychometric tests. Siblings were involved by collecting data by themselves, determining the content of the data, and analysing and interpreting the data that consist of their observations, experiences and reflections as well as how they negotiate and construct reality through their every day interactions in their familiar environments over a period of 19 weeks. In this innovative approach, interpretation of the photographs was primarily in the hands of the children through photovoice groups, while interpretation of the narratives from the 1-1 interviews was the responsibility of the authors employing Interpretative Phenomenological Analysis.
Results: Our methodology facilitated dialogue and the collection of an array of data including 140 transcription pages and 95 usable photos. Sibling-driven content analysis identified five major categories: shared time at home (27.06%), sensory difficulties (25.04%), special interests (20.40%), supportive family members (16%) and pets (11.05%). Interpretative Phenomenological Analysis identified important topics. Three master themes emerged: (i) typicality in siblings' relationships such as feelings of love and support, (ii) the perceived difficulties in siblings' relationships with their family members such as sensory overload and siblings' conflicts, (iii) copying strategies including animals as a source of companionship and special interests to cultivate positive emotions throughout the day.

Conclusions: A key challenge in current research and intervention is the inclusion of the voice of disadvantaged groups such as the children with a diagnosis of autism. Photo voice, as a methodological choice, facilitated the expression of the participants' experiences by equalizing the research process and expose take for granted views on siblings' experiences. Through eliciting sibling voice directly, we hoped to reveal positive aspects, as well as, previously unconsidered challenges in the life of children with a diagnosis of autism. A strong sense of love and pride of their autistic identity was expressed throughout the interviews, and this builds into an optimism that can be a crucial part of interventions that help to lift and further develop resilience, wellbeing and a life that is possible while planning for what remains to be difficult such as sensory and sleep difficulties. Such information around contemporary and lifecycle issues in the life of siblings is central to the goal of designing proactive empowering interventions by clinicians, communities such as school and other agencies, and by policymakers in relation to both quality improvement and cost containment.

3:16 **152.004** An International Autism Portfolio Analysis By United States (IACC-NIH), United Kingdom (Autistica) and Canada (Canadian Government)

S. Daniels[1], *J. Rava*[2], *J. Cusack*[3] *and G. Warner*[4], *(1)National Institute of Mental Health (NIMH), Rockville, MD, (2)National Institute of Mental Health, Office of Autism Research Coordination (OARC), Rockville, MD, (3)Autistica, London, United Kingdom of Great Britain and Northern Ireland, (4)Autistica, London, United Kingdom*

Background: In this talk, the Office of Autism Research Coordination (OARC) of the U.S. National Institutes of Health (NIH), Autistica of the U.K., and the Canadian Government will present findings from a ground-breaking *International Portfolio Analysis* that describes autism research investments spanning government and private funders in the U.S., U.K., and Canada.
OARC/NIH manages the Interagency Autism Coordinating Committee (IACC) a federal advisory body that provides advice to the U.S. government on issues related to ASD. OARC conducts an annual portfolio analysis of U.S. research projects to help guide the IACC's strategic planning efforts. Autistica is the national autism research charity in the UK. The Canadian Institutes of Health Research (CIHR) Institute of Neurosciences, Mental Health and Addiction (INMHA) supports research on biomedical, clinical, health services, and population research related to the neurosciences, mental health, and addiction.

These three international partners collected and analyzed data from research projects funded by government and private funders in their respective countries and analyzed it according to the seven general categories of research described in the IACC *Strategic Plan for ASD*.

Objectives: By taking an international perspective centered on universal research topic areas, the portfolio analysis presented in this talk should improve knowledge of international research efforts in the seven research areas adapted from the *IACC Strategic Plan* and identify potential gaps or areas of opportunity for future research endeavors and collaborations. The international partners plan to continue the analysis as an annual exercise and aim to encourage participation from more countries to demonstrate global progress in the field of autism research.

Methods: N/A

Results: N/A

Conclusions: N/A

Oral Session - 8A
Epidemiology
153 - Longitudinal studies of the ASD phenotype
1:45 PM - 2:35 PM - Willem Burger Hal

1:45 **153.001** Examining “Turning Points” in Trajectories of Symptom Severity in Children with Autism

S. Georgiades[1], *P. A. Tait*[1], *V. Bierling*[1], *M. P. Gallaugher*[1], *P. D. McNicholas*[1], *E. Duku*[1], *T. Bennett*[2], *M. Elsabbagh*[3], *P. Mirenda*[4], *I. M. Smith*[5], *W. J. Ungar*[6], *T. Vaillancourt*[7], *J. Volden*[8], *C. Waddell*[9], *L. Zwaigenbaum*[8], *E. Fombonne*[10], *S. E. Bryson*[11] *and P. Szatmari*[12], *(1)McMaster University, Hamilton, ON, Canada, (2)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (3)McGill University, Montreal, PQ, Canada, (4)University of British Columbia, Vancouver, BC, Canada, (5)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (6)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (7)University of Ottawa, Ottawa, ON, Canada, (8)University of Alberta, Edmonton, AB, Canada, (9)Simon*

Fraser University, Vancouver, BC, Canada, (10)Psychiatry, Pediatrics & Behavioral Neurosciences, Oregon Health & Science University, Portland, OR, (11)Dalhousie University, Halifax, NS, Canada, (12)The Hospital for Sick Children, Toronto, ON, Canada

Background: Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by variability in symptom presentation and outcome. To date only a small number of studies have examined the longitudinal course of ASD symptom severity (Gotham, Pickles & Lord, 2012; Szatmari et al., 2015). In Szatmari et al. (2015) we reported two distinct trajectory groups of autistic symptom severity: Group 1 (11.4% of the sample) had less severe symptoms and an improving trajectory; Group 2 (88.6% of the sample) had more severe symptoms and a stable trajectory. Those results were based on data collected during the preschool years so new studies are needed to explore how variability in autism severity unfolds beyond the key transition point of entry into school.

Objectives: To extend our longitudinal investigation of symptom severity into the early school years and identify possible key “turning points” in the developmental trajectories of children with ASD.

Methods: Data were drawn from the Canadian Pathways in ASD study and included 360 children with ASD. Autistic symptom severity was indexed by the Autism Diagnostic Observation Schedule (ADOS) standardized severity score. Trajectories were plotted using data from four time points collected between the time of diagnosis and age 11. Three-way clustering methods consisting of variables and observations over time modelled as matrix variate data were used to identify homogeneous groups of children. Our matrix variate data comprised ADOS severity score and associated variables such as the child’s age at assessment, child’s sex, and adaptive functioning skills (indexed by the Vineland Adaptive Behavior Scales; VABS II). These variables were identified via boosted regression trees, a predictive modeling method. Missing data were imputed using median imputation combined with normal noise. A finite mixture of skewed matrix variate distributions (Gallaugher and McNicholas, 2017) was used for clustering.

Results: Using the Bayesian Information Criterion, a 3-group model was selected as the best fit to the data. Symptom severity scores for children in Group 1 (54% of the sample) and Group 3 (14% of the sample) decreased over time and then plateaued. However, symptom severity scores for children in Group 2 (32% of the sample) increased over time. A “turning point” (or “elbow”) at around 54 months of age – a time that for many children coincides with transitioning into the school system – was identified in two trajectory groups. Specifically, at that point, severity scores for children in Group 3 stopped decreasing and leveled out; severity scores for children in Group 2 stopped decreasing and started to increase. Groups differed by sex and had different linear associations with ADOS, VABS and age at diagnosis.

Conclusions: Study findings provide further evidence for the heterogeneous nature of symptom severity in children with ASD. The identification of key “turning points” in these trajectories supports the idea that symptom severity does not unfold in a linear way. Child, family and contextual factors associated with “turning points” in symptom severity will be discussed within the longitudinal research and clinical practice frameworks.

1:57 **153.002** Predictors of Longer-Term Language Development in Language Delayed Children with ASD

V. Hus Bal[1], *M. Fok*[2], *I. M. Smith*[3], *P. Mirenda*[4], *P. Szatmari*[5] *and C. Lord*[6], *(1)STAR Center for ASD & NDD; Dept of Psychiatry, University of California, San Francisco, San Francisco, CA, (2)Graduate School of Applied and Professional Psychology, Rutgers University-New Brunswick, Piscataway, NJ, (3)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (4)University of British Columbia, Vancouver, BC, Canada, (5)Centre for Addiction and Mental Health, Toronto, ON, Canada, (6)University of California Los Angeles, Los Angeles, CA*

Background:
Approximately 40-60% of children with ASD are language delayed, but only 30% remain minimally verbal (MV; Pickles et al., 2014). Preschool expressive abilities, nonverbal cognition, joint attention and motor skills have been shown to predict language development in broad samples including children with and without language delay. There is a need for studies focused on language-delayed children to better understand factors that predict whether or not a child will remain minimally verbal and their language development beyond the preschool years. One challenge to this area of research is the limited availability of longitudinal cohorts with a sufficient number of language-delayed children to examine predictors of longer-term language outcomes.

Objectives: Identify factors that predict expressive language development in language-delayed preschoolers using two independent longitudinal cohorts of children with ASD.

Methods: Age 3 predictors of young adult language level were explored using CART in the Early Diagnosis cohort (N=125 followed from 2 to 19 years of age). Five Mullen subscales (Gross Motor, Fine Motor [FM], Visual Reception, Expressive Language, and Receptive Language) and two ADOS items (joint attention, motor imitation) were entered as age 3 predictors. Language delayed at 3 and MV at 19 were defined as not yet using phrases on the ADOS. Linear mixed models were then used to examine the effect of CART-identified predictors on Vineland expressive language trajectories from ages 3 to 19 for children not yet using phrases (n=81). Findings were replicated in an independent sample of 361 children followed from 3 to 10 years of age (Pathways) using ADOS language level and the Merrill Palmer FM and cognitive subscales as predictors of Vineland as expressive language trajectories.

Results: CART indicated that significantly delayed FM skills (i.e., T-score<20) were the strongest predictor of MV status at age 19. Within children with delayed FM, lower expressive language and visual reception abilities further predicted sustained language impairment. Linear mixed models indicated main effects of time (p<.001), and age 3 language level (p<.001) and FM skills (p=.002), as well as significant time x language (p<.001) and time x FM (p=.02) interactions. Visual receptive abilities at age 3 did not emerge as a significant predictor (p=.47; Figure 1). While age 3 language level did not differentiate expressive trajectories of children with the greatest language impairment (i.e., nonverbal or using fewer than five words), a main effect of FM (p<.005) and time x FM interaction (p<.05) remained significant (Figure 2). Findings were highly similar in the Pathways cohort, with the Merrill Palmer FM, but not cognitive scale, emerging as a significant predictor of expressive language from ages 3 to 10.

Conclusions: Findings from two independent cohorts using different assessment instruments suggest that significantly delayed fine motor skills may be predictive of sustained language impairments in language-delayed preschoolers with ASD. Future studies are needed to better understand the association between fine motor and language impairments. Fine motor skills may be reflective of other child characteristics that interfere with language development (e.g., reduced interest in interacting with objects) or a broader neurological vulnerability.

2:09 **153.003** Parsing the Heterogeneity of Multidimensional Adaptive Behavior Profiles over Time in ASD

C. Farmer[1], *A. Thurm*[1], *E. Duku*[2], *P. Szatmari*[3], *T. Bennett*[4], *M. Elsabbagh*[5], *P. Mirenda*[6], *L. Swineford*[7], *I. M. Smith*[8], *W. J. Ungar*[9], *T. Vaillancourt*[10], *J. Volden*[11], *C. Waddell*[12], *L. Zwaigenbaum*[11] *and S. Georgiades*[2], *(1)National Institute of Mental Health, Bethesda, MD, (2)McMaster University,* *Hamilton, ON, Canada, (3)Centre for Addiction and Mental Health, Toronto, ON, Canada, (4)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (5)McGill University, Montreal, PQ, Canada, (6)University of British Columbia, Vancouver, BC, Canada, (7)Speech and Hearing Sciences, Washington State University, Spokane, WA, (8)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (9)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (10)University of Ottawa, Ottawa, ON, Canada, (11)University of Alberta, Edmonton, AB, Canada, (12)Simon Fraser University, Vancouver, BC, Canada*

Background: The trajectory of development, versus static point-in-time estimates of skills, may serve as a useful phenotype among individuals with ASD (Georgiades, Bishop, & Frazier, 2017; Lord, Bishop, & Anderson, 2015). Extant studies of the developmental trajectory of adaptive behavior in ASD have focused on either separate specific subdomains or on an omnibus estimate of overall adaptive ability (e.g., Baghdadli et al., 2012; Bal, Kim, Cheong, & Lord, 2015; Szatmari et al., 2015). This may mask some of the variability manifest in the adaptive behavior profiles of individuals with ASD, including the interplay between adaptive behaviors closely linked to core ASD deficits and other problems in daily living.

Objectives: To further expand our knowledge of the course and pace of development of adaptive behavior in ASD, our objective was to characterize the jointly modeled trajectories of three pertinent domains of adaptive behavior (Socialization, Communication, and Daily Living Skills) as measured by the Vineland Adaptive Behavior Scales, Second Edition.

Methods: Data from two longitudinal studies of ASD were combined for analysis using growth mixture models (GMM). The first study, an accelerated longitudinal natural history study performed in the Eastern United States, comprised 106 children with ASD (82% male) who began the study between the ages of 2 and 7 years and were assessed up to five times at 6-month or 12-month intervals. The second study was a multisite longitudinal investigation of an inception cohort of 406 preschool children with ASD (84% male) from across Canada. These children were enrolled between the ages of 2 years and 4 years, 11 months, and were assessed up to six times. GMM is a statistical technique used to parse heterogeneity in developmental trajectories within a latent variable framework, by specifying an unobserved grouping variable that is explained by the pattern of scores over time. First, standard latent growth curves are fit to determine the shape of the average trajectory, and to serve as the baseline model against which the GMMs are compared. Next, a series of GMMs of increasing complexity are fit, each with up to six classes. The average age equivalents in each of three domains (Socialization, Communication, and Daily Living Skills) were jointly modeled.

Results: The available data were restructured into 6-month intervals beginning at 36 months (±3 months) and ending at 138 months (±3 months), for a total of 2,212 assessments (see **Figure 1** for data coverage). The best-fitting latent growth curve models had a quadratic shape for both Communication and Daily Living Skills, but the linear model was best fit to the Socialization data. In all cases, the overall model fit was poor (e.g., large and significant residual variance, large and significant chi-square test of model fit), suggesting that GMM may be better-suited to the data. The results of the joint trajectory model will be presented at the meeting.

Conclusions: The heterogeneity in development of adaptive behavior skills, both within-domain/across-individuals and across-domain/within-individuals, may be examined in order to provide a precise representation of the complexity of autism.

2:21 **153.004** Loss of Social-Communication Skills and Outcomes during Childhood in a Large General Population Cohort

***A. Havdahl**[1,2], S. Bishop[3], C. Farmer[4], S. Schjolberg[5], M. Bresnahan[6,7], D. Hirtz[8], M. Hornig[9], C. Lord[10], T. Reichborn-Kjennerud[11,12], P. Suren[13], A. S. Oyen[14,15], P. Magnus[13], E. Susser[6,7], W. I. Lipkin[9], C. Stoltenberg[13,16], G. Davey Smith[17] and A. Thurm[4], (1)MRC Integrative Epidemiology Unit, University of Bristol, Bristol, United Kingdom, (2)Department of Mental Disorders, Norwegian Institute of Public Health, Oslo, Norway, (3)University of California San Francisco, San Francisco, CA, (4)National Institute of Mental Health, Bethesda, MD, (5)Norwegian Institute of Public Health, Oslo, NORWAY, (6)Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, (7)New York State Psychiatric Institute, New York, NY, (8)National Institutes of Health, Bethesda, MD, (9)Center for Infection and Immunity, Mailman School of Public Health, Columbia University, New York, NY, (10)University of California Los Angeles, Los Angeles, CA, (11)Mental Disorders, Norwegian Institute of Public Health, Oslo, Norway, (12)Institute of Clinical Medicine, University of Oslo, Oslo, Norway, (13)Norwegian Institute of Public Health, Oslo, Norway, (14)Nic Waals Institute, Lovisenberg Diaconal Hospital, Oslo, Norway, (15)Department of Child Health, Norwegian Institute of Public Health, Oslo, Norway, (16)Department of Global Public Health and Primary Care, University of Bergen, Bergen, Norway, (17)Population Health Sciences, Bristol Medical School, MRC Integrative Epidemiology Unit, Bristol, United Kingdom*

Background:

Developmental regression, especially the loss of previously acquired social-communication skills, is often described as specific to autism spectrum disorder (ASD). However, studies of regression have largely been conducted in samples ascertained for diagnosed or suspected ASD. Therefore, little is known about the prevalence and correlates of regression in the general population. Furthermore, while studies have primarily relied on retrospective reporting, parental recall may be unreliable (Ozonoff et al., 2017). Prospective studies of regression as a predictor of longer-term neurodevelopmental outcomes has been limited by study periods restricted to the early developmental period.

Objectives:

We examined whether prospectively-reported loss of social-communication skills is associated with 1) parental recall of regression, and 2) concurrent and later neurodevelopmental functioning.

Methods:

Data were from the Norwegian Mother and Child Cohort Study (MoBa) and the Autism Birth Cohort, a study nested within MoBa. Preliminary analyses included 48,550 children (49% girls, born 1999-2009) with parent ratings of 15 social-communication skills at age 18 months (SD=0.55, range 15-29) and 36 months (SD=0.76, range 34-47). We included early-emerging skills (i.e., expected to be attained by 18 months) such as pointing and showing, from screeners for social-communication deficits in children. Prospectively-reported loss was defined as the reported absence at 36 months of any skills that were reported as attained at 18 months. Parents were also asked at 36 months to generally recall if their child had lost any social abilities. Follow-up questionnaire data were available for n=29,928 at 5 years and n=23,586 at 8 years. ASD diagnosis was available from the nationwide patient registry.

Results:

The majority of children (n=33,565, 69.13%) attained all social-communication skills by 18 months and maintained all at 36 months, while 17.67% (n=8,577) showed delayed attainment of at least one skill without any loss. Loss of at least one skill was observed in 13.20% (n=6,408). In contrast, few parents recalled any social loss ("yes":n=400, 0.83%; "not sure":n=590, 1.22%; missing n=83).

Correspondence between prospectively-reported and recalled loss was very low (kappa 0.02). Among parents who prospectively reported loss, only 2.03% (n=130) recalled a loss (an additional 3.16%, n=202, reported being "not sure"). Conversely, prospectively-reported loss was observed in 32.50% (n=130) of those who recalled a loss (34.24%, n=202, in the "not sure" group).

Prospectively-reported loss was associated with higher odds of a range of concurrent and later developmental delays (Fig.1-2), epilepsy (Fig.3), emotional and behavioral problems (Fig.4-5), functional impairments (Fig.6), and ASD symptoms and diagnosis (Fig.7).

Conclusions:

Loss of previously attained social-communication skills was prospectively reported for a substantial minority of children. However, these parents rarely recalled a general loss of social abilities, suggesting that rates of loss in retrospective studies may be underestimated.

Prospectively-reported loss was associated with later ASD symptoms and diagnosis, but also with neurodevelopmental problems not specific to ASD, highlighting the need to consider social-communication regression in a broader perspective. Repeated parent ratings of the same skill in prospective population-based cohorts may be valuable in increasing our understanding of the emergence of social-communication deficits in neurodevelopmental disorders.

Oral Session - 8B
Interventions - Non-pharmacologic - Preschool & Infant
154 - Early Intervention

2:40 PM - 3:30 PM - Willem Burger Hal

2:40 **154.001** Child Behavioral Outcomes from a Randomized Controlled Trial of Pivotal Response Treatment

G. W. Gengoux[1], *J. M. Phillips*[2], *C. Ardel*[1], *M. E. Millan*[2], *R. K. Schuck*[3], *T. W. Frazier*[4] *and A. Y. Hardan*[2], *(1)Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, (2)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (3)Psychiatry and Behavioral Sciences, San Jose State University, Palo Alto, CA, (4)Autism Speaks, New York, NY*

Background: Pivotal Response Treatment (PRT) is an evidence-based naturalistic behavioral intervention which is traditionally delivered via a parent training model. Support for its use in improving language abilities has historically come from single-case studies using primarily behavioral observation measures. There is a critical need for examination of objective outcome measures from larger samples. Furthermore, identification of behavioral factors which are associated with treatment response will be essential for individualizing treatment.

Objectives: This presentation will review behavioral outcomes from a randomized controlled trial comparing a Delayed Treatment Group (DTG) to a PRT package treatment (PRT-P) which combines parent training with clinician-delivered in-home treatment. Our aim is to highlight new data demonstrating how objective measures of social communication can be used to assess and predict treatment response in clinical trials.

Methods: Participants include 48 children with ASD and significant language delay, ages 2-5 years (M=46.3 ± 13 months). Children were randomly assigned to DTG or PRT-P, which involved weekly parent training and 10 hours per week of in-home therapist-delivered treatment for 3 months, followed by a less-intensive phase with 5 hours per week of in-home treatment and monthly parent training sessions. Dependent measures included ratings by trained raters blinded to treatment condition including functional verbal utterances [ICC (2,1) = 0.827] and parent fidelity of implementation [ICC (2,1) = 0.893] from Structured Laboratory Observation (SLO), Clinical Global Impression Improvement (CGI-I), as well as standardized parent questionnaires. Children in both groups continued stable community treatments during the trial (average of 9 hours/week in-home Applied Behavior Analysis).

Results: Examination of changes with PRT-P reveal that children in the active group demonstrated greater improvement between baseline (M=49.52 ± 32.1) and week 24 (M=70.57 ± 29.6) in frequency of functional utterances during the SLO compared to controls (BL: M=52.84 ± 24.6; Wk 24: M=54.16 ± 29.52; F(1,38)=4.517 p=0.040). Eighty-three percent of parents receiving PRT-P training met PRT fidelity of implementation criteria (80% fidelity) at week 24. Change in Total Utterances was significantly correlated with Parent Fidelity of PRT Implementation (r=.407, p=0.005). CGI-I ratings indicate that the PRT-P group showed more improvement in communication compared to controls (X^2(3, N=40)= 17.50; p=0.001). Specifically, 4 children were rated as very much improved (0 in DTG), 10 children rated as much improved (2 in DTG), 4 children rated as minimally improved (12 in DTG) and one child rated "no change" (5 in DTG). Stronger baseline social communication skill on SRS-2 was associated with greater improvement in total utterances by week 24 (r=-0.387, p=0.007).

Conclusions: These data suggest that the PRT package approach was effective in increasing functional communication skills and the majority of parents were able to learn PRT during the trial. Child treatment response was associated with parent fidelity and baseline social communication skill. Benefits and challenges of a combined parent training and clinician-delivered early intervention approach will be discussed, with a focus on factors which can predict an individual child's response to treatment and aid clinicians in personalizing care.

2:52 **154.002** Randomized Trial of Early Intervention for Spoken Communication in Autism Spectrum Disorder

C. Kasari[1], *T. Smith*[2], *R. Landa*[3], *S. Y. Shire*[4], *W. I. Shih*[1], *D. W. Mruzek*[2], *D. Herman*[5] *and D. Senturk*[6], *(1)University of California, Los Angeles, Los Angeles, CA, (2)University of Rochester Medical Center, Rochester, NY, (3)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (4)University of Oregon, Eugene, OR, (5)Kennedy Krieger Institute, Belcamp, MD, (6)UCLA, Los Angeles, CA*

Background: Applied behavior analysis interventions, including at least some discrete trial teaching (DTT), are often considered the standard of care for preschoolers with autism spectrum disorder (ASD) and limited language. DTT is a highly structured, adult-led teaching format that focuses on directly teaching sounds and words. A second category of approaches apply naturalistic, developmental behavioral interventions (NDBIs). These approaches focus on increasing social engagement by providing learning opportunities in the context of back-and-forth interpersonal interaction, often involving child-led play.

Objectives: To compare DTT to an empirically supported NDBI, the Interpersonal Developmental Approach (IDA) consisting primarily of JASPER.

Methods: Participants were 161 children with ASD, age 33-54 months at baseline, with limited language (<30 initiated spoken words during behavior observations). They were randomized to DTT (n=82) or IDA (n=79), and received one-hour intervention sessions five days per week for six months. Outcomes were assessed at baseline, end-of-treatment, and six-month follow-up. Outcome measures included the Reynell

Developmental Language Scales and the Mullen Scales of Early Learning (MSEL), both assessing expressive and receptive language, and the Early Social Communication Scales (ESCS), an observational measure of nonverbal communication behaviors, including frequency of initiations of joint attention (IJA). Generalized linear mixed models (GLMM) were fitted with log link function for count outcomes and identity link function for Gaussian outcomes. Hurdle models were used for Reynell expressive language and IJA; this model examined whether or not each participant displayed the behavior (binary process) and, if so, how many (zero-truncated Poisson process).

Results:

Children in both DTT and IDA significantly improved from baseline to post-intervention and follow-up.

Reynell receptive language yielded non-significant post-intervention and follow-up differences between groups, F(1,308)=1.06, p=0.305, and F(1,308)=1.62, p=0.204, respectively. For expressive language, there were no significant post-intervention or follow-up difference between groups in either the binary, F(1,162)=0.06, p=0.799, or the truncated Poisson model, F(1,162)=0.06, p=0.799. On the MSEL, children in both IDA and DTT demonstrated significant gains in both expressive and receptive language from baseline to post-intervention, F(1,304)=185.97, p<0.001, and F(1,304)=156.36, p<0.001, respectively, and follow-up, F(1,304)=339.37, p<0.001, and F(1,304)=353.0, p<0.001, respectively. There were no significant treatment differences between IDA and DTT in the rate of improvement in both expressive and receptive language from baseline to post-treatment, F(1,304)=0.23, p=0.635, and F(1,304)=0.86, p=0.354 respectively.

For IJA, there was no significant treatment or maintenance in the binary model, F(1,159)=0.07, p=0.793; however, IDA was superior to DTT in the truncated Poisson model, F(1,159)=4.44, p=0.037. Children who displayed IJA at baseline made greater improvement in IJA if they received IDA than if they received DTT.

Conclusions: Participants in both DTT and IDA improved, and the groups did not significantly differ on most outcome measures. IDA did produce larger gains in IJA for participants who already demonstrated some joint attention skills when they began intervention. The similar improvements observed in approaches that differ markedly in intervention content and method suggest that it may be advantageous to pinpoint efficacious components of each approach and identify ways to match components to the needs of individual children with ASD.

3:04 **154.003** Identifying Predictors of Successful Peer Engagement for Toddlers with Autism

__W. I. Shih__[1], S. Y. Shire[2] and C. Kasari[1], (1)University of California, Los Angeles, Los Angeles, CA, (2)University of Oregon, Eugene, OR

Background: Deciding how and when to combine interventions are everyday questions faced by community programs. Yet to date, intervention research provides few answers regarding how best to tailor individual children's programming. This study aims to respond to such questions posed by a community center-based program for toddlers with autism that offers two social communication interventions: a 1:1 social communication intervention (JASPER: Kasari et al., 2004) and adapted JASPER that includes a peer (jasPEER). It's possible that toddlers may need 1:1 intervention to best succeed in group jasPEER. This study aims to explore whether children's baseline skills may inform such questions.

Objectives: To explore predictors of successful peer engagement for children who received the jasPEER intervention in order to inform future services.

Methods:

Participants. Fifty toddlers (mean age 32.6 months, 80% male, and 84% minority) who received jasPEER were included.

Teacher-Child Interaction (TCX): Ten-minute teacher-child interactions were coded for children's time in engagement states: unengaged, person (e.g. engaged with another person only), object (e.g. engaged only with objects), joint engagement (e.g., notices teacher and shared activity). Verbal/nonverbal joint attention initiations (JA), and percentage of time in play levels (simple, combination, pre-symbolic, and symbolic) are also coded from the TCX.

Mullen Scales of Early Learning (MSEL): Expressive and receptive language subscales (age equivalency) were collected by independent assessors.

Peer Observation. Five-minute unsupported child-peer interactions were coded for engagement in 1 minute intervals. Children were considered "successfully engaged" with peers if they demonstrated awareness (parallel aware) or coordination of the peer (joint engagement) for at least 20% of time.

Results:

Random forest (Breiman, 2001), a machine learning technique, was used to identify potential predictors of successful peer engagement. While random forest has been shown to provide high level of prediction accuracy, the forest cannot provide objective decision rules or criteria needed to inform clinicians in determining which type of children would have successful peer engagement. Hence, decision rules were identified using the Classification and Regression Tree (CART: Breiman et al., 1984), a statistical learning technique designed to develop decision rules based on recursive partitioning of predictors, and generate cutoff values within predictors.

MSEL expressive language was the strongest predictor of successful peer engagement (accuracy 78%; p<0.001) where children who had >18.5 months of expressive language were more likely to show peer engagement while children who demonstrated <10% combination play were less likely to show peer engagement. Further, children who showed >10% combination play, and who spend less than 14% time object engaged are more likely to demonstrate peer engagement (accuracy 84%, p<0.001).

Conclusions: Expressive language remains the best predictor of peer engagement for toddlers with autism. However, the presence of functional play skills is also important. Children who struggled with basic combination play or who become overly focused on toys to the exclusion of others were less likely to share a play interaction with peers. Children with this profile may benefit from 1:1 intervention to ready them for peer interactions.

3:16 **154.004** Parent Training for Feeding Problems in Young Children with Autism Spectrum Disorder

C. R. Johnson[1], S. Hyman[2], K. Brown[3], L. Levato[4], C. A. Aponte[4], B. Schmidt[4], V. Evans[5], M. Brooks[6], H. Eng[6], T. Sax[6] and __T. Smith__[3], (1)Clinical and Health Psychology, University of Florida, Gainesville, FL, (2)Pediatrics, University of Rochester School of Medicine, Rochester, NY, (3)University of Rochester, Rochester, NY, (4)University of Rochester Medical Center, Rochester, NY, (5)University of Florida, Gainesville, FL, (6)University of Pittsburgh, Pittsburgh, PA

Background: Many children with autism spectrum disorder (ASD) have feeding problems including idiosyncratic food selectivity and food refusal, mealtime rituals, and disruptive behaviors at mealtime. Although preliminary evidence suggests that behavioral interventions can reduce these problems, the interventions have not been well tested in randomized clinical trials and are typically delivered in highly specialized settings (inpatient or day treatment centers) by feeding experts with little parental involvement or attention to nutrition. Reports have focused on short-term effects on specific target behaviors such as the number of bites that a child accepts, without systematically measuring nutritional sufficiency or parent perception of behavior. Given the prevalence of ASD, there is a great need for feeding interventions that are more widely available, efficient, cost-effective and capable of producing generalized improvements. Behavioral parent training may be a promising approach because of its success in managing other problem behaviors in children with ASD

Objectives: This three-site project (University of Florida, University of Rochester, University of Pittsburgh) further developed an alpha version of a 9-session, individually delivered manualized behavioral parent training program for feeding problems (PT-F) in children with ASD and conducted an initial test in a 20-week, randomized, waitlist controlled trial. PT-F is innovative in that it is time-limited, takes place in an outpatient setting with ongoing parent engagement, and involves an interdisciplinary collaboration of specialists

Methods: Forty-two young children with ASD were randomized in equal numbers to either PT-F or waitlist control. The sample was predominately male (95%) with a mean age of 5.2 years. The primary outcome measure was the Brief Autism Mealtime Behavior Inventory (BAMBI). Secondary outcomes included a rating by a blinded independent evaluator (Clinical Global Impression – Improvement; CGI-I) and the parent-rated About Your Child's Eating (AYCE), Irritability subscale of the Aberrant Behavior Checklist (ABC), and Home Situation Questionnaire (HSQ). All outcome measures were administered at baseline and Week 20. Wilcoxon rank-sum tests were calculated for continuous variables (BAMBI, ACYE) and chi-square tests for the categorical variable of responders (participants with CGI-I ratings of much or very much improved) vs. nonresponders (all other participants).

Results: Compared to children in the waitlist control, children whose parents participated in PT-F showed statistically significant reductions on the BAMBI (p = 0.007), AYCE (p = .004) and CGI-I (p =0.000). For the CGI-I, 48% of participants completing PT-F were responders compared to none in waitlist. However, overall disruptive and noncompliant behaviors were not decreased on the ABC-Irritability (p= 0.447) or HSQ (p = 0.179).

Conclusions: Our initial test of efficacy of PT-F in a small RCT yielded promising results on key outcome measures of feeding, eating and mealtime behaviors. Parents reported improvement in their child's mealtime behaviors and eating habits. In addition, an independent evaluator, masked to treatment group, rated many children in the PT-F group as improved compared to none of the children in the waitlist group. The encouraging outcomes in this small RCT support further investigation in a larger, definitive trial that is powered to explore predictors and moderators.

Oral Session - 9A
Early Development (< 48 months)
155 - Early Language Development
1:45 PM - 2:35 PM - Jurriaanse Zaal

1:45 **155.001** Synchrony at 15 Months, Children's Risk Status, and the Relationship to Later Language Ability at 24 Months.

H. L. Fipp-Rosenfield[1]*, A. C. Dowd*[2]*, B. G. Davidson*[3] *and A. R. Neal-Beevers*[2]*, (1)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (2)The University of Texas at Austin, Austin, TX, (3)Pediatrics, University of Miami Miller School of Medicine, Miami, FL*

Background: Synchrony is defined as the degree to which parent nonverbal and verbal communication follows their child's focus of attention and action during play (Siller & Sigman, 2002). It has been established that early synchrony in the mother-infant dyad plays a supportive developmental role in later language and communication abilities (Yirmiya et al., 2006). It has also been observed that the use of gesture in the mother-infant dyad has a positive influence on infants' later language abilities (Iverson et al. 2005). However, it is unclear how these developmental relationships vary across children at high-risk (HR) and low-risk (LR) for autism spectrum disorders (ASD).

Objectives: In this study, we hypothesized that mother-infant synchrony at 15 months would be positively associated with 24-month vocabulary scores. We also hypothesized an interaction between synchrony and risk, such that the influence of synchrony on vocabulary development will be weaker in HR infants.

Methods: 13 HR and 15 LR infants and their mothers were recruited as part of a larger longitudinal study. During their 15-month visit, each mother-infant dyad engaged in a 15-minute unstructured play session with a standardized set of toys. The video-recorded play sessions were coded for synchrony yielding the proportion of: (1) maternal indicating behaviors (e.g., pointing, showing, etc.) synchronized with infant's attention (MS1), (2) maternal utterances synchronized with infant's attention (MS2), and (3) maternal utterances synchronized with infant's attention & action (MS3; Siller & Sigman, 2002). Twenty percent of all videos were randomly selected and double-scored to establish ongoing interrater reliability. Intraclass correlations suggested excellent reliability (α = .86 - .98). Child expressive vocabulary was assessed at 24 months using the MacArthur-Bates Communicative Development Inventories: Words and Sentences Long Form (MCDI; Fenson et al., 2007).

Results: Hierarchical regression equations were used to predict language from: (1) gender (2) risk status, (2) synchrony and (3) risk by synchrony interaction. Separate regression equations were conducted for each language outcome and each synchrony predictor (see Table 1). Results of the regression analyses revealed that the model using MS2 to predict the number of words reported on the MCDI (MCDI_Number) approached significance and the model using MS3 to predict MCDI_Number was significant, accounting for 27% and 33% of the variance in MCDI_Number, respectively. In both models, gender was a significant predictor such that being female predicted higher MCDI_Number. Furthermore, MS3 predicted higher MCDI_Number. A marginally significant interaction suggested that the predictive relationship between MS3 and MCDI_Number was stronger for LR infants. Similar direction interactions were observed in other models, although none were statistically significant (see Figure 1).

Conclusions: Preliminary data from this prospective study support previous findings linking stronger mother-infant synchrony to enhanced language development. Specifically, we found that infants who were female and whose mother-infant interaction was characterized by greater verbal synchrony at 15 months had larger expressive vocabularies at 24 months. These preliminary findings also point to a possible interaction between verbal synchrony and risk status, such that the relation between synchrony and expressive language appears stronger for LR compared to HR infants.

1:57 **155.002** Is Early Verbal and Nonverbal Language Gain Related to Autism Spectrum Disorder' Symptomatology in Infants at Risk?

M. Franchini[1], *E. Duku*[2], *V. Armstrong*[3], *J. A. Brian*[4], *S. E. Bryson*[5], *N. Garon*[6], *W. Roberts*[7], *C. Roncadin*[8], *L. Zwaigenbaum*[9] *and I. M. Smith*[10], *(1)Dalhousie University / IWK Health Centre, Halifax, NS, Canada, (2)McMaster University, Hamilton, ON, Canada, (3)IWK Health Centre / Dalhousie University, Halifax, NS, Canada, (4)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (5)Dalhousie University, Halifax, NS, Canada, (6)Mount Allison University, Sackville, NB, Canada, (7)isand, Toronto, ON, Canada, (8)Autism Spectrum Disorder Service, McMaster Children's Hospital - Hamilton Health Sciences, Hamilton, ON, Canada, (9)University of Alberta, Edmonton, AB, Canada, (10)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA*

Background: Early communication impairment represents one of the most-reported early concerns in parents of young children with autism spectrum disorder (ASD). Moreover, verbal and nonverbal communication impairments are strongly associated with ASD symptomatology from the first years of life. Trajectory groups were examined in siblings at high risk (HR) for ASD and in children at low risk (LR) during the two first years, a period in which word and gesture learning show substantial gains and considerable intra-individual variability.

Objectives: We first aim to define distinct developmental trajectories for early language and gesture acquisition in siblings at HR for ASD and in LR children using an extensive parent-report questionnaire. Our second purpose is to identify early predictors and clinical and cognitive outcomes related to the derived trajectory groups based on verbal and nonverbal communication gains.

Methods: We used Group Based Trajectory Models (GBTM) to derive early communication trajectory groups. Data for language (expressive and receptive) and gesture acquisition were collected with the MacArthur Communicative Development Inventory-Infant Form (M-CDI) at 9, 12, 15, 18, 21 and 24 months of age. The sample was composed of 660 HR and LR infants (482 HR siblings, 361 males in the total sample). Clinical and cognitive measures were also collected before and after this period (at 6 and 36 months respectively). Predictors and outcomes were further examined according to the trajectory groups derived for each of the three measures. Finally, membership in each trajectory groups was analyzed with regard to the diagnostic outcome at 36 months.

Results: Analysis revealed three distinctive trajectory groups for the receptive language and gesture gain measures, and two groups for the expressive language acquisition measure. Pairwise comparisons between trajectory groups for the estimates of quadratic slope revealed significant differences for all comparisons (all p<.001) except for slopes 1 and 2 for gestures (p=.14). Intercepts for verbal expression and gestures did not differ significantly between trajectories (all p>.17), except for receptive language (all p<0.01). For each measure (expressive language, receptive language, and gestures), assigned trajectory groups were strongly related to clinical and cognitive outcomes. Children with an ASD diagnosis were less likely to be in the trajectory groups with the fastest language/gesture acquisition for all three measures. Clinical and cognitive measures at 6 months predicted trajectory group membership for receptive language and gesture gains. Global motor functioning was the only predictor for expressive language trajectory membership.

Conclusions: Our results confirm substantial variability in communication gains in the early development of both HR and LR infants. The results also suggest that this variability predicts further ASD symptomatology and is related to very early risk factors. Beyond communication-related behavioral features, predictors include motor skills and cognitive functioning. The current study has clinical implications in pointing out relevant language-related targets for early intervention.

2:09 **155.003** Preliminary Report: Predicting Expressive Language Abilities at Age 2 from Fine-Grained Infant Vocalization Codes at 12 Months

A. Faggen[1], *S. Plate*[1], *J. Brown*[1], *N. Libster*[2], *R. F. Slomowitz*[3], *J. Wood*[1], *J. Maldarelli*[3], *J. Pandey*[1], *R. T. Schultz*[1], *J. Parish-Morris*[1] *and .. The IBIS Network*[4], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (3)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)University of North Carolina, Chapel Hill, NC*

Background: Language delays and differences are evident as early as 12 months of age in children who ultimately develop autism spectrum disorder (ASD; Lazenby et al., 2016). To evaluate emergent language in young infants, clinicians use tools like parent report measures, semi-structured observations, and standardized assessments. In this project, we developed a finer-grained method of vocalization coding during infancy and toddlerhood that we hope will contribute to existing models of early language development. Accurate models are especially important for high-risk infant populations, as divergence from the expected trajectory can highlight potential treatment targets. In this preliminary report, we examine whether fine-grained vocalization coding at 12 months of age adds value to standardized test scores, when predicting expressive language abilities 1 year later.

Objectives: Determine whether vocalization coding adds significant explanatory variance to models of language ability from 12 to 24 months, in a sample of children at high- and low-risk of developing ASD.

Methods: Thirty-six children were assessed at 12 and 24 months as part of a longitudinal study of brain development (IBIS; Estes et al., 2015). The first group had an older sibling with ASD and were ultimately diagnosed with ASD (HR-ASD, N=10, 1 female). The second group had an older sibling with ASD but did not receive an ASD diagnosis (HR-neg, N=14, 6 female). The third group had a typically developing older sibling and were not diagnosed with ASD (LR-, N=12, 3 female). At each time point, participants were administered the Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 2002), and Mullen Scales of Early Learning (MSEL; Mullen, 1995). Reliable annotators blind to risk status segmented and coded videotaped administrations of the CSBS at 12 months, and categorized infant vocalizations as speech- or speech-like (e.g., babbles, words) or non-speech (e.g., growls, squeals). The relative duration of speech- vs. non-speech vocalizations was explored as a potential predictor of language ability at 24 months (MSEL Expressive Language t-scores).

Results: After controlling for 12-month MSEL Expressive Language t-scores, the relative duration of speech- or speech-like vocalizations (vs. non-speech vocalizations) during the CSBS at 12 months accounted for significant additional variance (ΔR^2) in 24-month Expressive Language ability, $\Delta F(1,33)=4.51$, $p=.04$, $\beta=.30$. Overall, the combined model accounted for 34% of the variance in 24 month scores, $F(2,24)=18.59$, $p<.001$. Adding information about 12-month CSBS scores (total scores and standard scores for speech, communication, and words subdomains) did not significantly improve model fit, $\Delta F(4,28)=.59$, $p=.67$.

Conclusions: The results of this preliminary exploration suggest that fine-grained vocalization coding in a heterogeneous sample adds additional explanatory variance to language predictions from 1 to 2 years of age, above and beyond what can be learned from standardized assessments. Our next steps are to increase our sample size, and include an additional time point with vocalization coding (6 months) to test the power of change in speech-like vocalizations from 6 to 12 months to predict 24-month language ability within separate diagnostic/risk groups.

2:21 **155.004** High-Dimensional Gesture Coding for Use in Prospective Gene-Brain-Behavior Studies of ASD

N. Libster[1]*, J. Brown*[2]*, S. Plate*[2]*, A. Faggen*[2]*, R. F. Slomowitz*[3]*, J. Wood*[2]*, J. Maldarelli*[3]*, J. Pandey*[2]*, R. T. Schultz*[2]*, J. Parish-Morris*[2] *and .. The IBIS Network*[4]*, (1)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)University of North Carolina, Chapel Hill, NC*

Background: Early gestures predict later social communication skills, including language, prosocial behavior, and peer play (Mundy et al., 1990; Sigman & Ruskin, 1999), and infants and toddlers with autism spectrum disorders (ASD) display gesture impairments by 12 months of age (Wetherby et al., 2007). Siblings of children with ASD, who are at heightened risk for developing an autism spectrum disorder, also demonstrate social communication deficits, often in a mild form (Yirmiya et al., 2006). However, most children with ASD are not diagnosed until ~4 years old (CDC, 2016). Research on social communication deficits in children under three therefore has important implications for improving early identification. In addition, gene-brain-behavior research has been hindered by behavioral metrics that are insufficiently granular. In this exploratory study, we compare fine-grained communicative gesture codes in 2-year-old children at high familial risk for ASD who received a diagnosis (HR-ASD), to those at high risk that did not receive a diagnosis (HR-neg), and those at low risk who did not develop ASD (LR-).
Objectives: Determine whether high-dimensional gesture coding of the Communication and Symbolic Behavioral Scales (CSBS; Wetherby & Prizant, 2003) differentiates diagnostic/risk groups in overall gestures, and in subcategories of behavior regulation, joint attention, and social gestures.

Methods: Trained clinicians administered the CSBS to 44 2-year-olds (LR-: 22, 6 female; HR-neg: 11, 4 female; HR-ASD: 11, 1 female) participating in the longitudinal Infant Brain Imaging Study (IBIS; Estes et al., 2015). Videos were segmented and coded for CSBS communicative gestures by 4 independent annotators. Coders were not informed of participant diagnostic status, and all coding discrepancies were resolved by consensus. Single gestures were summed into groups: Behavior Regulation (give, reach, open hand), Joint Attention (point, show), and Social Interaction (wave, high five, nod head, shake head).

Results: Overall gestures per 10 minutes differentiated the HR-ASD group from the LR- and HR-neg groups (*p*s<.001, Fig.1), but did not differentiate the LR- and HR-neg groups from each other. The same pattern was evident in the Behavior Regulation and Joint Attention subcategories (*p*s<.01). In the Social category, gestures per 10 minutes differentiated the LR- group from the HR-ASD group (*p*<.05), but did not distinguish the HR-neg group from the other two groups.

Conclusions: This project lays the foundation for dimensional gesture coding that can be used in genetic and imaging research, as well as to track developmental change and treatment response. Of note, our study does not address the issue of how gestures are defined and conceptualized. Although we were able to code over 1,700 individual gestures, they may fail to capture the full extent of communicative gestures in children with ASD. In addition, we only coded fully formed gestures – developing and partially formed gestures were coded in the “other” category; our findings may therefore not capture children’s emerging skills. Our next steps include distinguishing between gestures that do and do not carry communicative intent, increasing our sample size, and coding gestures in the same infants at 12 months for use in longitudinal analyses.

Oral Session - 9B
Early Development (< 48 months)
156 - Early Screening - New Methods / Approaches
2:40 PM - 3:30 PM - Jurriaanse Zaal

2:40 **156.001** Diminished Rate of Response to Name in Autism Spectrum Disorder: Using a Smartphone Application to Provide a Quantitative Measure of Behavior

R. P. Thomas[1]*, W. Guthrie*[1]*, L. A. Wang*[1]*, J. Miller*[2]*, W. Struebing*[2]*, J. W. Pennington*[3] *and J. S. Miller*[1]*, (1)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Department of Biomedical and Health Informatics, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)Department of Biomedical and Health Informatics, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Previous research suggests that children with autism spectrum disorder (ASD) show limited response to their name, though they may orient easily to other sounds (Dawson et al., 2004). A child’s response to name (RtN) is included in most screening and diagnostic tools because of its high sensitivity as an early indicator of ASD (Miller et al., 2017). However, current measures of RtN rely on parent report that only allows for yes/no ratings or on brief clinical observation of 1-5 name calls. A quantitative measure of RtN can provide information on the *rate* of response, which may improve screening or help us measure treatment response.
Objectives: To use a novel smartphone application to systematically measure RtN within a child’s natural environments and to generate a quantitative measure of a child’s rate of RtN.

Methods: Participants were parents of 83 children between 18-48 months (*M*= 35.68 months, *SD*= 8.82), reported to have a diagnosis of ASD (n=29), a developmental delay/disorder (DD; n=24), or typical development (TD; n=30). Through the RtN app, parents were instructed to complete up to 30 name call trials over 1-2 weeks. The app prompted parents to stand 5 feet behind the child, call the child’s name, and then rate yes/no on the app to indicate whether the child responded to his/her name. Parent ratings and video recordings of the child’s response were both collected through the app, allowing the team to examine parent accuracy. Cumulative rate was calculated after 1-5, 10, 15, and 20 trials.

Results: Rate of RtN plateaued near 15 trials for all groups (Fig. 1). Significant group differences were not observed in the first trial; ASD, DD, and TDC groups showed similar rates of response (77%, 97%, and 92% respectively), suggesting that a small number of trials may not be sufficient for detecting statistically significant differences in RtN. After 3 trials, the ASD group showed a significantly lower rate of RtN than the TDC group (62% vs 84%, *p*=.02), though differences for the DD group (79%) were not significant. Significant differences between the ASD and DD groups did not emerge until 10 trials (50% vs 73%, *p*=.005), and remained through 20 trials (*p*=.007).

Conclusions: Results indicate that one name call trial was not sensitive enough to detect group differences; most (77%) children with ASD responded to the first trial. In fact, none of the children with ASD showed a complete lack of response to name, as the average response rate after 20 trials was ~50%. Instead, differences were observed in the ASD group's *rate of response* rather than whether a child responded to an individual bid. These results, and use of a smartphone app to generate quantitative data, have important implications for how RtN is measured during clinical observations and through parent report questionnaires. A scalable measurement tool, such as this app, could open new horizons to community-based studies of ASD by providing a feasible way to screen large samples and identify infants at risk of developing ASD because of a low RtN rate.

2:52 **156.002** What Happens after Early Autism Screening? Factors That Predict Evaluation Attendance

R. K. Ramsey[1]*, J. Donelan*[2]*, T. Hamner*[3]*, D. A. Fein*[2]*, L. B. Adamson*[4] *and D. L. Robins*[5]*, (1)Georgia State University, Atlanta, OH, (2)Psychological Sciences, University of Connecticut, Storrs, CT, (3)AJ Drexel Autism Institute, Philadelphia, PA, (4)Psychology, Georgia State University, Atlanta, GA, (5)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

Background: Autism spectrum disorder (ASD) can be detected in toddlers prior to 24 months (Baranek et al., 2009, Pierce et al., 2011), which helps families access early intervention. However, age of diagnosis and participation in follow-up can differ by screening age, sex, race, ethnicity, and maternal education (Dietz et al., 2007, Giarelli et al., 2010, Khowaja et al., 2015, Mandell et al., 2009).
Objectives: This study examines evaluation attendance by parents of toddlers who screened at-risk for ASD at 12, 15, or 18 months, and analyzes the relation between evaluation attendance and demographic factors.

Methods: The sample included 710 (M_{age}=15.95 mos, *SD*=2.76) toddlers who screened at-risk for ASD at well-child visits. Children were screened at 12 months (Infant Toddler Checklist (ITC) and First Year Inventory-Lite (FYI-L)); 15 months (FYI-L and Modified Checklist for Autism in Toddlers, Revised, with Follow-Up (M-CHAT-R/F)); or 18 months (M-CHAT-R/F). Pediatrician ASD concerns also denoted risk at each age. Parent-reported demographics included the child's sex, race, ethnicity, and mother's education. Families of at-risk children were invited for a free evaluation that resulted in a diagnosis of ASD, other developmental disorders (DD) or no diagnosis (ND).

Results: There was a significant difference in evaluation attendance between age groups: 30.9% attended at 12 months, 19.1% attended at 15 months, and 35.3% attended at 18 months, $\chi^2(2, N=710)=17.20$, $p<.001$. Evaluation attendance did not differ between males (30.2%) and females (28.7%), $p=.378$, or between low (28.9%) and high (29.8%) maternal education groups, $p=.438$. However, significantly more minority race families (34.9%) attended evaluations compared to White families (27.4%, $\chi^2(1, N=597)=3.89$, $p=.030$), and significantly fewer Hispanic/Latino families (25.2%) attended compared to non-Hispanic/Latino families (35%, $\chi^2(1, N=518)=4.82$, $p=.017$). Across age groups, 203 children completed an evaluation ($N_{ASD}=51$, $N_{DD}=90$, $N_{ND}=62$). There were significant differences in diagnoses across age groups, $\chi^2(4, N=203)=36.93$, $p<.001$. At 12 months, 23.7% were ASD, 32.2% were DD, and 44.1% received ND. At 15 months, 4.3% were ASD, 43.5% were DD, and 52.2% received ND. At 18 months, 35.7% were ASD, 52% were DD, and 12.2% received ND.

Conclusions: Overall, attendance was lower than expected, although not inconsistent with research examining screening prior to 18 months (Dietz et al., 2007). Race and ethnicity related to evaluation attendance. Lower income and minority families often experience barriers to care (Liptak et al., 2008), and thus may have a greater need for accessible resources, making them more likely to attend a free evaluation. Hispanic/Latino families may be less likely to attend due to concern for language barriers (Zuckerman et al., 2009). Attendance seemed most impacted by screening age, with parents less likely to attend at 15 months compared to 12 or 18 months. Parents and pediatricians may have had less confidence in 15 month screen positive results, leading to lower attendance rates. Differential rates of diagnosis by age suggest lower accuracy in screening at 15 months: only 4.3% of at-risk 15-month-olds met criteria for ASD and a majority had no diagnosis. Future research may be able to refine screening thresholds at 15 months.

3:04 **156.003** Phenoscreening: A Developmental Approach to Rdoc-Motivated Sampling

J. T. Elison*, University of Minnesota, Minneapolis, MN*

Background: The Research Domain Criteria (RDoC) initiative has formalized research strategies for parsing the heterogeneity/variability inherent to the etiology, phenotypic presentation, and treatment response of major psychiatric disorders, but has not effectively integrated developmental considerations. Identifying multi-dimensionally-determined profiles of risk via data driven computational approaches represents one potential avenue to 1) improve early identification of at-risk phenotypes and 2) select unbiased samples for various research questions.
Objectives: The primary objective of this research is to derive multiple "high-risk" phenotypes, while remaining agnostic to traditional DSM categories, by leveraging multiple dimensional constructs and a data-driven computational strategy during a developmentally sensitive period. A secondary aim is to verify the prognostic utility of the risk profiling approach.

Methods: Parents of 17-25 month-old toddlers (n = 1570), drawn from a community-based sample, completed the MCDI, the Video-Referenced Rating Scale for Reciprocal Social Behavior (vrRSB; Marrus et al., 2015), and the Repetitive Behavioral Scales for Early Childhood (RBS-EC; Wolff, Boyd, & Elison, 2016). To identify discrete developmental phenotypes, we used factor mixture modeling (FMM), a statistical method for parsing population heterogeneity that identifies groups of empirically testable entities (i.e., latent classes). Statistically, FMM mixes factor analysis, used to estimate unobserved continuous variables, with latent class analysis, used to estimate latent categorical groups. Conceptually, FMM is a person-centered statistical approach that focuses on similarities and differences among profiles to identify homogenous subgroups of individuals, with each subgroup possessing a unique set of characteristics that differentiates it from other subgroups. To validate the predictive utility of these risk profiles, a subsample of toddlers (n = 107) was assessed on a distal, independent outcome (the Infant Toddler Social Emotional Assessment; ITSEA) at an average of 10 months after the initial assessment.

Results: FMM results, based in part on 2 factors derived from seven dimensional manifest variables, identified five asymmetrically sized subgroups (ranging from n = 4 to n = 1230). One percent of the sample (17/1570), captured by two subgroups, was characterized by increased repetitive behaviors and social communicative impairments. An additional 5% of the sample fell into a nominally moderate risk group (79/1570), whereas the remaining toddlers fell into 2 nominally low-risk clusters. Follow-up analyses on a subsample of 107 infants confirmed the predictive validity of the risk profiles, showing significant differences between high-, moderate-, and low-risk groups on internalizing, externalizing, and dysfunctional behavior as assessed by the ITSEA. Comparison of high- and low-risk groups revealed large effect sizes for internalizing (d = 1.39), externalizing (d = 0.83), and dysregulation (d = 1.87).

Conclusions: A data-driven computational approach yielded 5 homogenous subgroups of n = 1570 community-ascertained toddlers, the clinical utility of which was corroborated by outcomes measured longitudinally. Data-driven approaches, leveraging multiple developmentally appropriate dimensional/quantitative constructs holds promise for future efforts aimed toward early identification of at-risk-phenotypes. Further, we expect this method to inform a more personalized approach to clinical recommendation/intervention, as compared to the binary approach of traditional screening/sampling schemes.

3:16 **156.004** A Multimedia Screening System to Predict ASD Symptoms in Diverse Community Settings: Preliminary Convergent and Concurrent Validity

S. Macari[1], *K. Chawarska*[1], *M. Wilkinson*[1], *E. Barney*[2], *J. C. Snider*[3], *E. S. Kim*[4], *Q. Wang*[1], *Q. A. Yang*[3], *C. A. Wall*[5], *B. Li*[3,6], *M. Mademtzi*[1], *C. Foster*[1], *D. Macris*[1], *F. E. Kane-Grade*[7], *A. Milgramm*[8], *P. Heymann*[1], *E. Hilton*[1], *A. Zakin*[1], *H. Neiderman*[1], *K. Villarreal*[1], *K. K. Powell*[1], *S. Fontenelle*[1], *M. Lyons*[1], *A. Giguere Carney*[1], *K. Bailey*[1], *M. Kim*[3], *Y. A. Ahn*[3], *M. C. Aubertine*[9] *and F. Shic*[2], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Seattle Children's Research Institute, Seattle, WA, (4)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (5)Department of Psychology, University of South Carolina, Columbia, SC, (6)Computer Science and Engineering, University of Washington, Seattle, WA, (7)Boston Children's Hospital Labs of Cognitive Neuroscience, Boston, MA, (8)Center for Autism and Related Disabilities, Albany, NY, (9)Seattle Children's Hospital and Research Institute, Seattle, WA*

Background:

Earlier identification of ASD leads to earlier, more effective treatment. Many infants and toddlers with ASD would not be identified, however, without formal screening (Miller et al., 2011). ASD-specific screening, increasingly routine in well-child pediatric visits (Arunyanart et al., 2012), may benefit from new generations of tools that improve accuracy in the youngest children and decrease time burden. Furthermore, disparities exist in screening accessibility in racially- and economically-diverse populations (Herlihy et al., 2011). Electronic multimedia applications can provide remote administration of video illustrations to improve clarity, usability, and accessibility across diverse cultural and socioeconomic groups. The Yale Adaptive Multimedia Screeners (YAMS-One and YAMS-Toddler) were developed to fill these needs.

Objectives:

To evaluate preliminary convergent and concurrent validity in a pilot of the YAMS system in multiple community pediatric primary care sites.

Methods:

200 families from three urban community pediatric locations and 48 families attending a research clinic participated by completing age-appropriate versions of the YAMS via iPad: 1) the YAMS-One (for 10-16-month-olds; n=51 community infants, M_{age}=14m) along with a text-only version of the Communication and Symbolic Behavior Scales Infant-Toddler Checklist (CSBS-ITC; Wetherby & Prizant, 2002); or 2) the YAMS-Toddler (for 17-33-month-olds; 149 community toddlers, 48 research clinic toddlers, M_{age}=26m) accompanied by a text-only version of the M-CHAT-Revised/Follow-Up (Robins et al., 2014). Children in the research clinic sample were concurrently administered the ADOS-2 Toddler Module. The community sample was racially- and ethnically-diverse (88% non-white, 44% Hispanic) with a range of SES backgrounds: 51% of mothers had a high school degree or less. The research clinic sample was less diverse (20% non-white; 22% Hispanic) and more highly-educated (87% of mothers had a college degree or more). We used Pearson's r to examine associations between the YAMS-One/CSBS-ITC scores and the YAMS-Toddler/M-CHAT-R/F scores, respectively, to test preliminary convergent validity. To examine concurrent validity, Pearson's r measured the relationship between YAMS-Toddler scores and ADOS-Toddler Social Affect scores.

Results:

Pearson correlations showed high positive correspondence between YAMS-Toddler scores and M-CHAT-R/F final scores in both community (*r*(149)=.617, *p*<.001) and research clinic samples (*r*(48)=.825, *p*<.001). YAMS-One scores were marginally associated with CSBS-ITC Composite Scores, including Social Composite (*r*(51)=-.245, *p*=.08) and Symbolic Composite (*r*(51)=-.248, *p*=.08) but not Speech Composite (*p*=.66) in the community sample. In the research clinic sample, there was a significant correlation between YAMS-Toddler scores and ADOS SA scores (*r*(46)=.662, *p*<.001).

Conclusions:

Results suggest good convergent and concurrent validity for YAMS-Toddler in both diverse community samples and research clinic samples. YAMS-One (infant version), was only modestly associated with CSBS-ITC scores. The latter is a broadband screener for social-communication delays, while the YAMS-One taps into attention and emotion regulation constructs as well as social communication, all of which may characterize prodromal symptoms of ASD around the first birthday. Longitudinal follow-up will yield information on the predictive power of the YAMS-One for later autism severity. The YAMS system shows promise as a valid ASD screener that capitalizes on modern technology to enable more efficient screening, using video supports to broaden accessibility across socioeconomic and cultural barriers.

Oral Session - 10A
Medical and Psychiatric Comorbidity
157 - Suicide and Bullying in ASD
1:45 PM - 2:35 PM - Arcadis Zaal

1:45 **157.001** Emotion Reactivity and Bullying in Adolescent Boys with Autism; Bi-Directional Longitudinal Outcomes

C. Rieffe[1], *S. Novin*[2] *and E. Broekhof*[1], *(1)Leiden University, Leiden, Netherlands, (2)Utrecht University, Utrecht, Netherlands*

Background: Bullying is a worldwide concern for everyone involved. Bullying involves repeated and intentional harm to someone over a longer period of time, causing long-lasting negative effects on the victim's mental health and social development, but in fact, everyone involved is negatively affected, including the bully. Adolescents with autism are more often involved in bullying than adolescents without autism, and although emotional functioning is important in this respect, we do not yet know the causality of these relationships.

Objectives: Fear is more often related to victimization in normal development, but we found that anger was more dominant in victims with autism in an earlier, cross-sectional study. In this study, we longitudinally examined these relationship again, to establish their causality. Based on parents' feedback and clinical observations, we expected that more victimization in adolescents with autism could cause a stronger anger reaction, since it seems that trying to gain control over socially difficult and unpleasant situations often causes an uncontrollable emotional arousal.

Methods: A total of 185 adolescent boys (89 with autism) were tested, age range was 10 to 15 years old. The participant filled out self-report questionnaires on Bullying, Emotion Reactivity (from which we only used the scales for Anger and Fear). Background information was derived from their parents and schools. Informed consent for participation was provided by all parents and participants.

Results: In order to examine the contribution of emotions on Bullying and Victimization and vice versa, General Linear Model (GLM) analyses with clustered bootstrapping were performed. The outcomes showed that being bullied caused higher levels of shame and fear in boys with and without autism, but also more anger in boys with autism specifically. Higher levels of anger, in turn, caused more victimization in both groups. More fear contributed more strongly to more victimization in boys without autism.

Conclusions: The outcomes of this longitudinal study show a bidirectional relationship between emotion reactivity and victimization in adolescents boys with and without autism. Adolescents who are more bullied, develop more negative emotions, anger and fear, over time, which may not come as a surprise. Unfortunately, however, these stronger levels of negative emotions can, in turn, be a trigger for bullies who now see that their bullying is effective. Consistent with the literature on adolescents from a community population, fear is the most dominant emotion related to bullying. Yet, adolescents boys with autism seem to predominantly react with anger when being bullied, supporting the viewpoint that socially unpleasant situations cause uncontrollable arousal. These new insights might offer important strategies for prevention and anger management in adolescents with autism.

1:57 **157.002** Suicide Screening in Neurodevelopmental and Autism Clinics: Early Data and Implications

S. Rybczynski[1,2], *P. H. Lipkin*[3,4,5] *and R. A. Vasa*[6], *(1)Kennedy Krieger Institute, Baltimore, MD, (2)Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, (3)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD, (4)Johns Hopkins University School of Medicine, Baltimore, MD, (5)Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, (6)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD*

Background: Children and adults with neurodevelopmental disabilities, including autism spectrum disorder (ASD), are reported to be at increased risk for suicidality. However, no studies have screened for suicidal ideation in this population when presenting to outpatient clinics. In 2015, The Joint Commission, an international healthcare accreditation organization, issued a "Sentinel Event Alert" mandating health care facilities to implement suicide screening in all healthcare settings. This study presents preliminary data on suicide screening in medical outpatient clinics at The Kennedy Krieger Institute, a large university-based center for neurodevelopmental disabilities.

Objectives: (1) To determine the overall rates of past suicidal ideation, prior suicide attempts and current suicidal ideation in individuals presenting to 27 distinct outpatient neurodevelopmental medical clinics (2) To compare rates of suicidality in patients with ASD to patients with other neurodevelopmental conditions.

Methods: All individuals greater than 9 years of age were screened during August and September 2017. There was no upper age limit for screening. Suicide screening instruments included the "Ask Suicide Screening Questions" (ASQ) (ages 9 to 18 years) and the "Ask Suicide-Screening Questions to Everyone in Medical Settings" (ASQ'em) (over age 18 years). Nurses performed the screenings during the initial intake. Patients and caregivers were given the option to opt out of the screening. Patients or their caregivers could respond to the questions. We reviewed results for patients presenting to all clinics. We then compared patients presenting to autism and related disorders clinic with those presenting to the center for development and learning, and neurology and developmental medicine clinics. The latter two clinics collectively see patients with a variety of neurodevelopmental disorders, including ADHD, intellectual disability, learning disabilities, epilepsy and other neurological diagnoses.

Results: A total of 2054 patient visits were eligible for suicide screening. Patients were screened at each visit. A total of 522 (25.4%) of the 2054 eligible patients declined screening. Of those screened in all clinics (1532 distinct visits), 99 (6.5%) screened positive for past or present suicidal ideation or prior attempted suicide, and 1433 (93.5%) were negative screens. In our autism clinic, 317 patients were eligible for screening and 106 (33.4%) declined screening. Among those who were screened (211 patients), 29 (13.7%) had positive screens and 182 (86.3%) negative screens.Of the 555 patients eligible for screening in the center for development and learning, 101 (18.2%) declined screening. Of the patients screened (454 patients), 23 (5.1%) screened positive and 431 (94.9%) screened negative.In the neurology and developmental medicine clinic, 237 patients were eligible for screening of which 72 (30.4%) declined screening. Of the patients screened (165 patients), 9 (5.5%) screened positive and 156 (94.5%) had negative screens.

Conclusions: Individuals with neurodevelopmental disabilities are at risk for suicidal ideation. In our sample, patients with ASD had higher rates of suicidality compared to patients with developmental and neurological conditions. A substantial number of individuals declined screening. Further studies are needed to determine outcomes for patients who screen positive and examine reasons for why screening was declined.

2:09 **157.003** Suicidality and Familial Liability for Suicide in Autism: A Population Based Study

T. Hirvikoski[1], *M. Boman*[1], *Q. Chen*[1], *B. D'Onofrio*[1], *E. Mittendorfer-Rutz*[1], *P. Lichtenstein*[1], *S. Bolte*[2] *and H. Larsson*[3], *(1)Karolinska Institutet, Stockholm, Sweden, (2)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (3)School of Medical Sciences, Örebro University, Örebro, Sweden*

Background: Studies on the individual risk and familial co-aggregation of suicidal behaviour in autism spectrum disorder (ASD) are lacking.

Objectives: This study aimed to explore the gender specific risk of suicide attempt and suicide in ASD individuals with (ASD+ID) and without intellectual disability (ASD-ID), as well as the potential role of familial liability.

Methods: Swedish national registers were used to conduct a matched case-cohort study applying conditional logistic regression models. We identified 54168 individuals with ASD (ASD-ID n = 43570; ASD+ID n = 10598) recorded from January 1, 1987, to December 31, 2013, and 270840 controls matched for gender, age and residential information. We also compared risk of suicidal behaviour at three levels of family relatedness in 348192 relatives of individuals with ASD and 1740960 matched control relatives.

Results: Individuals with ASD-ID had an increased risk of both suicide attempt and suicide, even after adjustment for depression and attention-deficit hyperactivity disorder (ADHD). Females with ASD-ID had higher risk of suicide attempt and suicide as compared to males with ASD-ID. The risk was also increased in ASD+ID group regarding both attempted suicide and suicide, although to a lesser degree as compared to ASD-ID group. In comparison to controls, relatives of individuals with ASD had an increased risk of suicidal behaviour. First-degree relatives of individuals with ASD had significantly higher risk estimates of suicidal behaviour than second- and third-degree relatives.

Conclusions: Individuals with ASD are at increased risk of suicidal behaviour, in particular females without intellectual disability. Psychiatric comorbidities and shared familial risk factors are important explanations to the increased risk of suicidal behaviour in ASD. Clinicians treating patients with ASD should be vigilant for suicidal behaviour and consider treatment of psychiatric comorbidity.

2:21 **157.004** Suicidality and Non-Suicidal Self-Injury in Adults with Autism Spectrum Conditions

S. A. Cassidy[1,2], *L. Bradley*[3], *R. Shaw*[4] *and S. Baron-Cohen*[2], *(1)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (3)Coventry University, Coventry, United Kingdom, (4)NHS Coventry and Warwickshire Partnership Trust, Warwickshire, United Kingdom*

Background: Recent research has shown significantly increased risk of suicidality in Autism Spectrum Conditions (ASC). However, previous studies have utilised clinical samples, lacked validated measures and failed to explore risk or protective factors. Non-suicidal self-injury, unemployment and psychiatric conditions have all been identified as risk factors for suicide in the general population. People with ASC also describe camouflaging their ASC in order to fit in in social situations, at great potential cost to their mental health. However, no study has yet explored all these factors in relation to suicidality in ASC. This is crucial to inform new suicide prevention strategies for this group.

Objectives: 1) To compare the prevalence of suicidality and NSSI between those with and without ASC; and 2) To explore risk and protective factors for suicidality in those with ASC.

Methods: A comprehensive online survey was co-designed with the help of a steering group of adults with ASC who had experienced mental health problems and/or suicidality. Adult males and females with ASC, and control females without ASC or suspected ASC, completed the survey online. Measures included the Suicide Behaviour Questionnaire-Revised (SBQ-R), the Non-Suicidal Self-Injury Assessment Tool (NSSI-AT), and the Autism Spectrum Quotient (AQ). Participants also provided details of diagnosed developmental and mental health conditions, experiences of attempting to camouflage their ASC in order to fit in in social situations, employment, education, treatment and support.

Results: The ASC group comprised 168 adults (67 male, 101 female), and 108 control females without ASC or suspected ASC, aged 20-60 years old, recruited from online adverts and the University of Cambridge Autism Research Database. Significantly more ASC females reported lifetime experience of NSSI (81.8%) than ASC males (55.4%), and control females without ASC (27.6%) (all $p < .001$). In the ASC group, mean SBQ-R (10.31 *SD* 4.2) was significantly higher than the recommended cut off for psychiatric populations (>=8); 69.8% of the ASC group scored at or above this cut off. After statistically controlling for age, education, occupational status, living arrangements, co-morbid developmental and mental health conditions, ASC females scored significantly higher on the SBQ-R than control females (10.61 (*SD* 4.16) vs 6.27 (*SD* 3.18)). In the ASC group, history of NSSI, at least one mental health condition, unemployment, and camouflaging ASC were associated with significantly higher scores on the SBQ-R (all $p < 0.05$).

Conclusions: Results showed that a majority of ASC adults had experienced NSSI, and scored significantly above the recommended cut off for suicide risk in psychiatric populations. After controlling for a number of factors such as mental health conditions, unemployment and living situation, ASC females scored significantly higher in suicidality than control females. Results suggest that the factors underlying increased risk of suicidality in ASC compared to the general population goes beyond co-morbid psychiatric conditions and demographic risk factors. One new autism-specific risk factor for suicidality identified was the tendency to camouflage their ASC in an attempt to cope in social situations. Implications for suicide prevention are discussed.

Oral Session - 10B
Medical and Psychiatric Comorbidity
158 - Symptoms, Traits and Biomarkers: The Search for Stratification

2:40 PM - 3:30 PM - Arcadis Zaal

2:40 **158.001** Emotional and Behavioural Problems in Adolescents with ASD Are Associated with Alterations in Neural Indices of Perceptual Processing

V. Carter Leno[1], *P. White*[1], *I. Yorke*[1], *S. Chandler*[1], *G. Baird*[2], *A. Pickles*[3], *T. Charman*[4] *and E. Simonoff*[1], *(1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom, (3)Biostatistics and Health Informatics, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (4)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

Many young people with autism spectrum disorder (ASD) exhibit co-occurring emotional and behavioural problems. The development of effective interventions requires greater knowledge of the causes of these problems. One approach is to explore whether variation in specific neurocognitive processes, thought to be impaired in individuals with ASD, is also associated with additional psychopathology. Perceptual/sensory processing atypicalities are often reported in ASD, but how these relate to co-occurring emotional and behavioural problems is not well explored.

Objectives:

To test the association between neural indices of perceptual processing, and emotional and behavioural problems, in a well-characterised sample of adolescents (11-15 years) with ASD (n=43; 29 males, 14 females) with a wide-range of IQ (27-129).

Methods:

Event-related potentials (ERPs) were recorded in response to both deviant (8% probability, 1200Hz) and standard tones (92% probability, 1000Hz) in an auditory oddball paradigm.

Analyses focused on perceptual sensitivity, measured by the response to deviant, as compared to standard tone (mismatch negativity; MMN), and the differential ERP response to the first (S1), second (S2) and third (S3) standard tone presented directly after the deviant tone. Multivariate regression tested the association between ERPs and parent-reported emotional and behavioural problems. Primary analyses used the ADHD, emotional and conduct problems sub-scales of the Strengths and Difficulties Questionnaire (SDQ), and the Affective Reactivity Index (ARI). Secondary analyses used the Developmental Behaviour Checklist (DBC) total behaviour problem score.

Age, sex, IQ, and ASD severity were used as covariates. Sensitivity analyses excluded those taking psychotropic medication (n=5), and then separately excluded those with epilepsy (n=2).

Results:

No association was found between MMN amplitude and SDQ sub-scales or ARI. An association was found between MMN amplitude and DBC total behaviour problem score ($p<0.05$), and this remained at a trend level when controlling for age, sex and IQ ($p=0.07$), but became non-significant when controlling for age, sex, IQ and ASD severity ($p=0.11$). The association remained in unadjusted sensitivity analyses ($p<0.05$).

A selective association was found between ERP response (N2) to S1 and SDQ emotional problems ($p<0.05$). No associations were found to S2 or S3. This pattern of results remained in all co-variation and sensitivity analyses ($ps<0.05$). Follow-up analyses showed participants who scored positively on the Social Communication Questionnaire (SCQ) item indexing repetitive behaviours had a greater ERP response to S1 as compared to those who did not ($p<0.05$). No association was found between ERP response and the summed score of SCQ items indexing social impairment.

Conclusions:

Results regarding the association between MMN amplitude and DBC extend prior work, which has found comparable associations between behavioural problems and perceptual hyper-sensitivity using care-giver ratings of perceptual sensitivity.

Results regarding the selective response to S1 suggest a higher initial orienting response following deviant stimuli was linked to both internalising and repetitive behaviours, and thus are interpreted within the 'intolerance of uncertainty' framework.

Overall, findings suggest that perceptual processing atypicalities should be investigated in aetiological models of psychopathology in ASD, and ultimately the assessment of perceptual sensitivities may be helpful in individuals with co-occurring emotional and behavioural problems.

2:52 **158.002** Sleep Disturbance in Children and Adults with ASD in the EU-AIMS LEAP Cohort: Association with Symptomatology, Comorbidities, Quality of Life, and Intellectual Ability

A. San Jose Caceres[1], *D. V. Crawley*[1], *B. Oakley*[1], *E. Simonoff*[2], *T. Charman*[3], *J. K. Buitelaar*[4], *D. G. Murphy*[5], *E. Loth*[1] *and J. Tillmann*[6], *(1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (3)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (5)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (6)King's College London, London, United Kingdom of Great Britain and Northern Ireland*

Background: Rates of sleep problems in individuals with ASD range between 40%-80% (Johnson et al. 2009). Recent studies report the importance of sleep in the manifestation of ASD core symptoms (e.g. repetitive behaviours and communication; Park, et al., 2012; Tudor, et al., 2012) and sensory abnormalities (Mazurek et al., 2015). Psychiatric comorbidities have also been shown to be associated with sleep problems in neurodevelopmental conditions (e.g. challenging behaviours are more likely to co-exist in individuals with ASD who suffer from sleep disturbances; Lundqvist, 2013), ultimately impacting family life. Although some studies have shown sleep problems throughout the life span (e.g. Øyane, & Bjorvatn, 2005), to date, most of the studies focus on children and little attention has been given to the continuity and impact of these problems in adulthood.

Objectives: 1) To investigate the type and severity of sleep problems in individuals with and without ASD in relation to age, and ability level; 2) To study the associations of sleep problems on ASD core symptoms and psychiatric comorbidities (i.e. depression, anxiety, ADHD) as well as quality of life and adaptive functioning.

Methods: 294 individuals with ASD and 204 individuals with typical development or mild intellectual disability, with IQ ranging from 40-148 and aged 6-30 years were recruited as part of the multi-centre EU-AIMS Longitudinal European Autism Project (Charman et al., 207; Loth et al., 2017). Autism symptomatology was characterized with the ADOS, ADI-R, Social Responsiveness Scale, Short Sensory Profile, and Repetitive Behaviours Scale. Sleep disturbances were studied with the Child Sleep Habits Questionnaire (parent report version for 6-11 years-olds) or the self-report adolescent version in individuals over 11 years of age of IQ above 75, and parent reported for those below. Quality of life was measured with the Columbia Impairment Scale, and adaptive functioning with the Vineland adaptive behaviour interview. Comorbidities were characterized using the ADHD DSM-5 checklist, and Beck questionnaires for Anxiety and Depression.

Results: Children with ASD showed significantly greater overall sleep disturbances than controls, in particular, anxiety around sleep time, quality of waking (e.g. feeling rested, difficulties waking up, etc.), parasomnias, and daytime sleepiness (all $p_{corrected} < .037$). Adolescents and adults with ASD reported poorer quality of waking than controls ($p_{corrected} = .004$). Repetitive behaviours and sensory abnormalities correlated moderately with the total sleep time across ages, as reported by parents (all $r > .44$, all $p_{corrected} < .004$), but not on self-reports. In children, sleep correlated to adaptive behaviour ($r = -.35$, $p_{corrected} = .005$). Across ages, the total sleep time was moderately correlated to anxiety, depression and ADHD (all $r > .42$, all $p_{corrected} < .005$), as well as quality of life (all $r > .36$, all $p_{corrected} < .004$), but only on individuals of IQ > 75.

Conclusions: Sleep problems are linked to ASD core symptoms and adaptive behaviour in children with ASD, but sensory anomalies, and frequent comorbidities across the ages. Future analyses will examine whether the effect of sleep on clinical symptoms may be mediated by differences in cognitive or emotional processes.

3:04 **158.003** Sensory over-Responsivity Is Associated with Anxiety Disorders in Preschoolers with Autism and Typical Development

K. L. Carpenter[1], *J. Lorenzi*[1], *L. DeMoss*[2], *H. Riehl*[3], *E. Glenn*[3], *L. Beyer*[3], *J. Emerson*[3], *K. L. Williams*[4], *V. Smith*[5], *H. L. Egger*[6], *G. Baranek*[7] *and G. Dawson*[8], *(1)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (2)Rhode Island Consortium for Autism Research and Treatment, Brown University, East Providence, RI, (3)Duke Center for Autism and Brain Development, Durham, NC, (4)Department of Allied Health Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)Duke University, Durham, NC, (6)Department of Child and Adolescent Psychiaty, New York University Langone Health, New York, NY, (7)Chan Division of Occupational Science and*

Occupational Therapy, University of Southern California, Los Angeles, CA, (8)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC

Background: Around 50% of individuals with autism spectrum disorder (ASD) have a comorbid anxiety disorder. Despite the fact that anxiety disorders are common and impairing in individuals with ASD, we know little about the early risk factors for anxiety in ASD, especially in the preschool period. One such risk factor is sensory over-responsivity - a set of symptoms characterized by heightened and unusual reactivity to sensory stimuli.
Objectives: We conducted an in-depth study of the relationship between sensory over-responsivity and anxiety symptoms in preschool age children with ASD as compared to typically developing (TD) children.

Methods: Ninety-six 3-6 year old children (65 ASD, 31 TD) participated in this study. ASD was diagnosed using the ADOS and ADI-R by research reliable examiners. Sensory challenges were assessed via parent report using the Sensory Experiences Questionnaire v3.0 (SEQ). Anxiety disorders, including generalized anxiety disorder (GAD), separation anxiety disorder (SAD), social anxiety disorder, and specific phobia, were assessed with the Preschool Age Psychiatric Assessment (PAPA). The relationship between sensory over-responsivity and anxiety was tested with Pearson correlations. The relative odds of meeting criteria for anxiety disorders given mean sensory over-responsivity score was tested with logistic regression. In the TD group, exact logistic regression was used to account for limited sample size.

Results: Forty-six children (71%) with ASD and 11 TD children (35%) met both symptom and impairment criteria for at least one anxiety disorder. Further, 39 children (60%) with ASD and 4 TD children (13%) fell 2SDs above typically developing norms for sensory over-responsivity. Overall, there was a significant correlation between mean sensory over-responsivity score and number of anxiety symptoms in all children (r^2=0.68, p<0.0001), as well as in both groups separately (ASD: r^2=0.60, p<0.0001; TD: r^2=0.44, p=0.01). This relationship translated into a 5-fold increased chance of anxiety in children with high levels of sensory over-responsivity in the ASD group (OR 5.5, 95% CI: 1.72, 17.56, p<0.01) and a 7-fold increase in the TD group, though it was not statistically significant in the TD group (OR 7.1, 95% CI: 0.64, 79.24, p=0.1). In the ASD group, sensory over responsivity significantly increased the odds of GAD by a factor of 6 (OR 6.6, 95% CI: 1.69, 25.55, p<0.01) and SAD by a factor of 3 (OR 3.6, 95% CI: 1.26, 10.32, p=0.02). In the TD group, sensory over responsivity increased the odds of SAD by a factor of 15 (OR 14.96, 95% CI: 0.952, 942.9 p=0.056), but was not associated with other types of anxiety.

Conclusions: Results suggest sensory over-responsivity is strongly associated with anxiety disorders in preschoolers with ASD, as well as TD preschoolers. In preschoolers with ASD, sensory over-responsivity is associated with both GAD and SAD. In TD preschoolers, preliminary results suggest it is associated with SAD only. Identifying early child characteristics, such as sensory over-responsivity, that confer risk for anxiety may set the stage for the development of targeted treatment strategies that can reduce or prevent anxiety before it emerges in young children.

3:16 **158.004** Biomarkers As Intermediate Indicators of Improvement in ASD: A RCT with OMEGA-3

C. Moreno[1] *and M. Parellada*[2]*, (1)Hospital Gregorio Maranon, Madrid, Spain, (2)Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background: A high ω6/ω3 ratio [fatty acid (FA) index] in the cell membrane has been associated with inadequate brain development. It has started to be used as a biomarker of treatment efficacy in human diseases.
Objectives: The aim of this study was i) to investigate if omega-3 supplementation improves erythrocyte membrane ω6/ω3, plasma antioxidant status (TAS) and autistic behaviors ii) to identify markers of response (i.e. baseline TAS, baseline ω6/ω3 ratio, age subgroups, etc.)

Methods: A randomized, crossover, placebo-controlled study was designed to investigate the effect of 8 weeks of supplementation with ω3 (962mg/d and 1155mg/d for children and adolescents, respectively). Sixty-eight children and adolescents with Autism Spectrum Disorders (ASD) completed the full protocol. Primary outcome measures were erythrocyte membrane FA composition and TAS. Secondary outcome measures were Social Responsiveness Scale and Clinical Global Impression-Severity.

Results: Treatment with ω3 improved the erythrocyte membrane ω6/ω3 ratio (treatment effect p<0.008, d=0.66; within subjects effect p<0.007, d=0.5) without changing TAS. There was a within subjects significant improvement in Social Motivation and Social Communication subscales scores, with a moderate to large effect size (p=0.004, d=0.73 and p=0.025, d=0.79 respectively), but no treatment effect (treatment-placebo order). Carryover effects cannot be discarded as responsible for the results in behavioral measures. When the sample was stratified into those with higher baseline antioxidant status and those with lower antioxidant status (<p50 vs p>50), the group with higher antioxidant status showed a greater benefit. In this group, there was a within-subject improvement in antioxidant capacity after supplementation with PUFAs (p<0.001, ηp2=0.247, large effect size); the ω3/ω6 ratio showed a treatment effect in both groups, as it does the whole sample (with a larger effect size in those with more baseline antioxidant stress (ηp2=0.194 vs ηp2=0.0.092). A further subdivision of the samples was conducted, with 2 groups, those with lower ω3/ω6 (percentile <50) (n=32) and those with higher ω3/ω6 (n=33). For the lower half of the sample, ω3/ω6 and AA/DHA showed a treatment effect (as did the whole group) (p=0.04 and p=0.02, respectively); a within-subjects effect was clear only in the lower ω3/ω6 group (p<0.001). All effect sizes were large. Further post-hoc analyses are being conducted in order to identify subgroups of patients that better respond to the intervention administered in this study.

Conclusions: In conclusion, supplementation with ω3 FA might be studied as an add-on to behavioral therapies in ASD. Optimal duration of treatment requires further investigation. With regard to side effects, the effect of this supplementation on the lipid profile needs monitoring.

Panel Session
Diagnostic, Behavioral & Intellectual Assessment

159 - The Female Autism Phenotype: New Methods, New Discoveries

3:30 PM - 5:30 PM - Grote Zaal

Panel Chair: William Mandy, *University College London, London, United Kingdom of Great Britain and Northern Ireland*

Discussant: Christopher Gillberg, *Gillberg Neuropsychiatry Centre, Department of Psychiatry and Neurochemistry, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden*

There is a burgeoning interest amongst researchers, clinicians, and members of the autism community in the 'female autism phenotype', i.e., a female-typical pattern of core and associated autistic characteristics. This is driven by the realisation that autistic females are often excluded from clinical care and research, because they do not fit the stereotypical conceptualisation of autism, which is largely based on male cases. To reverse this sex/gender-based inequality we need a better, evidence-based understanding of autism in girls and women. In this panel a combination of leaders in the field and early career researchers will present diverse methodologically innovative approaches to studying the female autism phenotype; and report on the discoveries these have yielded. The talks cover an in-depth, phenomenological investigation via qualitative research; new measures of the female autism phenotype; twin and family pedigree designs; and longitudinal epidemiological investigations. The panel will be of interest to autism scientists and clinicians, as it is designed to: (1) offer new insights into the female autism phenotype; (2) explain how these can be translated into practice to improve care for autistic females; (3) and point towards new, fruitful ways of conducting research in the area.

3:30 **159.001** Understanding the Health Care Experiences of Girls and Women on the Autism Spectrum

Y. Hamdani[1]*, Y. Lunsky*[1]*, C. Kassee*[1]*, F. Nafeh*[2]*, B. Gladstone*[3]*, N. Bardikoff*[4]*, S. Ameis*[5]*, A. Sawyer*[1]*, P. Desarkar*[5]*, P. Szatmari*[1] *and M. C. Lai*[1]*, (1)Centre for Addiction and Mental Health, Toronto, ON, Canada, (2)Centre for Addiction and Mental Health, Toronto, Canada, Toronto, ON, Canada, (3)Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada, (4)Autism Ontario, Toronto, ON, Canada, (5)Department of Psychiatry, University of Toronto, Toronto, ON, Canada*

Background:

Diagnosing autism spectrum disorder (ASD) in females may be challenging because their social behaviours present differently than males. Many girls and women are undiagnosed, misdiagnosed or diagnosed late in life. Their health care needs are often unrecognized, or unmet compared to males with ASD. Many experience mental health, self-identity, and gender-related challenges, and inadequate or insufficient health care and support. Systematic research that explores female experiences of ASD is lacking. Research that integrates a gender analysis, which involves identifying socio-cultural themes related to gender in data, can contribute to enhanced understandings of the health care experiences of autistic girls and women.

Objectives:

Our objective was to understand the ASD and health care experiences of girls and women. Research questions included:

1. How do girls and women experience autism and the process of being diagnosed with ASD?
2. How does being a girl or a woman with ASD affect access to health care?
3. What are girls' and women's experiences of both ASD-specific and general health care?

Methods:

A qualitative descriptive design (Kahlke, 2014) was adopted, which involved conducting individual and focus group interviews with three groups of participants: girls with ASD (12 to 18 years old), women with ASD (18 years and older), and parents/guardians. Our minimum target was 11 participants per category. A project advisory group of girls, women and parents provided ongoing recommendations about the methods and results. Thematic analysis methods proposed by Braun and Clarke (2006) were used to identify patterns in the data related to ASD, gender, and health care experiences. Interview transcripts were read and discussed by five research team members to develop a coding scheme by consensus. The interviewer's post-interview memos were incorporated into the data set for analysis. A research assistant then coded the transcripts and memos using NVivo software to organize the data for the purpose of further analysis. Key themes were generated, reviewed and refined by the larger research team.

Results:

To date, 17 women and 6 parents have participated in the study. Recruitment of girls is in progress. Preliminary results indicate that there are specific presentations of ASD in females compared to males, and that gender-related factors contributed to females being undiagnosed and having unmet health care needs. Key themes included: 1) feeling different from others at an early age; 2) being diagnosed with mental health conditions and overlooked for ASD; 3) experiencing exhaustion from managing ASD in daily social life; 4) being socialized differently than boys and men; and, 5) lacking access to health, education, employment and social services and supports. Gender and ASD identities and expressions were entwined and influenced how girls and women experienced health care and social interactions.

Conclusions:

Understanding the health care experiences of girls and women with ASD can inform: 1) the development of diagnostic and health care practices that are tailored to their specific health care needs; 2) the training of health professionals; and, 3) pathways to improve access to both general health and ASD-specific services and supports.

3:55 **159.002** It Gets Better? Sex/Gender Differences in Social Camouflaging in Autistic and Non-Autistic Adults

L. Hull[1]*, W. Mandy*[1]*, C. Allison*[2]*, P. Smith*[3]*, S. Baron-Cohen*[2]*, M. C. Lai*[4] *and K. V. Petrides*[5]*, (1)University College London, London, United Kingdom of Great Britain and Northern Ireland, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (3)University of Cambridge, Cambridge, United Kingdom, (4)Centre for Addiction and Mental Health, Toronto, ON, Canada, (5)London Psychometric Laboratory, London, United Kingdom*

Background:

Social Camouflaging (i.e., behaviours performed by autistic individuals to compensate for and/or mask their autism during social interactions) has increasingly become the focus of research attention as it may contribute to risk and resilience across an individual's lifespan. However, almost all work to date on this topic has been qualitative, reflecting the lack of validated measures of camouflaging. This exploratory work has suggested that that autistic women and girls camouflage to a greater extent than men and boys, and that camouflaging may be associated with reduced wellbeing; but these ideas have yet to be formally tested. Further, no research to date has compared camouflaging behaviours in autistic and non-autistic people, or looked at whether camouflaging behaviours remain constant across the lifespan. To address these gaps in knowledge, the newly validated Social Camouflaging in Autism Questionnaire (SCAQ) has been developed as the first measure of self-reported camouflaging behaviours.

Objectives:

This study aimed to assess camouflaging behaviours using the SCAQ in men and women with and without a diagnosis of an autism spectrum condition. The study also aimed to identify the relationship between autistic traits, number of years since diagnosis, and camouflaging in autistic men and women.

Methods:

284 autistic adults (104 men, 180 women) and 448 non-autistic adults (193 men, 255 women) completed an online survey including the SCAQ and a standardised measure of autistic traits, amongst other measures.

Results:

In this sample the SCAQ had high reliability ($\alpha = 0.94$) and demonstrable convergent and discriminant validity. A significant interaction between gender and diagnostic status was found for total camouflaging behaviours. Autistic women camouflage at significantly higher levels than autistic men ($p < .001$, $d = 0.60$); non-autistic men camouflage at moderately higher levels than non-autistic women ($p = .03$, $d = 0.25$). For autistic women, autistic traits predicted greater camouflaging behaviours ($B = .65$, $p < .001$), while years since diagnosis (controlling for age) predicted fewer camouflaging behaviours ($B = -0.86$, $p = .001$). For autistic men, autistic traits predicted greater camouflaging behaviours ($B = 0.47$, $p < .001$), whereas years since diagnosis (controlling for age) did not significantly predict camouflaging behaviours ($B = 0.40$, $p = .19$). Age did not significantly predict camouflaging for either gender.

Conclusions:

The newly developed Social Camouflaging in Autism Questionnaire is a reliable and valid method to measure self-reported camouflaging behaviours amongst autistic adults. Autistic adults of both genders camouflage at significantly higher levels than non-autistic adults, and autistic women camouflage to a greater extent than autistic men. The more time since an autistic woman was diagnosed, the less likely she is to camouflage, perhaps suggesting greater acceptance of autistic behaviours by herself or others around her. In contrast, this effect was not observed in males.

4:20 **159.003** Examining Autism Sex/Gender Differences in Presentation and Mental Health across a Range of Research Designs

F. Happé[1]*, L. Livingston*[1]*, E. Colvert*[2] *and E. Yarar*[3]*, (1)Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Institute of Psychiatry, KCL, London, United Kingdom of Great Britain and Northern Ireland, (3)King's College London, London, UNITED KINGDOM*

Background:

Women and girls on the autism spectrum have often been excluded from research. This has likely led to male-biased information on which theory and clinical practice are based. New approaches are needed to address this inequality in autism science, to insure our diagnostic and intervention efforts are fair to females.

Objectives:

Four approaches to researching autism gender differences will be described, with illustrative data from recent studies. The aim is to examine possible autism gender differences in presentation and mental health, and to highlight strengths and weaknesses of different approaches.

Methods:

Four contrasting approaches will be described, examining sex differences in: a) adults presenting for diagnosis of autism at a specialist clinic (N=90 ASD, 46 non-ASD, m age 40 years); b) twins (m age c.13 years) meeting diagnostic criteria for ASD (N=135), their non-ASD co-twins (N=55) and comparison twins (N=144); c) twins high in autistic traits, identified from an on-going population-based study (N c.8,000, data from age 8 & 12 years); and d) grandparents (N=43, m age 70 years) of offspring with ASD, hence enriched for the broader autism phenotype. Data from diagnostic (e.g. ADI, ADOS) and trait measures of ASD (e.g., CAST, BAPQ), and mental health (e.g. SDQ, HADS) will be considered across the different designs.

Results:

Strengths and weaknesses of different approaches will be contrasted. Although females in general scored lower than males on autistic trait measures, few sex differences emerged across our different samples in mental health or quality of life. In some cases, sex-differences seen in neurotypical samples were not seen in ASD samples. Our actively ascertained and population-based samples did not show the gender differences in IQ expected from previous clinic-based data.

Conclusions:

Research on gender differences in autism currently relies on diagnostic measures largely designed from and for males. Research with diagnosed samples alone may therefore risk circularity. Examination of trait scores in population-based samples may help us move research forward. A major challenge exists, however, if ASD in females presents very differently from ASD in males, given that ASD is currently a purely behavioural diagnosis with no reliable biomarkers.

4:45 **159.004** Sex/Gender Differences across Contexts and Reporters

J. L. Taylor[1]*, L. E. Smith DaWalt*[2]*, S. Odom*[3]*, K. Hume*[3]*, B. Kraemer*[4] *and L. J. Hall*[4]*, (1)Vanderbilt Kennedy Center, Nashville, TN, (2)University of Wisconsin-Madison Waisman Center, Madison, WI, (3)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)Special Education, San Diego State University, San Diego, CA*

Background:

Women with autism spectrum disorder (ASD) have a more difficult time than men maintaining post-secondary employment/educational positions, though they obtain these positions at similar rates. One hypothesized explanation for this difference is that social deficits associated with ASD have a greater impact on the day-to-day functioning of women with ASD, given that social behavior is generally more important for societal interactions of females versus males. The present study explores this hypothesis in a sample of high school-aged students with ASD.

Objectives:

This study has two objectives: 1) to test for sex differences in parent- and teacher-reported autism symptoms; and 2) to examine sex differences in patterns of social interactions for high school students with ASD.

Methods:

Participants include 547 adolescents (76 Females, 471 Males) between 13 and 20 (M=16.2, SD=1.4), who all have an educational diagnosis of ASD and are part of a larger longitudinal study of 60 high schools in 3 states (CA, NC, WI). The sample was diverse with 45.7% of students being from a racial or ethnic minority group. Parent-reported lifetime autism symptoms were assessed using the Social Communication Questionnaire. Teacher-reported current autism symptoms were measured using the Social Responsiveness Scale-II. Parents and teachers answered questions regarding the student with ASD's social behavior, including how frequently they interacted with typically-developing and disabled peers in schools, and how often they interacted with peers outside of school by phone, over the internet, and in person.

Results:

Analysis of variance was used to test for sex differences in autism symptoms and social participation. Although parents rated lifetime autism symptoms as nearly identical for males versus females (M=20.67, SD=7.66 for males; M=21.15, SD=7.42 for females), F=0.20, p=.65, teachers rated autism symptoms as more severe in the females (M=69.18, SD=11.13 for males; M=78.00, SD=15.84 for females), F = 33.33, p < .001. Sex differences were also noted in some aspects of social participation – both in and out of school. Teachers reported that females spent a greater percentage of time compared to males interacting with typically-developing peers, F=7.76, p<.01, although there were no sex differences in percentage of time interacting with peers with disabilities, F=3.25, p=.07. Despite more time interacting with peers without disabilities, females were no more likely than males to have a single person that they interacted with at least 5 times in a week (a regular social partner), F=.79, p=.375. Outside of school, females were more likely than males to interact with peers using technology (e.g., calling/texting/internet), F=6.87, p < .01, but there were no sex differences in in-person interactions with peers (e.g., getting together with friends outside of school), F=2.40, p=.12

Conclusions:

Discussion will touch on possible explanations for discrepancies in teacher versus parent findings on sex differences in autism symptom severity, including: 1) autism symptoms that become less severe over time for males versus females (lifetime versus current symptoms); and 2) similar symptom presentations that appear more impairing in females due to societal expectations or unsuccessful peer interactions.

Panel Session

Cognition: Attention, Learning, Memory

160 - Linking Behavioral and Neurobiological Perspectives to Examine Executive Function in ASD and Their Impacts on Social, Academic and Adaptive Outcomes

3:30 PM - 5:30 PM - Willem Burger Zaal

Panel Chair: So Hyun Kim, *Psychiatry, Center for Autism and the Developing Brain, White Plains, NY*

Discussant: Elizabeth Pellicano, *Macquarie University, Sydney, Australia*

This panel combines cutting-edge behavioral phenotyping and electrophysiology to examine executive function (EF) in children with ASD. EF is one of the strongest predictors of academic, social, adaptive, and mental health outcomes. Recent behavioral and neurobiological evidence suggests that difficulties in EF skills may emerge early on in children with ASD. However, the current scope of research is limited by a lack of 1) valid, child-friendly tasks targeting core EF skills specifically designed for ASD, 2) studies examining the underlying neurobiological mechanisms of EF, and 3) longitudinal investigations elucidating long-term impacts of early problems with EF. To address these gaps, the first presentation examines the patterns of EF in children with ASD based on highly-usable, innovative, tablet-based EF games that incorporate both social and non-social stimuli. The second and third presentations investigate electrophysiological markers of EF in relations to achievement, symptom severity and other clinical features in children with ASD. The last presentation examines the link between preschool EF and long-term outcomes in ASD symptom severity and adaptive functions based on a 12-year longitudinal study. These findings provide a further step towards advancing our understanding of early neurobiological and behavioral patterns of EF and their impacts on longer-term outcomes.

3:30 **160.001** A Mobile Game Platform for Studying Social Influences on Executive Function in ASD: Towards Accessible Remote Measurement

M. C. Aubertine[1], *B. Li*[2], *M. Kim*[3], *M. Mademtzi*[4], *S. A. A. Chang*[5], *E. Barney*[6], *C. Foster*[4], *T. St. John*[7], *A. Atyabi*[8] *and F. Shic*[6], *(1)Seattle Children's Hospital and Research Institute, Seattle, WA, (2)Computer Science and Engineering, University of Washington, Seattle, WA, (3)Seattle Children's Research Institute, Seattle, WA, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Yale University, New Haven, CT, (6)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (7)University of Washington, Seattle, WA, (8)Seattle Children's Research institute University of Washington, Seattle, WA*

Background:

Mobile applications and games offer an accessible, often highly acceptable, method for assessing skills and developmental ability in special populations (e.g. young children), potentially facilitating data collection from the large sample sizes needed to parse and study clinically-relevant heterogeneity. Here, we present a mobile game that uses social and nonsocial stimuli to examine executive functioning skills, a known vulnerability for children with ASD.

Objectives:

1. Design a fun tablet-based game targeting areas of executive function.
2. Compare game performance and play patterns between diagnosis groups (ASD, typically developing (TD)) across stimuli (social, nonsocial).
3. Assess the predictive value of game performance to IQ and a validated measure of executive function, the Behavior Rating Inventory of Executive Function (BRIEF).

Methods:

Three games were created to assess: shifting, working memory, and inhibitory control. The shifting game showed four images (happy or angry faces, red or blue fractals) and required users to guess which image fit the unwritten rule. The working memory task required users to memorize one to four images and then choose the correct objects. The inhibitory control game required users to touch as many pictures as possible, but stop when a stop sign or angry face appeared. Each game had two social blocks and two nonsocial blocks that alternated (three counterbalanced orders). Participants were sixty-five children (ASD, N=33; TD, N=32) ages 2 to 17 years. Experimenters placed the tablet in front of participants seated at a table. Directions were presented on the screen and read aloud. Participants were allowed to engage with the tablet in any way they preferred.

Results:

A one-way ANOVA revealed, in the shifting game, participants with ASD made more mistakes than TD children in social (p=.015) and nonsocial conditions (p=.021). Children with ASD also touched more targets than TD children during the stop period of the inhibitory game in the nonsocial condition (p=.021), but not the social condition (p=.411). Inhibitory game performance was the only predictor of IQ (social, r=.345, p<.05; nonsocial, r=.456, p<.001). A one-way ANCOVA controlling for IQ and age revealed children with ASD were less accurate than TD children in the working memory game for social (p=.024) and nonsocial (p=.01) conditions. Partialling for IQ and age, significant relations were found between the BRIEF shifting subscale and shifting game duration (r=.467, p=.044) and correct guesses (social and nonsocial, r=.472, p=.035). Planning/organization subscale was correlated with nonsocial learning latency for the shifting game (r=.504, p=.028). In the inhibitory game, nonsocial accuracy was correlated with self-monitoring (r=-.421, p=.041) and emotional control (r=-.402, p=.05) subscales.

Conclusions:

In support of previous findings, children with ASD showed several EF deficits compared to their TD peers. In some areas, these deficits may interact with the sociality of the task. Mobile games, including the game presented here, have the potential to predict valuable clinical indicators such as IQ. While some facets of the BRIEF correlated with some game outcomes, more exploration is necessary to elucidate these relationships.

3:55 **160.002** Neurobiological Mechanisms of Executive Function (EF) As a Predictor of Social and Academic Outcomes in More-Able Kindergarteners with ASD

S. H. Kim[1]*, L. C. Shuffrey*[2]*, N. Benrey*[3]*, Y. B. Choi*[4]*, N. H. Brito*[5]*, W. P. Fifer*[2] *and C. Lord*[6]*, (1)Psychiatry, Center for Autism and the Developing Brain, White Plains, NY, (2)Division of Developmental Neuroscience, Columbia University Medical Center, New York, NY, (3)Weill Cornell Med School, New york, NY, (4)Psychiatry, Weill Cornell Medical College, White Plains, NY, (5)Department of Applied Psychology, New York University, New York, NY, (6)University of California Los Angeles, Los Angeles, CA*

Background: Although past studies have shown atypical electrophysiological patterns of response monitoring and inhibitory control in ASD, these investigations have been limited to older school-age children and adults with ASD. This calls for more in-depth examinations of neurobiological mechanisms of EF in young children with ASD.

Objectives: We examined behavioral and electrophysiological patterns of EF skills and their impacts on concurrent social and academic outcomes in more-able kindergarteners with ASD.

Methods: We integrated innovative behavioral and event-related potential (ERP) tasks to target EF in 43 more-able kindergartners with ASD (no cognitive/structural language delays; mean age=64 months, SD=6). Novel computerized EF tasks were administered on a touch-screen tablet ("EF Touch"; Willougby et al., 2010) to assess inhibitory control ("Spatial Conflict Arrows [SCA]"), working memory ("Pick the Picture"), and attention shifting ("Something's the Same [STS]") based on proportions of correct trials. EF-related ERP components, Error Related Negativity [ERN], Correct Related Negativity [CRN], error positivity (Pe), N2 and P3 were elicited with a newly validated child-friendly Go/No-go ERP task ("Zoo Game"; Grammer et al., 2014) for a subset of children (*n*=17). Social and academic achievement were measured by the Brief Observation of Social Communication Change (BOSCC; Grzandinsky, Lord et al., 2016) and Woodcock Johnson Achievement Test (WJ). Regression analyses were conducted to examine the significant effects of EF on social/academic skills. Non-parametric correlations were used to examine the associations between ERPs and social/academic outcomes.

Results: Significant effects of inhibitory control (EF Touch SCA) and attention shifting (STS) on math achievement (WJ Applied Problems) emerged while controlling for age, gender, and maternal education ($p<0.05$). Additionally, when IQ was controlled, the effect of inhibitory control on math achievement still remained significant. The Zoo Game successfully elicited ERP components related to response monitoring (ERN/CRN, Pe) and inhibitory control (N2, P3; **Figure 1**). Larger No-go P3 amplitudes were significantly associated with worse achievement in reading (WJ Letter Word Identification [r_s=-.66]; Passage Comprehension [r_s=-.59], $p<0.05$). Greater No-go N2 amplitudes were significantly associated with more social communication impairments (BOSCC, r_s=0.71, $p<0.05$). Larger CRN was marginally correlated with worse achievement potentially due to a small sample size (WJ Passage Comprehension, r_s=-.48, p=0.08).

Conclusions: Preliminary data with recent cohorts of 43 more-able kindergarteners with ASD showed potential links between EF and concurrent academic and social outcomes. Results also showed that less efficient inhibitory processing related to larger N2 and P3 may be associated with poorer academic and social outcomes. This is in line with previous findings showing that children with ASD may require more neural resources for inhibitory control. Similarly, hyperactive response monitoring related to larger CRN (similar to findings in those with anxiety) may be linked to more limited academic skills. These findings might shed light in examining functional mechanisms of atypical neural activities related to EF deficits in young children with ASD, which will be critical for the development of more focused behavioral interventions targeting EF skills prior to school entry. The data collection is currently underway, and we hope to expand our analyses to a larger, longitudinal sample.

4:20 **160.003** Event-Related Potentials Linked to Executive Function Predict Concurrent School Functioning Among School-Aged Children with ASD

S. Faja[1]*, R. Golden*[1]*, R. Gilbert*[1]*, A. Vaidyanathan*[2]*, D. Hyatt*[3] *and L. J. Nelson*[4]*, (1)Boston Children's Hospital, Boston, MA, (2)The Banyan Academy of Leadership in Mental Health, Mugappair west, Chennai, India, (3)Medicine, University of Illinois Chicago, Chicago, IL, (4)Boston University, Boston, MA*

Background: Executive function (EF) is often reduced among individuals with ASD, even in the absence of more generalized cognitive difficulties. EF underlies the ability to manage complex problems, respond to novel situations, and strategically approach goals. Evidence suggests that it is comprised of inhibition, set-shifting, and working memory by mid-childhood. Understanding the neural profile that underlies EF in children with

ASD is critical because EF is linked to academic success and the ability to successfully navigate social situations in children without ASD. The N2 event-related potential (ERP) has been linked to inhibition of conflicting information or responses. We previously reported that children with ASD had greater overall N2 amplitudes than children without ASD and amplitude differences between congruent and incongruent flanker conditions related to EF behavior (Faja et al., 2016). Little research has examined the link between neural signatures of EF and academic and social functioning in ASD.

Objectives: To examine individual differences in ERPs during two inhibitory EF tasks with respect to academic, executive, and social functioning in the classroom.

Methods: As part of a larger clinical trial of EF intervention, 75 children (10 female), aged 7-11 years, with ASD and a full-scale IQ of 107 (range: 80-150) participated. Teachers responded to surveys about EF (BRIEF) and social functioning (SRS-2 and SSIS). Parents responded to the CBCL Academic Competence scale. Electrophysiological recordings were collected to examine the N2 during Flanker and Go/Nogo tasks. Mean amplitude and latency were computed for each condition (congruent/incongruent, go/nogo). Larger ERP difference scores suggest more effortful or slower processing for the condition requiring greater inhibition. Sixty-nine children provided adequate ERP data for the Flanker task (33 with teacher surveys) and 37 for the Go/Nogo task (18 with teacher surveys).

Results: During the Flanker task, greater overall N2 amplitude uniquely predicted lower Academic Competence beyond age and IQ (F_{change}=5.68, *p*=.02). More negative N2 amplitude for incongruent trials related to more teacher-reported problems with Organization of Materials (BRIEF; *r*(32)= -.38, *p*=.03). During the Go/Nogo, longer nogo versus go N2 latencies related to more teacher-reported problems with Shifting, *r*(18)= .62, *p*=.006, Monitoring, *r*(18)= .47, *p*=.05, and Behavioral Regulation, *r*(18)= .51, *p*=.03. Socially, larger go/nogo N2 latency differences related to more difficulties with Social Awareness (SRS-2; *r*(18)= .49, *p*=.04) and reduced Social Engagement (SSIS; *r*(17)= -.52, *p*=.03) at school. Larger differences between go and nogo amplitudes also related to lower teacher-reported Social Communication ability, *r*(17)= .57, *p*=.02, Cooperation, *r*(17)= .54, *p*=.03, and Social Responsibility, *r*(17)= .59, *p*=.01.

Conclusions: Neural responses during inhibitory EF tasks predict functioning at school. Specifically, children who exert more neural effort to suppress interfering stimuli (i.e., incongruent flankers), have worse general functioning and organization at school. Additionally, children with slower neural responses to cues to inhibit a dominant response were less flexible, less careful, and more dysregulated. Those who required more neural effort and responded more slowly to inhibitory signals also had reduced social functioning at school. The results of an EF training intervention on teacher-reported EF skills will also be presented.

4:45 **160.004** Childhood Executive Function Predicts Later Adaptive Functioning and Autistic Features: A 12-Year Longitudinal Study

E. Pellicano[1,2]*, S. Cribb*[3] *and L. Kenny*[4]*, (1)Macquarie University, Sydney, Australia, (2)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom, (3)School of Psychology, University of Western Australia, Nedlands, Australia, (4)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland*

Background:

Long-term follow-up studies show that the developmental outcomes of autistic individuals are highly variable, even for individuals at the more able end of the autism spectrum. While some cognitively-able individuals go on to live independently and obtain qualifications, the majority fail to achieve independence, to attain full-time employment or to enjoy friendships. Explaining this variability is of critical importance: to discover why developments take place in some areas and not in others, and especially in some individuals and not in others.

Objectives:

This study sought to test the potential sources, namely theory of mind (ToM) and executive function (EF), of the variability in developmental outcomes in a cohort of autistic children assessed at two follow-up time-points, 3 years (Time 2) and 12 years (Time 3) after initial intake (Time 1).

Methods:

Thirty-seven autistic children (4 girls) were assessed on two key components of EF (planning and cognitive flexibility) and on a battery of ToM tasks (1st- and 2nd-order false-belief understanding) at Time 1 (M age = 5 years; 7 months) and Time 2 (M = 8 years; 4 months), as well as a measure of autistic features (ADOS-G). Of these 37 participants, 28 (2 girls) were assessed again at Time 3, 12 years later (M age = 17 years; 7 months), in terms of their adaptive behaviour (Vineland Adaptive Behaviour Scales – 2nd edition) and core autistic features (ADOS-2).

Results:

At Time 2 (3-year follow-up), early EF skills were longitudinally predictive of change in children's ToM test performance, independent of age, language, nonverbal intelligence, and early ToM skills. Predictive relations in the opposite direction were not significant. Individual differences in early EF but not ToM skills also predicted variation in children's social communication and repetitive behaviors and interests at the 3-year follow-up. At Time 3 (12-year follow-up), early EF *and* ToM skills predicted significant variance in autistic adolescents' autistic features (ADOS severity scores) but only early EF skills predicted unique variance in young people's adaptive behaviour at the 12-year follow-up.

Conclusions:

These longitudinal findings clearly demonstrate that EF measured in early childhood has predictive power: it uniquely predicts autistic children's developing ToM and their behavioural features 3 years later, *and* their behavioural outcomes (autistic features, everyday adaptive functioning) 12 years later. Together, these findings provide compelling reasons to suggest that individual differences in the developmental trajectories of autistic children's EF skills might well explain some of the variability in children's functional outcomes, both in the shorter term and in the longer term, and underscores their importance as a key target for early intervention. -p

Panel Session
Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
161 - Psychosocial and Demographic Moderators of Intervention Outcomes for Youth and Young Adults with ASD
3:30 PM - 5:30 PM - Willem Burger Hal

Panel Chair: Alan Gerber*, Stony Brook University, Stony Brook, NY*

Discussant: Matthew Lerner, *Psychology, Stony Brook University, Stony Brook, NY*

Social deficits are a defining characteristic of youth with autism spectrum disorder (ASD); however, symptom presentation is often highly heterogeneous (Georgiades et al., 2013). While research on interventions to remediate such deficits among individuals with ASD has recently proliferated, results remain similarly variable (Gates et al., 2017). This variability begs the fundamental questions of "for whom" do current treatments work (Kazdin, 2007). Likewise, in parallel to effort across child psychopathology (Ng & Weisz, 2017), there have been calls to individualize interventions in ASD in order to maximize benefits for participants (Lerner et al., 2012). The question remains, though: where – among the vast array of potential factors – to begin? In fact, basic psychosocial and demographic information is available in nearly all intervention datasets that contains under-explored factors that may be used to constrain heterogeneity of outcomes and potentially individualize interventions. This panel will synthesize findings from several social-focused interventions to explore when and how widely-available key moderators – age, gender, language, and comorbid diagnoses – may similarly and differentially impact outcomes. An integrative discussion will address both person- and treatment-level factors that may drive variability in moderator effects and provide concrete direction for the future of ASD social interventions.

3:30 **161.001** Examining the Influence of Age on Social Skills Intervention Outcomes: Does Age Moderate Social Improvements in ASD?

A. J. McVey[1], *H. K. Schiltz*[1], *A. D. Haendel*[2], *B. Dolan*[3], *K. Willar*[4], *A. Carson*[5], *F. Mata-Greve*[6], *C. Caiozzo*[7] *and A. V. Van Hecke*[8], *(1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Medical College of Wisconsin, Milwaukee, WI, (4)Children's Hospital Colorado, Aurora, CO, (5)Pediatrics, Autism Center, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (6)Marquette University, Shorewood, WI, (7)Psychiatry and Behavioral Sciences, Children's Hospital of Philadelphia, Philadelphia, PA, (8)Psychology, Marquette University, Milwaukee, WI*

Background: Although social skills interventions exist for children, adolescents, and adults with autism spectrum disorder (ASD; Palmen, Didden, & Lang, 2012; Reichow & Volkmar, 2010; White, Keonig, & Scahill, 2007), very few studies have examined the influence of age on the outcome of receiving such an intervention (e.g., Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007). Literature demonstrates that ASD is a lifetime condition, that is, children do not "age out" of ASD symptomology. In both clinical and research domains, however, a small proportion of youth who receive intervention have been shown to experience "optimal outcome," that is, amelioration of ASD symptoms to a non-clinical level (Fein et al., 2013). It may be that there are "ideal" times, or sensitive periods, during development when the receipt of a social skills intervention may be most helpful.
Objectives: The present study examined the relation between age and social knowledge and behavior among adolescents and young adults with ASD before and after receiving a well-validated social skills intervention, the Program for the Education and Enrichment of Relational Skills (PEERS®). It was hypothesized that older age would be associated with better social knowledge prior to the intervention and that younger and older age would show less malleability across the intervention, both in terms of social knowledge and social behavior.

Methods: One-hundred seventy-nine adolescents and young adults with ASD aged 11-28 participated in this study (EXP = 88; WL = 91). Participants received the PEERS® or PEERS® for Young Adults intervention, corresponding with their age. Self-report or caregiver-report of social knowledge (TASSK/TYASSK), direct interactions (QSQ), and social behavior (SRS, SSIS) was collected before and after intervention.

Results: The EXP and WL groups did not differ by age $t(177) = 1.42$, $p = .16$. Pearson correlations were conducted to examine the relation between participant age and each of the social knowledge and behavior variables at both pre- and post-intervention. Results indicated positive associations between age and TASSK/TYASSK at both pre- ($r = .48$, $p < .001$; all participants) and post- (EXP: $r = .24$, $p = .02$; WL: $r = .39$, $p < .001$), as well as age and QSQ at pre- ($r = .17$, $p = .02$; all participants) but not post-; neither the SRS nor SSIS showed significant associations with age at either time point. Multiple linear regressions were employed to examine the potential moderating role of age in intervention outcome. Results indicated that there was no significant age by group interaction for any outcome measure.

Conclusions: Our hypotheses were partially supported. The current study provides some evidence that, while younger participants demonstrate lesser PEERS® knowledge than their older counterparts, both before and after intervention, and have fewer direct social contacts prior to intervention, age itself does not appear to moderate intervention response. That is, seemingly regardless of age, adolescents and young adults benefit from the intervention.

3:55 **161.002** Gender and Psychiatric Comorbidity Moderate Outcomes of a Community-Delivered Group Social Skills Intervention for Youth with ASD

A. H. Gerber[1], *E. Kang*[1], *C. E. Simson*[1], *E. J. Libsack*[1] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: The most widely used treatment for social competence in youth with autism spectrum disorder (ASD) is group social skills interventions (GSSIs; McMahon et al., 2013); however, effect sizes are variable (Gates, Kang, & Lerner, 2017). One empirically supported GSSI for youth with ASD that has been successfully delivered in both controlled and "real world" community-based settings is socio-dramatic affective-relational intervention (SDARI; Lerner et al., 2011). A major challenge in implementing empirically-supported GSSIs in the "real world," however, is the complex clinical heterogeneity exhibited by youth with ASD in the community (Wood et al., 2015), which can lead to considerable variability in outcomes for community-delivered interventions (Perry et al., 2008). Thus, it is particularly important to identify individual difference factors (i.e., potential moderators) among participants in community-delivered interventions to optimize their effectiveness. In particular, three variables that have particularly strong theoretical promise – yet little previous examination – as moderators of GSSIs (Lerner & White, 2015): gender, psychiatric comorbidity, and psychotropic medication use.
Objectives: Based on prior research (Lerner & White, 2015), we hypothesized that female participants, as well as those with comorbid anxiety, would demonstrate larger treatment gains, but those with ADHD would experience attenuated effects. Given the limited research on medication use, we conducted exploratory analysis of its effects.

Methods: Seventy-five youth, ages 9 to 17 years (M=12.86 years, SD=2.19; 59 male; 86.7% parent-reported ASD) participated in a 6-week community-based summer GSSI in groups of 5-9. Parents completed pre-post measures of broad psychopathology (BASC-2; Reynolds & Kamphaus, 2004), ASD symptomatology (SRS; Constantino & Gruber, 2007), and social skills (SSRS; Gresham & Elliot, 1990). Participants completed a computer-based emotion recognition task (DANVA-2; Nowicki, 2004). We utilized generalized estimating equations (GEE) in an ANCOVA-of-change framework to account for nesting within groups.

Results: Participants with unitary anxiety displayed *greater improvements* in ASD symptom severity and vocal emotion recognition relative to those without anxiety or with multiple comorbidities (see Table 1). Additionally, participants with unitary ADHD demonstrated *greater* gains in adaptive skills compared to those without. Multiple comorbidity of ADHD and anxiety was associated with *limited improvements* in ASD symptom severity and social skills, and a *decrement* in vocal emotion recognition (see Figure 1) relative to all other participants. Additionally, females experienced greater improvements in facial emotion recognition, while males experienced greater improvements in vocal emotion recognition. There were no effects of medication.

Conclusions: This is among the first studies to examine the impact of outcome moderators in a community-based GSSI. Extending prior work (Antshel et al., 2011), we found that participants with both ADHD and anxiety made the *fewest* gains and, in fact, experienced no gains and even iatrogenic effects across several measures. Given the complexity of comorbidity in youth with ASD (Simonoff, 2008), this illustrates the importance of a thorough assessment of comorbid symptomatology. We also found evidence that gender moderated the effects of a GSSI when other studies have not (McVey et al., 2017). This again highlights the impact of phenotypic heterogeneity in community-based interventions on treatment effectiveness.

4:20 **161.003** Gender Differences Among the Social Conversational Profiles of Adolescents with ASD Participating in the START Socialization Program Clinical Trial

***J. A. Ko**, A. R. Miller, T. W. Vernon, A. Chiu, M. Allison, R. Graef, E. Prado, A. Barrett and E. McGarry, University of California Santa Barbara, Santa Barbara, CA*

Background: Researchers have increasingly focused on exploring gender differences associated with autism presentation and treatment response. Previous research relying on parent- and self-report measures indicates that females with ASD may demonstrate unique profiles of social-communication symptoms compared to males (Head et al., 2014; Lai et al., 2011). However, there is very limited research investigating gender differences in the context of a clinical trial. Even fewer studies have examined gender differences in video-recorded social behaviors and interactions (e.g. McMahon, Vismara, & Solomon, 2013). Direct observation of social behaviors during live social interactions may provide a more objective and ecologically valid means to understand how gender influences social presentation both before and after participation in a socialization intervention.

Objectives: The present study examines gender differences in the use of verbal and nonverbal social interaction skills following participation in the START socialization intervention for adolescents with ASD.

Methods: Participants were 32 adolescents with ASD (22 males and 10 females ages 12-17 years) who completed the Social Tools And Rules for Teens (START) program. The START program is a 20-week experiential social competence and motivation intervention. Each weekly group session consisted of an individual check in, socialization time, discussion of a weekly social topic, group activity, and a check-out that involved the parent. At pre- and post-intervention time points, participants engaged in two five-minute video-recorded conversations with unfamiliar, similarly-aged peers (one with a male and one with a female). Trained raters naïve to project hypotheses and the time point of each video coded these conversations for verbal and nonverbal social interaction skills (i.e. question asking, responding to questions, mutual engagement, eye contact, positive facial expressions, and listening behaviors). Two video coders coded each behavior and reliability was established for a minimum of 30% of the videos.

Results: Analysis of Covariance (ANCOVA) methods were performed to examine if females and males possessed similar or different patterns of socialization in response to the START intervention. To take into account pre-group differences, pre-intervention values of the video-recorded social behaviors were used as a covariate. When controlling for baseline scores, gender was found to have a significant impact on treatment outcome for question asking and positive facial expressions. More specifically, females had significantly improved at asking questions (p = 0.01; large effect) and showing positive facial expressions (p = 0.47; medium-large effect) during the brief conversations compared to males. There are ongoing analyses on the other verbal and nonverbal social skills.

Conclusions: Results indicate that there are clear gender differences in adolescents with ASD across verbal and nonverbal social skills in the context of the START socialization program. Findings from the present study may help inform how socialization interventions and treatment strategies can be tailored to meet the specific needs of different demographic subgroups.

4:45 **161.004** An Exploration of Possible Moderators in an Addressing Disparities Comparative Effectiveness Trial for Elementary Students with ASD or ADHD

***L. Anthony**[1], B. J. Anthony[1], A. Verbalis[2], D. Naiman[3], A. B. Ratto[2], S. Seese[2], J. Safer[4], M. F. Skapek[5], M. D. Powers[6], M. Troxel[1] and L. Kenworthy[2], (1)University of Colorado, Denver, Aurora, CO, (2)Children's National Health System, Washington, DC, (3)Applied Mathematics and Statistics, Johns Hopkins University, Baltimore, MD, (4)Georgetown University, Washington, DC, (5)Psychological Sciences, University of Connecticut, Storrs, CT, (6)Children's National Health System, Rockville, MD*

Background: As we grapple with the importance of determining patient-centered outcomes, those of us conducting intervention research with individuals who have neurodevelopmental disorders need to explore the possible moderating effects of important variables such as age, IQ, language(s) spoken in the home, income level and ethno-racial identity.

Objectives: This study presents the exploratory analyses of possible moderating variables from a larger comparative effectiveness research (CER) trial that may be used for hypothesis generation for future studies.

Methods: The trial compared Unstuck and On Target (UOT) to Contingency Behavior Management (CBM) in 21 Title I elementary schools in three school districts for students with ASD or ADHD. Both interventions targeted executive functioning skills in the classroom. The primary outcome for these analyses are academic classroom observations on the following behaviors: demonstrates social reciprocity, follows rules, transitions appropriately, gets stuck, displays negativity, and participates in class (total raw scores ranging from 0 (worst) to 6 (best)). IQ was measured by the WASI-II. Family income ranged from $8,796-400,000 and was split into tertiles (<35,000; 35,000-100,000; >100,000).

Results: Diagnosis is an important moderator, with ADHD students making significant treatment gains in both interventions (d=.45-.70), while ASD students only showed a positive effect in UOT (d=.42-.60). Importantly, age (r=-.033; p=.69), IQ (r=.165; p=.055) and income (r=.062; p=.495) do not significantly correlate with change in classroom behavior. This lack of significance remains true when analyzed separately by ADHD and ASD. There are three categories for language spoken at home: English only, Spanish only, and More than one language spoken. To be included in the study, parents needed to be able to understand parent trainings, handouts and parent questionnaires in either English or. Overall, language spoken in the home does not moderate the effectiveness of UOT as measured by blinded classroom observations (F=.001), but it does a little bit more with CBM, with the children whose families spoke English only in the home making the *least* amount of progress, though again, this change was not statistically significant (F=.191; see Table 1).

When looking at potential descriptive differences by race/ethnicity and intervention, it appears that Other (primarily reported as mixed race) students change the most, followed by Black students in UOT, Latino students in either intervention, with White students in both interventions and Black students in CBM making the smallest positive changes. None of these results were statistically significant on t-tests.

As stated above, there is not a significant linear relationship between income and change. However, because income was the specific disparity that this CER trial was designed to address, further exploration is warranted. Descriptively, high- and low-income students changed the most, though these differences are not significant (F=.185).

Conclusions: Overall, there may be some important moderators of effectiveness that could be explored in future large-scale effectiveness trials. It is particularly interesting that the hypotheses generated from these descriptive analyses include speaking languages other than English at home, being non-White and not from a middle-income family may predict greater change in hypothesis-, treatment-, and diagnosis-naïve classroom observations.

Panel Session
Miscellaneous

162 - Tracking Innovation: Catching Up with Recent Winners of the Slifka /Ritvo Innovation in Autism Award

3:30 PM - 5:30 PM - Jurriaanse Zaal

Panel Chair: Shafali Jeste, *University of California, Los Angeles, Los Angeles, CA*

For nearly a decade, the Alan B. Slifka Foundation has partnered with INSAR to offer the Slifka-Ritvo Innovation in Autism Award. This Award promotes innovative autism research designed to catalyze novel treatments and improvements in quality of life, as well as transformative insights into etiology. This panel offers an opportunity to review the outcomes of these efforts, providing summaries from Slifka-Ritvo Award winners (from 2014 – 2016) of their projects and impact on subsequent research. Dr. Naples will summarize his project developing improved methods for studying the social neuroscience of autism across the spectrum, and where these efforts will lead next. Dr. Hoekstra will review findings regarding understanding and reporting on autism in Ethiopia, with implications for capturing the broader landscape of autism around the world. Dr. Shcheglovitov will share progress on the use of human-derived induced pluripotent stem cells into mouse models to better understand functional connectivity differences in autism. Dr. Libertus will present results of his efforts to remotely and cost-effectively assess early motor development in infants with high likelihood of developing autism. The Chair will lead an integrative discussion on the impact of these projects and implications for the future of autism research.

3:30 **162.001** Human iPSC-Derived Neurons and Organoids for Studying Cortical Development, Synapses, and Synaptopathies

O. Shcheglovitov, *University of Utah, Salt Lake City, UT*

Background: Human cerebral cortex is a complex brain structure associated with many human-specific behaviors and disorders. Many genes important for the development and wiring of this structure have been found mutated in the individuals with autism spectrum disorders (ASDs). It has previously demonstrated that cerebral organoids generated from induced pluripotent stem cells recapitulate many important aspects of human cortical development. The main issue, however, has been reduced reproducibility and impaired functional maturation of neurons in these structures.

Results: To improve experimental reproducibility and neuronal maturation, we developed a new method enabling generation of three-dimensional cortical organoids from single induced pluripotent stem cell (iPSC-) derived neural rosettes – neural tube-like structures in vitro. We demonstrate that single-rosette-derived cortical organoids grow large in suspension culture, reaching 4-5 mm in diameter by 4 months while maintaining a single internal lumen, and consist of different types of neuronal cells, including cortical neural progenitors, deep and superficial cortical excitatory neurons, inhibitory neurons, and different glial cells, organized around the lumen. Using slice patch-clamp electrophysiology, we also show that many neurons in slices from single-rosette-derived cortical organoids fire repetitive action potentials, receive excitatory and inhibitory synaptic inputs, exhibit typical pyramidal-like morphologies, and have dendritic spines.

Conclusions: Our results indicate that human cortical organoids generated from single iPSC-derived neural rosettes could be useful for studying and modeling human cortical development in health and disease.

3:55 **162.002** Novel Paradigms for Studying Brain Activity across the Autism Spectrum

A. Naples, *Child Study Center, Yale University School of Medicine, New Haven, CT*

Background

Individuals with ASD experience profound difficulty in social interactions. These challenges are most evident in dynamic, interactive contexts; however, most brain research in ASD has studied neural response in unrealistic social contexts, such as passive viewing of static faces on a computer monitor. Furthermore, it is estimated that 30% of individuals with ASD are minimally verbal, a characteristic associated with poorer prognosis across academic, economic, and socio-emotional domains. Despite having the most significant need for support, most neuroscience research excludes these individuals from participation.

Objective

We have developed methods to measure brain activity during reciprocal interactions. Integrating highspeed eye-tracking (ET; measuring where a person looks on a computer screen) and electroencephalographic recording (EEG; measuring brain response) enables simulation of social interactions with animated faces that respond to a participant's gaze (faces that "look back" or smile in response to gaze). Importantly, these methods allow us to characterize attention and brain activity in the absence of explicit instructions and task demands. The experimental paradigms are driven by non-verbal behavior, and participants are "self-paced" in their completion of the task. We have capitalized on these technological advances to explore brain activity and attention in individuals with autism with varying levels of cognitive and language abilities, including individuals who may have difficulty following explicit experimental instructions. Our goal is to evaluate the efficacy of these methods for minimally verbal individuals and to explore brain activity in this sample.

Method

We collected co-registered high-speed EEG and eye-tracking data from individuals with ASD with IQ<70 during simulated social interactions. Onscreen faces responded to participant gaze by opening their eyes or mouths when looked at, or by looking towards or away from the participant. Importantly, the gaze-contingent nature of the experiment guaranteed attention to the eyes or mouth of onscreen faces during all facial movement, ensuring that brain activity reflected the locus of visual attention. We explored the P100 and the N170, temporally early neural indices of face processing, and pupil diameter.

Results

Preliminary data from four children with ASD showed modulation of brain activity in response to gaze-contingent facial movement such that reciprocal eye-contact elicited more negative and earlier activity at the N170 than mouth movement (mean difference=-1.85mv [Cohen's d=1.49], 21ms [Cohen's d=1.38]). A marginally significant effect was observed for P100 latency, such that eye movement was processed faster than mouth movement (t=-2.49, p=.08). Data collection is ongoing, and analyses are exploring the effects of gaze change and modulation of pupil diameter.

Discussion

Our preliminary data show efficacy for interactive neuroscience methods in this sample, with expected modulation of brain activity to social stimuli. Innovative experimental designs that are accessible to participants with a wide range of developmental and functional levels will reduce barriers to participation in clinical neuroscience research.

4:20 **162.003** Remote Assessments of Motor Skills in Infants at High Familial Risk for ASD

***K. Libertus**, Psychology, University of Pittsburgh, Pittsburgh, PA*

Background: The emergence of foundational motor abilities have implications for the development of several key behaviors during infancy. Specifically, attaining motor milestones, such as reaching, sitting, or walking, provides the child with new learning opportunities about the social and physical world (Gibson, 1988; Libertus & Hauf, 2017). However, in clinical contexts, early motor development is typically neglected unless motor problems are severe enough to interfere with daily living skills. For example, the often noted but mild motor delays observed in Autism Spectrum Disorders (ASD) are not considered diagnostic. This is surprising, given recent reports of delayed postural control and gross motor skills in infants at familial risk for ASD (Flanagan, Landa, Bhat, & Bauman, 2012; Nickel, Thatcher, Keller, Wozniak, & Iverson, 2013). Further, research with typically developing infants has noted far-reaching developmental cascades that are initiated by self-produced motor acts (e.g., Libertus & Needham, 2010, 2011; Soska, Adolph, & Johnson, 2010). Therefore, more research is needed to better understand the emergence of early motor skills and their impact on development across domains as well as their potential role in ASD where subtle differences in motor ability might affect subsequent social-cognitive development.

Objectives: Design and implement a remote observation protocol to study early motor development.

Method: A total of 43 infant-parent dyads provided longitudinal data on grasping and sitting development over an 8-week period starting at 3-months of age. Assessments were conducted in the family's own home using videoconferencing. On 3 follow-up occasions when the child was 10, 14, and 18-months of age, parents completed language and motor skill questionnaires about their child. Correlation and regression were used to examine the relation among motor skills and with subsequent language development (CDI) at 10 and 14 months.

Results: Results revealed that the emergence of sitting and grasping skills in early infancy do not correlate with each other, suggesting that the child focuses at one skill at a time. Further, only grasping skills seemed impacted by maturational factors. Regression analyses showed that early motor skills did indeed predict language development at 10 and 14 months of age, but not at 18 months of age. However, vocabulary size at both 10 and 14 months were significant predictors of language skills at 18 months. Consequently, early motor skills may indirectly influence language development at 18 months of age.

Conclusions: The current study demonstrates that early motor skills can be assessed remotely via videoconference and provides empirical support for interactions between motor and language development starting in early infancy. Benefits of the remote assessment protocol include its cost efficiency and wide potential participant base. Preliminary observations with infants at high-familial risk for ASD have been started and will be discussed.

4:45 **162.004** The Face of Autism in Ethiopia: The Expression, Recognition, Reporting and Interpretation of Autism Symptoms in the Ethiopian Context

***R. A. Hoekstra**[1], F. G. Bayouh[2], B. T. Gebru[1], M. Kinfe[2], A. Mihretu[2], W. Adamu[2], E. Carmo[1] and C. Hanlon[3], (1)Department of Psychology, King's College London, London, United Kingdom, (2)Department of Psychiatry, School of Medicine, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia, (3)Addis Ababa University and King's College London, Addis Ababa, Ethiopia*

Background: To improve identification and intervention for children with autism worldwide a better understanding is needed of the cultural-specific expression of autism symptoms and of how these symptoms are recognised, reported and interpreted by caregivers. A good understanding of these cultural factors is essential to inform adaptations of existing autism screening tools and autism interventions to non-Western and low-resource settings.

Objectives: To explore the expression, recognition, reporting and interpretation of autism symptoms in Ethiopia.

Methods: Audiotaped semi-structured interviews were conducted with fifteen Ethiopian caregivers of a child with autism and with nine local clinical professionals with autism experience. Informants were asked to describe the child's strengths and difficulties, and the caregivers' main concerns. Probes included autism characteristics listed in international diagnostic criteria. Data were analysed using framework analysis, and compared and contrasted with findings from two previous studies by our group: i) a situational analysis describing the current service provision for children with autism in Ethiopia (Tekola et al., 2016); and ii) a structured survey in caregivers of children with developmental disorders, exploring their explanatory models, unmet needs and challenges (Tilahun et al., 2016).

Results: Most caregivers identified strengths of their children; several indicated their child ‘greets other well’ (social greetings are ritualised in Ethiopia and carry great significance). Clinicians and caregivers together provided locally prevalent examples of all main diagnostic symptoms. Problems with social communication were highlighted most: the majority of caregivers indicated they don’t understand their child’s wants or needs. Reported examples of restricted repetitive behaviours and activities included repetitive play (e.g. splitting grass); sensory sensitivity (e.g. to loud noises) and insistence on sameness (e.g. eating only injera). Most caregivers found their child’s inability to communicate the most challenging; several also mentioned lack of self-help skills or challenging behaviours. While caregivers could easily describe their primary concerns, some core autism symptoms remained unrecognised: ‘I only start thinking about this [non-verbal communication problems] now that you raised it. ...We never thought of that’.

Several caregivers’ comments suggested that symptom interpretation and reporting may be affected by beliefs and stigma. These results corroborate our previous findings, indicating that autism families experience severe stigma (Tilahun et al., 2016) and social exclusion (Tekola et al., 2016), and that caregivers often attribute their child’s condition to spiritual causes and believe it can be cured (Tilahun et al., 2016).

Conclusions: This exploratory study from Ethiopia suggests the expression of core autism symptoms does not differ markedly from reports in Western countries. However, due to local belief systems, cultural norms and low levels of awareness some symptoms may be missed when using a standard Western autism tool. In order to avoid low sensitivity, prevailing caregiver-reported screening tools will require careful cultural adaptation. Moreover, existing autism interventions will require adaptation to local context and culture. The studies reported here have informed our current endeavour, adapting and piloting the World Health Organization’s Caregiver Skills Training for use in Ethiopia, leading to the first intervention available for children with developmental disorders living in rural Ethiopia.

Poster Session
164 - Cognition: Attention, Learning, Memory

5:30 PM - 7:00 PM - Hall Grote Zaal

1 **164.001** A Meta-Analysis of Working Memory in Individuals with Autism Spectrum Disorders

A. Habib[1]*, C. Melville*[2]*, F. E. Pollick*[3] *and L. Harris*[2]*, (1)University of Glasgow, Glasgow, United Kingdom of Great Britain and Northern Ireland, (2)University of Glasgow, Glasgow, United Kingdom, (3)School of Psychology, University of Glasgow, Glagow, United Kingdom*

Background: Autism spectrum disorders (ASD) are lifelong neurodevelopmental disorders. Numerous studies have shown that individuals with Autism spectrum disorder (ASD) are associated with working memory (WM) deficits, however, the findings from research on WM impairments in ASD has been inconsistent and it is not clear whether WM deficits are commonly experienced by individuals with ASD.
Objectives: To determine whether individuals with ASD experience significant impairments in WM and whether there are specific domains of working memory that are impaired.

Methods: We conducted a comprehensive systematic review and a meta-analysis using four electronic databases EMBASE (OVID), MEDLINE (OVID), PsychINFO (EBSCOHOST), and Web of Science, to examine the literature to investigate whether people with ASD experience impairments related to WM. Meta-analyses were conducted separately for phonological and visuospatial domains of WM. Subgroup analyses investigated age and intelligence quotient as potential moderators.

Results: A total of 29 papers containing 34 studies measuring phonological and visuospatial domains of WM met the inclusion criteria. WM scores were significantly lower for individuals with ASD compared to typically developed (TD) controls, in both the visuospatial domain when investigating accuracy (d: -0.73, 95% CI -1.04 to -0.42, $p < 0.05$) and error rates (d: 0.56, 95% CI 0.25 to 0.88, $p<0.05$), and the phonological domain when investigating accuracy (d:-0.67, 95% CI -1.10 to -0.24, $p>0.05$) and error rate (d: 1.45, 95% CI -0.07 to 2.96, $p=0.06$). Age and IQ did not explain the differences in WM in ASD.

Conclusions: The findings of this meta-analysis indicate that across the lifespan, people with ASD demonstrate large impairments in WM across both phonological and visuospatial WM domains when compared to people without ASD.

2 **164.002** Adaptive Behavior in Preschoolers with Autism Spectrum Disorder: The Role of Executive Function

J. R. Bertollo[1]*, A. S. Nahmias*[2]*, S. R. Crabbe*[3]*, L. Kenworthy*[4]*, D. S. Mandell*[5] *and B. E. Yerys*[1]*, (1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)MIND Institute, UC Davis Medical Center, Sacramento, CA, (3)University of Pennsylvania, Philadelphia, PA, (4)Children's National Health System, Washington, DC, (5)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Adaptive behavior, the ability to function independently, is a well-measured concept that relates closely to functional outcomes in individuals with autism spectrum disorder (ASD). Even in the preschool years, children with ASD demonstrate poorer adaptive behavior than those with Down syndrome, a group with impaired cognitive ability, suggesting that cognitive ability alone does not explain the discrepancy in these skills. Research also suggests that adaptive behavior impairment increases with age, warranting research on which factors explain adaptive behavior, as well as its change over time. Some studies have demonstrated the importance of executive function skills, such as shifting and organization, in predicting adaptive behavior in individuals with ASD. However, this research has focused on school-age youth with average to above-average intelligence. Less work has extended into younger samples or those with a broader range of cognitive abilities, so it is not known whether the same skills are implicated across the ASD population and across development.
Objectives: To examine the association between executive function and adaptive behavior in preschoolers with ASD.

Methods: Ninety-one preschoolers with ASD (mean age=52.1 months; 81% male) from two sites were included in this analysis. At one site, teacher report on the Behavior Rating Inventory of Executive Function – Preschool (BRIEF-P) and the Adaptive Behavior Assessment System-II (ABAS-II) were used to assess executive function and adaptive behavior respectively. The other site relied on caregiver report on both the BRIEF-P and the Vineland Adaptive Behavior Scales, Second Edition (Vineland-II). We standardized measures of adaptive behavior by focusing only on adaptive practical and socialization skills. “Adaptive practical skills” were either Vineland-II Daily Living Skills Standard Score or ABAS-II Practical Composite Standard Score. Depending on site, cognitive or developmental functioning level (hereinafter, “nonverbal IQ”) was measured by either a nonverbal subtest of the Differential Ability Scales-2 or Wechsler Preschool and Primary Scale of Intelligence-III, or Visual Reception on the

Mullen Early Learning Scales. Stepwise regressions were conducted for each adaptive behavior domain to determine the unique variance contributed by the BRIEF-P scales, above and beyond nonverbal IQ (Table 1). Site was also entered as a covariate of no interest to minimize confounding effects from site differences, including rater and measure differences.

Results: For adaptive practical skills, nonverbal IQ and site accounted for 28.4% of variance. The BRIEF-P scales explained 8.0% of variance in practical skills and the model comparison was marginally significant; Plan/Organize scale was statistically significant. For adaptive socialization skills, the covariates predicted 13.5% of variance, but only nonverbal IQ was significant. The BRIEF-P scales explained an additional 12.0% of variance in socialization skills, with the Shift scale reaching statistical significance.

Conclusions: These results show that specific executive function skills play an important role in explaining variance in different aspects of adaptive behavior in early development, extending prior literature into preschoolers with ASD. Future research should replicate these findings with longitudinal designs and performance-based measures to sharpen our understanding of executive function in preschoolers with ASD, which may provide insight for adapting interventions to improve functional outcomes.

3 **164.003** Adults with High Autistic Traits Are Reluctant to Trade Accuracy for Monetary Reward: A Probabilistic Reasoning Experiment

H. Lu[1,2]*, H. Zhang*[2,3,4] *and L. Yi*[5]*, (1)Academy for Advanced Interdisciplinary Studies, Peking University, Beijing, China, (2)Peking-Tsinghua Center for Life Sciences, Peking University, Beijing, China, (3)School of Psychological and Cognitive Sciences, Peking University, Beijing, China, (4)PKU-IDG/McGovern Institute for Brain Research, Peking University, Beijing, China, (5)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

Background:

Information processing has been considered as a cause of dysfunctions in autism spectrum disorders (ASD; e.g., van de Cruys et al., 2014). Different empirical studies, however, provided seemingly contradictory findings on whether and how autistic people differ in probabilistic reasoning (Brosnan, Chapman, & Ashwin, 2014; Jänsch & Hare, 2014). What were confounded in previous studies are the abilities to judge probabilistic information and to use the information for decision-making.

Objectives:

To investigate how people with various autistic traits are driven by accuracy (the goal of judgment) and monetary reward (the goal of decision-making) to different extents by introducing monetary reward into a probabilistic reasoning task. In certain experimental conditions, accuracy and reward formed the opposing forces: pushing expected accuracy over a point would reduce expected reward.

Methods:

We recruited forty-eight 18- to 28-year-old college students and measured their autistic traits with Autism-Spectrum Quotient (AQ) on a 4-point scale (0, 1, 2, and 3). Participants played a computerized Bead Task, in each trial of which they saw two bead jars. One of the jars had a blue-to-pink beads ratio of 80%:20% or 60%:40%, and the other had the opposite ratio. Participants were told that one jar had been randomly chosen and their task was to judge which jar was chosen. For each correct judgment, participants could win up to 10 game points. Before judging, they could draw 0 to 20 beads sequentially from the chosen jar and stop sampling at any time. This information gathering could incur a cost: 0, 0.1, or 0.4 points for each bead drawn. There were 288 trials with three cost conditions blocked and two ratio conditions randomly mixed in each block.

Results:

We divided the participants evenly into three groups based on AQ scores (IQ-matched) and performed an ANOVA (Group × Cost × Ratio) on the jump-to-conclusion rate (the percentage of the trials with no more than two beads drawn). Jump-to-conclusion was not an optimal choice when the sampling cost was low, but could be more rewarding when the sampling cost was high. We found a three-way interaction (Figure 1): in the 80%:20% ratio condition where accuracy and reward were rarely in conflict, all the groups adequately adapted to the change of the cost. However, in the 60%:40% ratio condition, the high-AQ group was less likely than the other two groups to trade accuracy for expected reward when the cost climbed.

The distribution of the reaction time was bimodal. Consistent with our findings in the number of beads drawn, the reaction time gradually shifts from the shorter to the longer in the low- and middle-AQ groups with the drawing cost rising, while the shift in the high-AQ group seemed somewhat cost-resistant (Figure 2).

Conclusions:

In sum, we found that autistic traits influence how people use probabilistic information for decision-making. People with high autistic traits are highly driven by the accuracy of judgment even though pursuing the accuracy means costing their expected reward, while people with low autistic traits are more adaptively driven by expected reward.

4 **164.004** Alterations in Global and Local Visual Processing Is Associated with Autism and Autistic Traits – a Twin Study.

J. Neufeld[1]*, A. Hagström*[2]*, A. van't Westeinde*[3]*, K. Lundin*[2]*, E. Cauvet*[4]*, J. Isaksson*[2] *and S. Bolte*[5]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Srockholm, Sweden, (2)Karolinska Institutet, Stockholm, Sweden, (3)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden, (4)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (5)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background:

Autism Spectrum Disorder (ASD) has long been suggested to be associated with altered local and global sensory processing. However, the nature of such alterations remains controversial with theories ranging from a reduced drive to integrate information into a coherent 'gestalt' ("*weak central coherence*"=WCC; Frith, 1989) to *enhanced perceptual functioning* in local information processing (Mottron et al., 2006) or a more *detail-focused processing style* (Happé, 1999) in ASD. Findings are largely contradictory, with reports of superior local processing or no differences compared to TD in high-functioning individuals with ASD (Muth et al., 2014) and no local advantage but slower global processing in more heterogeneous ASD-samples (van der Hallen, 2015).

Objectives:

In the light of these contradicting findings the current study aimed to gain more conclusive results by testing alterations in global and local visual processing in association with ASD and autistic traits for the first time in a large and well characterized sample of monozygotic (MZ) and dizygotic (DZ) twins, discordant or concordant for ASD or autistic traits. Using this approach, we implicitly controlled for a vast number of confounding factors – including family background, sex and age. Furthermore, we assessed the impact of genetic vs environmental contributions to this link by comparing MZ (100% genetically identical) and DZ twins (50% shared genes).

Methods:

134 same-sex twin pairs (N=268, 53%male, 63.5%MZ, mean age=16.5+/-5.5, 64 diagnosed with ASD) selected from the Roots of Autism and ADHD Twin Study Sweden (RATSS, Bölte et al., 2014) were included.

The Fragmented Pictures Test (FPT) was used to test the ability to construct a gestalt from incomplete visual information (global processing), measured by amount of visual information needed. The Embedded Figures Test (EFT) was used to test the ability (speed) to detect details while ignoring global information (local processing). Autistic traits were assessed with the Social Responsiveness Scale-2 (SRS). Clinical consensus diagnosis of ASD was supported by diagnostic tools, such as the Autism Diagnostic Interview – Revised (ADI-R), the Autism Diagnostic Observation Schedule Second Edition and medical history.

Conditional linear regressions were conducted to assess the within-twin pair relationships between visual tasks and ASD diagnosis/autistic traits, while controlling for general intellectual abilities using the Wechsler Intelligence Scales.

Results:

Both, ASD diagnosis (Z=2.19, p=0.028) and higher autistic traits (Z=1.97, p=0.048) were associated with the need for more visual information to construct a gestalt in the FPT. There was no difference between MZ and DZ sub-cohorts in this relationship. In contrast, speed of local processing in the EFT was only associated with autistic traits within DZ twins alone (Z=-2.15, p=.031), with twins with higher autistic traits being faster.

Conclusions:

Consistent with the WCC hypothesis, our results confirm the notion of altered global processing (need for more visual information) in ASD and individuals with high autistic traits while implicitly controlling for a large number of confounding factors. In contrast, an association between faster local processing and higher autistic traits was only seen within DZ but not MZ pairs, indicating that the latter effect is under genetic control.

5 **164.005** An Eye-Tracking Study on Biological Motion Perception in Children with High-Functioning Autism Spectrum Disorder

C. H. Chiang[1], *W. J. Lin*[2] *and J. L. Tsai*[3], *(1)Department of Psychology, National Chengchi University, Taipei City, Taiwan, (2)Taipei Student Counseling Center, Taipei, Taiwan, (3)Psychology, National Chengchi University, Taipei, Taiwan*

Background: Literature had been demonstrated that children with autism spectrum disorder (ASD) revealed atypical perceptual pattern in biological motion with eye-tracking paradigm. However, some methodological issues such as subject characteristics and the strategy of data analysis are needed to explore.

Objectives: This study investigated the preferential attention and attentional processing on the basic motion perception, animal biological motion perception, and human biological motion perception in children with High-Functioning ASD (HFASD). It aimed to explore the processing of biological motion perception in children with HFASD. Moreover, concerning the heterogeneity within ASD, the study examined the biological motion perception in intellectually gifted children within HFASD.

Methods: Fifty children aged 7 to 10 years with HFASD and twenty-five children with typically development（TD） matched on age and IQ were recruited. The current study utilized preferential looking paradigm and motion point-light displays, demonstrating three visual comparisons: (1) basic motion perception: object motion paired with scrambled motion; (2) animal biological motion perception: animal motion paired with object motion; (3) human biological motion: human motion paired with animal motion. Eye-tracking techniques were applied to measure proportion of dwell time and time course of fixation probability on each motion stimuli.

Results: In basic motion perception, children with TD and HFASD preferentially attend toward scrambled motion. In biological motion perception, generally, children with TD and HFASD preferentially attend toward animal motion and human motion. Time-course analysis revealed that children with TD and HFASD attended toward animal motion and human motion at the same time window. Moreover, in animal biological motion perception, children with HFASD showed lower preferential interest in animal motion than children with TD at the early stage of time course, and there were no significant difference between groups at the late stage of time course. In human biological motion perception, children with TD and HFASD showed similar level of preferential interest in human motion at the early stage of time course; however, children with TD maintained preferential interest in human motion across time, but children with HFASD reduced preferential interest in human motion across time. At the late stage of time course, children with HFASD showed significantly lower level preferential interest in human motion than children with TD. Concerning the heterogeneity within the study sample of HFASD, results indicated that there was no difference on the level of preferential interest in animal motion between intellectually gifted HFASD (IG-HFASD) and TD group; however, in human biological motion perception, IG-HFASD and nonIG-HFASD group reduced preferential interest in human motion across time course compared to TD group.

Conclusions: Findings suggested that children with HFASD exhibit the equivalent preferential interest and speed of attending to biological motion as did TD children. However, children with HFASD reduced referential interest in human biological motion across time course compared to TD children, and not influenced by the intellectually gifted advantage with compensation. The results implicated that biological motion perception may play an important role to understanding the social deficit in children with ASD.

6 **164.006** Attention Allocation during Visual Search in ASD: Results from the ABC-CT Feasibility Study

T. Tsang[1], *E. Barney*[2], *A. Naples*[3], *R. Bernier*[4], *G. Dawson*[5], *S. Jeste*[1], *J. McPartland*[3], *C. A. Nelson*[6], *M. Murias*[7], *C. Sugar*[1], *S. J. Webb*[4], *F. Shic*[2] *and S. Johnson*[1], *(1)University of California, Los Angeles, Los Angeles, CA, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (5)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Boston Children's Hospital, Boston, MA, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and*

Behavioral Sciences, Duke University, Durham, NC

Background: Attenuated attention to social stimuli is a hallmark characteristic of autism spectrum disorder (ASD), and visual search tasks have been used to address salience of social stimuli such as faces (Gliga et al., 2009). 7-14-month-old infants who later developed ASD demonstrated a face “pop-out” effect, much like their typically-developing (TD) peers (Elsabbagh et al., 2012). However, older children with ASD attended to faces less than TD controls in the presence of competing non-social stimuli (Sasson et al., 2008). Visual search may potentially monitor changes in social functioning, and restrictive and repetitive behaviors (Sasson et al., 2008). Here, we evaluated the possibility that visual search tasks can aid in the detection of reliable biomarkers of social impairments in children with ASD.

Objectives: The current study aimed to evaluate whether visual search can reveal reliable differences in attention between children with ASD and TD controls, and to relations between visual search performance, and social and repetitive behavioral features of the autism phenotype. This study is part of a larger project on creating objective measures of treatment gains in clinical trials.

Methods: 46 children (23 ASD, 23 TD; 4.01-11.40 years) participated in the visual search task (adapted from Gliga et al., 2009). Stimuli comprised six circular arrays of five colored images (face, cell phone, vehicle, bird, and scrambled face). Participants viewed each array for 20 s while gaze patterns were recorded using a SR Eyelink 1000 Plus eye tracker. The primary dependent variable was percentage of time spent looking at the face; additional dependent variables included on-screen looking time and number of fixations to each target. Participants also completed a battery of behavioral assessments of social and cognitive development. Eye-tracking data were analyzed using linear mixed-effects modeling with repeated effects of trial; diagnosis, trial, and their interaction were included as fixed effects, and full-scale IQ as a covariate. Associations between social and cognitive measures, and visual search performance were determined with Spearman correlations.

Results: On-screen looking time did not differ by diagnosis status ($F_{1, 49.689}$=1.304, *p*=0.26) or trial ($F_{1,44}$=1.56, *p*=0.19), suggesting no between-group difference in overall visual engagement. Children with ASD looked less at faces ($F_{1,43.55}$ =13.130, *p*=0.001) than TD controls, over and above effects of full-scale IQ and trial. Similarly, children with ASD made fewer fixations within the face than TD controls ($F_{1, 36.381}$=6.027, *p*=0.019at non-face, object targets did not differ by diagnosis status ($F_{1, 41.193}$=0.255, *p*=0.616), suggesting a specific attenuation in attention to social stimuli. Greater fixation to the face was associated with higher Vineland Communication Standard Scores (rho=0.374, *p*=0.011).

Conclusions: Faces captured and held attention less for children with ASD, suggesting that the visual search task is sensitive to differences in social attention between diagnostic groups. In addition, attention to faces was associated with better functional communication skills, implying that visual search performance indexes a relevant domain of social functioning in ASD. Visual search tasks may help to objectively address changes in social functioning or treatment response in clinical trials.

7 **164.007** Attention to Faces in Toddlers Showing Early Signs of Autism Spectrum Disorder: A Marker of Early Risk

A. T. Marin[1]*, H. Yu*[2]*, E. Baker*[3]*, B. Nguyen*[4]*, M. Ware*[5]*, E. Pompan*[6]*, N. M. McDonald*[3]*, A. Gulsrud*[7]*, C. Kasari*[8] *and S. Jeste*[8]*, (1)UCLA Center for Autism Research and Treatment, University of California, Los Angeles, Los Angeles, CA, (2)School of Medicine, Nankai University, Tianjin, China, (3)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (4)Center for Autism Research and Treatment, UCLA, Los Angeles, CA, (5)UCLA, Los Angeles, CA, (6)University of California Los Angeles, Los Angeles, CA, (7)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (8)University of California, Los Angeles, Los Angeles, CA*

Background: Lack of attention to faces is considered one of the earliest and most reliable indicators of risk for Autism Spectrum Disorder (ASD; Dawson et al., 2005; Wetherby et al., 2004). These abnormalities in social attention during early development may contribute to the underlying heterogeneity that characterizes ASD. Using eye tracking methodology, the measurement of time spent examining faces provides an objective marker of dynamic eye gaze that can quantify characteristics of attention in toddlers showing early behavioral signs of ASD. This sensitive measure could provide utility as an outcome marker of social attention in clinical trials for early social communication interventions.

Objectives: We examined: 1) whether fixation time on faces differentiates toddlers who are showing behavioral signs for ASD (HR-ASD) and age-matched typically developing controls (TD), and 2) whether this marker of social attention relates to social communication and cognitive skills.

Methods: Two age-matched groups of HR-ASD (n=64;$M_{\text{age-months}}$=18.5,SD_{age}=2.5) and TD (n=21;$M_{\text{age-months}}$=17.4,SD_{age}=2.3) toddlers participated in a visual paired comparison eye-tracking task (Tobii Systems, Inc.). Toddlers in the HR-ASD group fell within the mild-to-moderate or moderate-to-severe ranges of concern on the Autism Diagnostic Observation Schedule, Toddler Module (ADOS–T). Toddlers viewed two fixed images of faces that were presented in juxtaposition to one another four times each with an on-screen duration time of ten seconds per trial, while eye fixation data was recorded. One image consisted of the child’s primary caregiver and the other of a stranger who was matched based on similarity of physical appearance. Areas of interest (AOI; mouth, eyes, face) were drawn for each image, and eye fixation time in milliseconds per AOI was obtained. An independent sample *t*-test was used to examine risk group differences in percent time looking at the face (i.e., time fixation on face/total fixation time). Correlations between percent eye fixation to the face and non-verbal/verbal developmental quotient (NVDQ/VDQ) were also examined (Mullen Scales of Early Learning).

Results: HR-ASD toddlers did not differ from TD toddlers in percent looking time at familiar/unfamiliar faces, or at the eyes/mouth (all *p*’s>.37). However, HR-ASD toddlers spent significantly less time looking at the face than TD toddlers (*t*(77.2)=3.09,*p*=.016; see Figure 1). Whole-group correlations revealed the percent time looking at the face positively related to VDQ (r_T(83)=.23,*p*=.003) and NVDQ scores (r_T(83)=.17,*p*=.024), but did not correlate with the ADOS-T total score (r_T(63)=-.12,*p*=.186).

Conclusions: Our results indicate that toddlers showing early signs of ASD spent less time looking at faces than TD toddlers. Moreover, HR-ASD toddlers who spent more time looking at faces had higher cognitive abilities, yet no relationships were found with ASD symptoms. Figure 1 depicts a great deal of heterogeneity within the HR-ASD group, suggesting that this may be a promising marker of which toddlers may benefit most from intervention. Null findings with regards to the familiar/unfamiliar face and mouth/eyes suggests these contrasts are developmentally inappropriate within this age group. Ongoing research will examine attention to faces as an outcome measure and predictor of response to intervention in an eight-week clinical intervention designed to target early social communication skills.

8 **164.008** Attentional Disengagement in School-Age Children with ASD and Relationship to Phenotype: Results from the ABC-CT Feasibility Study

Q. Wang[1]*, E. Barney*[2]*, R. Bernier*[3]*, G. Dawson*[4]*, S. Jeste*[5]*, K. Chawarska*[1]*, J. McPartland*[1]*, C. A. Nelson*[6]*, M. Murias*[7]*, C. Sugar*[5]*, S. J. Webb*[3]*, A. Naples*[1] *and F. Shic*[2]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle*

Children's Research Institute, Seattle, WA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (5)University of California, Los Angeles, Los Angeles, CA, (6)Boston Children's Hospital, Boston, MA, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC

Background: Children with Autism Spectrum Disorder (ASD) exhibit atypicalities in attentional disengagement compared to controls. However results have been inconsistent with some groups noting longer (Elsbbagh et al, 2009, 2013, Kawakubo et al. 2007, Landry and Bryson 2004) while others observe shorter disengagement times (Chawarska, et al, 2003, 2010), or no difference (Kawakubo, et al., 2011, Fischer et al., 2014). Furthermore, little is known about relationships between atypical disengagement and phenotypic characteristics in both typically developing (TD) children and children with ASD.
Objectives: 1. Analyze group differences in reaction times during a gap overlap paradigm (including gap, overlap, and baseline phases). 2. Examine the association between engagement on screen and reaction times with behavioral characterization.

Methods: Participants were children with ASD (n=24, age = 7.9±2.2) and TD controls (n=26, age = 6.6±2.0). Paradigms were adapted from Elsbbagh et al (2009, 2013) with in-house trial randomization and no gaze contingency. Dependent measures were percentage of valid looking time (%Valid) and reaction time to the peripheral stimulus (RT). Data were analyzed using linear mixed models (LMM) with diagnosis, condition and their interaction as factors, covarying for full scale IQ (FSIQ). For RT, a natural base logarithm transformation was used. Spearman's rank correlations were applied to compare T scores from the Social Responsiveness Scale (SRS) to the eye-tracking measures in children with and without ASD respectively.

Results: A LMM of %Valid showed a main effect of group (d = 0.98, p = 0.038), with the ASD group looking less than TD, and no effect of task condition, interaction, or FSIQ. Similarly, a LMM of RT showed a main effect of group (d = 0.28, p =0.048), with shorter RTs in the participants with ASD than TD. Condition effects were observed (p < 0.001), with fastest RTs in the gap condition, then baseline, and slowest in overlap. The interaction and FSIQ were not significant.

A negative correlation was observed between %Valid and SRS Autistic Mannerisms in participants with ASD (r(23) = -0.50 p = .015). In the TD group, a negative correlation was observed between %Valid and SRS Social Awareness (r(26) = -0.53, p = 0.005) and Social Cognition (r(26) = -0.62, p = 0.001). In the TD group, RT in the overlap condition was correlated with SRS Social Cognition (r(26) = 0.45, p = 0.02), while no correlation between the RT and SRS was found for children with ASD (ps>0.1).

Conclusions: Lower overall attention, which was associated with more severe autism symptoms indicated by SRS, was observed in children with ASD. Children with ASD showed faster disengagement times compared to TD children, suggesting greater bias for exogenously driven salient cues, limited processing of the central stimulus, or greater efficiency in visual exploration in ASD. In TD children, slower disengagement was associated with social cognition difficulties, contrary to continuum-based expectations that children with ASD should be slowest of all. These results suggest that a simple deficit model of attentional disengagement in ASD may not adequately describe our observed results.

9 **164.009** Attentional Performance in Adolescents with ASD in Normal Range of Intelligence

M. Pudło[1] *and E. Pisula*[2]*, (1)University of Warsaw, Faculty of Psychology, Warsaw, Poland, (2)University of Warsaw, Warsaw, Poland*

Background: The results of previous studies on individuals with ASD mostly regard only one type of attentional process such as orienting attention. However, it is essential to examine the performance of various attentional processes in adolescents with ASD. There is evidence of impaired bottom-up attentional at individuals processes. On the other hand, some researchers postulate the poor executive attentional control and atypical attentional processing e.g. overselectivity in individuals with ASD. In addition, the developmental and educational challenges during adolescence require efficient alerting, orienting, and executive processes of attention. As a result, the knowledge of what kind of attention processes the adolescents with ASD manifest decreased and increased performance could be useful for interventions and education.
Objectives: The aim of the research was to assess the efficacy of numerous attentional indicators in adolescents in the normal range of intelligence. The performance at attentional processes was examined such as: alerting, orienting to spatial cues, solving cognitive conflicts, visual-spatial search, concentration performance, and selectivity.

Methods: The following tests were used in the study: The Attention Network Test (ANT), Test of concentration d2 and The Color Trails Test (CTT). The participants were 37 adolescents with ASD, 12-20 years of age, selected from a larger sample, with a Wechsler IQ in the normal range ≥75, and 37 controls. The groups (ASD and control) were matched by chronological age and Full-Scale IQ. The psychiatric diagnosis of autism and Asperger Syndrome was based on the ICD-10 criteria. The diagnosis of ASD was confirmed with use of ADOS-2 and ADI-R.

Results: The results of ANOVA showed significant differences in reaction times between the groups for seven conditions in the ANT: No cue, double cue, spatial cue, center cue, and flanker conditions: Congruent, incongruent, and neutral. The differences in the effects of ANT (alerting, orienting and executive attention) between groups were not revealed. The differences were present between participants with ASD and their counterparts in the Test of Concentration d2 on two indicators: Their ability on Concentration-Performance and Fluctuation Rate. No significant differences between the groups in CTT were found. The second step in the analysis was to select attentional tasks, which would differentiate the most adolescents with ASD from typically developing counterparts. The discriminant function analysis showed that adolescents with ASD differed the most from the control group in the task with the center cue condition in ANT and the task with incongruent flanker. Individuals with ASD reacted slower with these two conditions than their counterparts from the control group. However, the ASD group manifested high efficacy at the indicator from the Test of concentration d2: Total corrected processed.

Conclusions: The results of the discriminant analysis are consistent with the hypothesis of enhanced perceptual capacity and overselectivity for individuals with ASD. Decreased efficacy at orienting attention is typical for children with ASD, however as discriminant analysis shows, adolescents from the study did not seem to differ significantly from typically developed counterparts in orienting attention.

10 **164.010** Atypical Visual Attention Patterns to Social and Non-Social Stimuli in the Broad Autism Phenotype

N. Maltman[1]*, K. Nayar*[2]*, G. E. Martin*[3]*, N. J. Sasson*[4] *and M. Losh*[5]*, (1)Northwestern University, Evanston, IL, (2)Feinberg School of Medicine, Department of Psychiatry and Behavioral Sciences, Northwestern University, Evanston, IL, (3)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (4)University of Texas at Dallas, Richardson, TX, (5)Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: Differences in attention to social stimuli have been repeatedly observed in eye-tracking studies of individuals with autism spectrum disorder (ASD), particularly in the context of competing information, such as objects associated with circumscribed interests (Sasson et al., 2008; 2011). Evidence of subtle differences in visual attention to social stimuli (e.g., faces) has also been reported in parents of individuals with ASD, and among those parents who display subclinical features of the broad autism phenotype (BAP) in particular (Spezio et al., 2007; Adolphs, et al., 2008). The BAP is a constellation of subclinical traits (pragmatic language, personality features) related to the core features of ASD. This study built on this work by applying eye tracking during a passive viewing paradigm, adapted from Sasson et al. (2008), to examine patterns of visual attention to social, neutral, and circumscribed interest stimuli in parents with and without the BAP.

Objectives: This study examined whether visual attentional patterns to social and nonsocial images in parents of individuals with ASD are similar to those observed in ASD, and whether these differences are related to features of the BAP.

Methods: Thirty parents of individuals with ASD, and 9 controls viewed 12 separate visual arrays on a Tobii T60 eye tracker for 10 seconds each. Each visual array included 12 luminance-matched gray-scale images drawn from both public domain and Sasson et al. (2008) of four image types: smiling people, neutral objects (e.g., table, gloves), objects associated with high interests in ASD (e.g., trains, electronic devices), and those associated with personality features of the BAP, such as rigid or perfectionistic qualities (e.g., calendar, folded clothes). Image types were presented in randomized order to control for potential order effects. Analyses evaluated visual exploration (number of images explored over time) and perseveration (amount of time spent on each image). BAP status (positive + or negative -) was determined using the Modified Personality Assessment Scale (MPAS; Tyrer, 1988).

Results: Visual attention differed across parent groups, and in relationship to BAP features. Similar to patterns reported in ASD (Sasson et al., 2008), parents of children with ASD demonstrated reduced exploration (*p*s<.05) and increased perseveration (*p*s<.05) with all image types across slides, relative to controls. These findings were driven by the BAP+ parents, who showed decreased exploration (*p*s<.04), and increased perseveration (*p*s<.05) on slides containing ASD-related high interest images, compared to those without BAP features and controls.

Conclusions: Differences in visual attention to social and nonsocial stimuli observed in BAP+ parents bear striking resemblance to patterns observed in ASD, and may suggest key differences in attentional biases related to genetic liability to ASD.

11 **164.011** Autistic Children at the Age of Diagnosis Are More Interested in Letters Than Typical Children

A. Ostrolenk[1], *B. Forgeot d'Arc*[2] *and L. Mottron, M.D.*[3], *(1)Université de Montréal - Department of Psychiatry, Montréal, QC, Canada, (2)Département de Psychiatrie, Université de Montréal, Montréal, QC, CANADA, (3)University of Montreal Center of Excellence for Pervasive Developmental Disorders (CETEDUM), Montreal, QC, Canada*

Background:

Hyperlexia is defined by advanced reading skills relative to comprehension, acquired at an early age in the absence of explicit teaching, concurrent with a strong orientation toward written material, and accompanied by a neurodevelopmental disorder. Hyperlexia is the most common special ability reported in autism. Ostrolenk et al.'s (2017) literature review of 82 individual cases of hyperlexia and 22 group studies (including 315 hyperlexic subjects) showed that the reported prevalence of hyperlexia in autism varies between 6 and 21%. Furthermore, Ostrolenk et al., (2017) found that of the published hyperlexic case studies reviewed, a significant proportion (84%) were on the autism spectrum. However, within this literature, there are no group studies specifically investigating children's *interest* in written material.

Objectives:

Our objective was to **estimate the prevalence of atypical interest for written material** in a representative population referred for an autism diagnosis assessment.

Methods:

Participating families were referred to our clinic after autism was suspected in their child. They were administered a six-minute questionnaire by the psychiatrist; questions about the child's interest in written material, their related skills and behaviours, as well as questions about their comprehension and oral language level were included. The parents of 79 children answered the questionnaire at intake, of which 40 subsequently received an autism diagnosis at the end of the evaluation (50.63%). The children were 28 to 86 months old (mean = 46.29; SD = 12.26). The two groups (autism diagnosis and no diagnosis) did not differ in their age. The children's interest in written material was rated using 4 categories, coded with numbers 1 to 4; 1 - *None* < 2 - *Moderate* < 3 - *Intense* < 4 - *Exclusive*.

Results:

Children later diagnosed with autism had a mean interest for written material that was superior to the non-diagnosed group (means: 2.20 vs. 1.69 out of 4). An ANCOVA analysis using age as a covariate, demonstrated a significant interaction between diagnosis and interest for letters (p=.013). Significantly more autistic children had an *intense* or *exclusive* interest in written material compared to non-autistics (42.50% vs. 20.51%). For those who had an interest in written material, the mean age of the interest onset was similar in both groups (29.51 months).

Conclusions: Our study demonstrates the existence of an association between autism and an early interest in written material, with a significantly larger portion of autistic toddlers demonstrating an intense interest compared to non-autistic toddlers. These findings confirm the need for more research on hyperlexia in autism, the factors involved in its emergence, and its possible uses during diagnosis assessment and intervention.

12 **164.012** Binding in Short-Term Memory across Modalities in Younger and Older Adults with Autism Spectrum Disorder

M. Ring[1], *B. Guillery-Girard*[2], *P. Quinette*[2], *S. B. Gaigg*[3] *and D. M. Bowler*[4], *(1)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany, (2)Inserm—EPHE, Université de Caen-Normandie, Unité E0218, Laboratoire de Neuropsychologie, CHU Côte de Nacre, 14033 Caen Cedex, France, Caen, France, (3)City, University of London, London, United Kingdom, (4)Autism Research Group, City, University of London, London, United Kingdom*

Background:

Adults with Autism Spectrum Disorder (ASD) show difficulties in long-term memory which are assumed to result from altered relational binding (Bowler et al., 2011). Relational binding is the process by which elements of an episode are related to form a coherent episodic representation and to enable flexible retrieval. There is some evidence that short-term memory can also be impaired in ASD, for example when asked to remember the temporal order of item presentation such as digits, words (Poirier et al., 2011) or locations in a grid (Bowler et al., 2016). Similar to ASD individuals TD older adults (TD OA) present an associative deficit (Naveh-Benjamin, 2000) and, therefore, they show lower memory especially in relational tasks compared to younger TD individuals, which was found for long-term (Rotblatt et al., 2015) and short-term memory (Lecouvey et al., 2015). The ageing analogy of ASD describes similarities in memory in ASD and TD OA (Bowler, 2007) in that the memory difficulties ASD individuals show at younger age are similar to that of TD OA. This was confirmed for order memory (Ring et al., 2016).

Objectives:

This study aimed to compare systematically short-term memory across different modalities to investigate whether it is impaired in ASD similarly to long-term memory when it depends on relational binding and to test which task is most difficult. In addition, the ageing analogy was tested. It was predicted that short-term memory in ASD would be reduced compared to TD adults and that age would have a significant negative effect on TD but not ASD memory.

Methods:

Fifty-three ASD and 54 typically developing (TD) participants matched on gender, chronological age (CA; $M_{CA} = 43.19$), and intelligence quotient (IQ; $M_{FIQ} = 111$) were tested with three tasks testing verbal (sequence of letters), visuo-spatial (sequence of crosses in the cells of a grid) and multimodal short-term memory span (sequence of letters in the cells of a grid).

Results:

TD participants had a significantly longer span compared to ASD individuals in all tasks ($F = 12.24$, $p < .01$, $\eta_p^2 = .10$). The multimodal task was hardest for both groups, followed by the visuo-spatial task ($F = 47.97$, $p < .0001$, $\eta_p^2 = .31$). ASD participants made more mistakes than TD participants ($F = 6.37$, $p < .05$, $\eta_p^2 = .06$). Whereas age had a significant negative effect on TD individuals' memory ($R^2 = .13$, $F(1,52) = 8.05$, $p = .006$), short-term memory in younger and older ASD individuals did not differ significantly ($R^2 = .01$, $F(1,51) = 0.53$, $p = .47$).

Conclusions:

Similar to long-term memory, ASD individuals show difficulties in relational short-term memory that are similar across the verbal, visuo-spatial and multimodal domain. The analysis of the effect of age on short-term memory found confirmation for the ageing analogy. Age had a significant negative effect on TD but not ASD individuals' relational short-term memory. ASD might be protective against the effects of age on memory.

13 **164.013** Children and Adults with Autism Detect Rapidly Presented Temporal Information More Accurately Than Typically Developing Individuals

***J. Kopec**, A. M. Prawl, E. P. McKernan, E. A. Kaplan, E. L. Koelmel and N. Russo, Psychology, Syracuse University, Syracuse, NY*

Background: Individuals with autism spectrum disorders (ASDs) experience enhanced or more efficient visual perception abilities in spatial visual search tasks in comparison to IQ and age-matched typically developing (TD) individuals.

Objectives: The goal of this study was to extend the notion of enhanced visual search to the temporal domain and across development in individuals with autism.

Methods: We tested children (n = 21) and adults (n = 4) with autism, as well as mental-age matched TD children (n = 21) and adults (n = 4) in two rapid serial visual presentation (RSVP) tasks at six different presentation rates (13, 26, 39, 65, 91, 195 ms/item). In the Color task, participants detected a purple target letter amongst black letter distractors, while in the Category task, participants detected a black letter amongst black number distractors.

Results: Across all groups and both tasks, slower presentation rates resulted in higher accuracy. In the Color task, adults with ASD were more accurate than TD adults at shorter presentation rates, but similar at longer presentation rates. Children with ASD showed comparable performance to TD adults at shorter presentation rates and outperformed TD children across presentation rates. In the Category task, all adults were more accurate than children except at the shortest presentation rates. Children with ASD were more accurate than TD children across the majority of presentation rates, while no significant differences were found between adults with ASD and TD adults.

Conclusions: These results suggest that both children and adults with ASD experience enhanced visual processing in the temporal domain, particularly in tasks involving temporal binding of stimulus features (i.e., binding a color to a letter).

14 **164.014** Creativity Assessment in ASD: Mathematical and Non-Mathematical Thinking Processes

***O. E. Hetzroni**[1], M. Leikin[2] and H. Agada[3], (1)University of Haifa, Haifa, Israel, (2)Department of Special Education, University of Haifa, Haifa, Israel, (3)Special Education, University of Haifa, Haifa, Israel*

Background: Creativity has been identified as a creation of an object, action, or idea that is new and valuable within it's time and frame. Creativity can be evaluated using fluency, flexibility, originality, and details/expansion as performance parameters. Research investigating creativity among individuals with ASD incorporated mostly traditional creative thinking processes such as art, writing, and, music. Mathematical and science creative thinking were not evaluated among individuals with ASD.

Objectives: The goal of this study was to investigate traditional and mathematical creative thinking processes among individuals with and without ASD, and to evaluate the relations between creative thinking and cognitive processes namely verbal and spatial working memory, and inhibition.

Methods: Participants included two groups of 20 children with HFASD and with typical development (TD) ages 9-11, matched based on Raven's IQ test. Participants were asked to participate in five sets of tests: mathematical and pictorial tasks developed to evaluate creativity in multiple solutions to problems using the four parameters performance scale developed to evaluate creativity; the Stroop color-word test, the Wechsler's letter-number sequencing test, and the Corsi block task.

Results: There were no significant differences based on gender, IQ or age among all participants. There were no significant differences in inhibition and spatial working memory, but there was a significant difference in verbal memory test results between the two groups. In the mathematical creativity test, results demonstrate a significant difference in fluency and in flexibility, with the group of children with ASD presenting more solutions to the problems, with a larger variability in the solutions. However, there was no significant difference in the general level of creativity. In the pictorial problem solving test, results demonstrate a significant difference in fluency and originality, and a close to significant difference in the general level of creativity. In this test, the group of children with TD presented more solutions to the problems, with a larger variability in the solutions. There were negative correlations between the mathematical problem solving abilities and the results in the Stroop test among both groups, and positive correlations between the pictorial problem solving abilities and the Raven's IQ results. Specific results in the ASD group demonstrated negative correlations between the mathematical fluency and the originality levels and the Stroop, and between the pictorial fluency and the flexibility levels and all the math creativity results.

Conclusions: Results demonstrate that children with HFASD and children with TD did not differ in their general creativity when solving mathematical problems. Yet, children with HFASD showed more fluency and flexibility in the math task, while children with TD showed more flexibility and originality in the pictorial test. These results might indicate a tendency for higher levels of creativity in mathematical thinking in comparison with non-mathematical creativity among children with ASD. Cognitive measures were similar across both groups, except for the verbal working memory that was significantly lower than the control group. Further conclusions and comparisons will be discussed in the presentation in relation cognitive performance and specific creativity parameters among both groups.

15 **164.015** Data-Gathering Style in Autism and Its Relationship with Paranoia

K. Bennert[1]*, A. Russell*[2]*, A. Canning*[3]*, M. Brosnan*[4] *and G. Roberts*[5]*, (1)Bristol Autism Spectrum Service, Bristol, United Kingdom of Great Britain and Northern Ireland, (2)Psychology/Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (3)Fromeside Secure Services, Avon and Wiltshire Mental health Partnership, Bristol, United Kingdom, (4)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (5)Bristol Autism Spectrum Service, Bristol, United Kingdom*

Background: Individuals with Autism Spectrum Conditions (ASC) have been found to experience higher levels of paranoia than the general population. However, cognitive mechanisms involved in the development and maintenance of paranoia may differ from those proposed for typically developed (TD) individuals with persecutory ideation. A reasoning bias in the form of reduced data-gathering ('jumping-to-conclusions', or JTC bias) is regarded as contributory factor for paranoia in people with psychosis and non-clinical populations.

Objectives: To examine data-gathering style and its association with paranoia in individuals with ASC and TD controls. To elucidate conflicting previous research findings regarding presence /absence of a JTC bias in individuals with ASC.

Methods: Data-gathering style was investigated in 39 adults with ASC and 64 typically developed controls using two probabilistic reasoning tasks: the classic Beads Task paradigm, traditionally employed to evidence reduced data-gathering in paranoid schizophrenia, and an emotionally salient equivalent.

Results: Despite higher levels of paranoia, the ASC group requested significantly more information (>3 beads) and were significantly less likely to show a JTC bias than the TD group. Task design was not found to significantly affect performance for either group and there was no difference between groups with regard to degree of confidence at point of decision-making. Paranoia did not correlate with amount of data-gathering for either group.

Conclusions: Results suggest that data-gathering style may not be a contributory factor for paranoia in autism, consistent with the proposal of a differential cognitive structure of paranoia in individuals with ASC. Cognitive behavioural interventions for individuals with ASC and paranoia may need to be adapted to address alternative cognitive mechanisms involved in its development and maintenance.

16 **164.016** Decreased Experience-Driven Optimization of Eye-Movement Patterns in People with Autism Spectrum Conditions

M. E. Krol*, Faculty of Psychology II, SWPS University of Social Sciences and Humanities, Wroclaw, Poland*

Background:

Pellicano and Burr (2012) proposed that predictive coding theory may help to understand the mechanism behind the cognitive phenotype of autism, i.e. the diminished ability to generate and employ predictions in the processing of sensory data. In other words, people with autism may see the world without the "glasses of experience"- and in consequence may have difficulty ignoring noise inherent in sensory input and distinguishing signal from noise. This may also manifest itself in the difficulty with the generalization of experience and inflexibility of thinking. Predictive coding account of autism also explains enhanced sensory discrimination abilities (a consequence of very realistic sensory experience), local information bias at the expense of global information or diminished susceptibility to perceptual illusions, which are caused by strong top-down expectations distorting the perception of certain images.

Objectives:

We wanted to investigate the ability of participants with ASC (autism spectrum conditions) to use top-down expectations to optimize their eye-movement patterns. In a previous study with typically developing participants, we showed "economies of experience" in eye-movement patterns, i.e. optimization of eye-movement patterns aimed at more efficient and less costly visual processing. We showed that eye-movement dispersion, velocity, and the number of fixations decreased with each stimulus presentation. This suggests that eye-movement patterns can evolve to facilitate the optimal processing of a given stimulus via experience-driven perceptual learning. The aim of this study was to test whether this experience-driven optimization would be present to a similar extent in participants with ASC.

Methods:

21 participants with ASC diagnoses confirmed by ADOS, and 23 age-, IQ- and gender-matched typically developing (TD) participants took part in the study. Participants' eye movements were recorded using a remote eye-tracking device SMI RED250Mobile, with a sampling rate of 250 Hz. Participants looked at Mooney-type, degraded stimuli that were difficult to recognize without prior experience, but easily recognizable after exposure to their undegraded versions, in a design similar to a Loth, Gómez and Happé (2010) study. Participants first saw the degraded version of the stimulus, which was used to record the eye-movements without prior experience of the stimulus. Next, participants saw the original, disambiguated photograph, immediately followed by the degraded version again. These presentations were used to disambiguate the degraded stimulus and enable perceptual learning, to make sure that the participants would be able to link the degraded and undegraded stimuli. Finally, after a delay, participants saw the degraded version again, interspersed with other stimuli, which was used as a measure of perception with prior experience and the outcome of perceptual learning.

Results:

We compared the first presentation (pre-experience) and the last presentation (post-experience). We performed a mixed-model analysis, controlling for intelligence, age and ASC diagnosis, of several eye-tracking measures. We found that participants with autism used their experience to optimize their eye-movement patterns to a smaller degree compared to TD participants.

Conclusions:

This study provides evidence in support of the predictive coding account of autism and identifies atypical perceptual learning in people with ASC, who may underuse top-down expectations to optimize eye-movement patterns.

17 **164.017** Developing and Piloting a New Parent-Report Measure of Executive Function for Use with Children with ASD

*L. Ledger-Hardy[1], **W. Mandy**[2], D. H. Skuse[3] and P. Burgess[4], (1)University College London, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom, (4)UCL, London, United Kingdom*

Background:

Although executive function difficulties are well documented amongst individuals with autism spectrum disorder (ASD), there is no consensus on how best to assess these in clinical practice and research. Studies using performance-based measures (i.e., cognitive tests) often demonstrate relatively modest effect sizes and inconsistencies between studies are apparent. These findings lack ecological validity, as they do not reflect the fact that severe difficulties with planning and organisation are commonplace in the day-to-day lives of children with ASD. A widely used parent-report questionnaire measure, the Behaviour Rating Inventory of Executive Function (BRIEF), was designed to have greater ecological validity than traditional performance-based measures. A review of the literature reveals that the average score on the BRIEF for children with ASD is close to the maximum score on the BRIEF, indicating the presence of a ceiling effect.

Objectives:

The aim of this study was to develop and pilot a new parent-report measure of executive function, specifically for use with children with ASD. This measure was intended to have good ecological validity and be sensitive to variability across the full range of day-to-day executive function difficulties experienced by children with ASD.

Methods:

This research was completed in two parts. Study 1 focused on the development of the measure and Study 2 focused on its initial validation. In Study 1, parents and professionals underwent in-depth interviews about the nature of executive function difficulties in children with ASD. These interviews were analysed using qualitative methods and this directly informed the development of the new measure, thereby maximising its ecological validity. The measure was then piloted online with parents of children with ASD (N = 44) and parents of TD children (N = 55), enabling preliminary examination of its psychometric properties.

Results:

A thematic analysis of the nature of executive function difficulties in children with ASD revealed widespread executive function difficulties across multiple domains. The new measure was named the A-POD (Autism Planning and Organisation Difficulties) and initially contained 48 items. Piloting of the A-POD online revealed a large difference between the ASD and TD groups (*r* = .79), indicating that children with ASD were reported to have substantially greater levels of executive dysfunction. The A-POD demonstrated good test-retest reliability (r=.82) and internal consistency (α=.98). The items with the weakest reliability were removed and the final version of the A-POD contained 38 items. Preliminary positive evidence of its criterion and construct validity was found.

Conclusions:

Day-to-day executive function difficulties are substantial and widespread amongst children with ASD. The A-POD is a promising measure of these difficulties, demonstrating encouraging psychometric properties. Both parent-report and performance-based methods of assessment should be used to gain a comprehensive picture of a child's executive function ability.

18 **164.018** Differences in Attentional Disengagement in Preschoolers at Risk for ASD and with FXS

***C. A. Wall**[1], Q. Wang[2], B. Tonnsen[3], K. E. Caravella[4] and J. E. Roberts[5], (1)Department of Psychology, University of South Carolina, Columbia, SC, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Psychological Sciences, Purdue University, West Lafayette, IN, (4)University of South Carolina, Columbia, SC, (5)Psychology, University of South Carolina, Columbia, SC*

Background:

Early visual attention is critical to shaping learning opportunities. Although attentional problems are not core features of neurodevelopmental disorders such as fragile X syndrome (FXS) and autism spectrum disorder (ASD), much work has highlighted atypical attention patterns in young children in these populations (Tonnsen, Grefer, Hatton, & Roberts, 2014). Many studies utilize eye-tracking to measure low-level differences in attention at young ages in children with ASD and FXS. One example is attentional disengagement, indexed by the gap-overlap paradigm. Longer latencies to attentional disengagement may suggest attention difficulties, and increased latency of disengagement has been shown to discriminate infant siblings who go on to develop ASD from those who do not (Elsabbagh et al., 2013). Little work has examined performance on the gap-overlap task in very young children with FXS although some studies suggest attentional disengagement is impaired in older individuals (Shelton et al., 2014). Given the high rate of comorbidity of ASD with FXS and the mounting interest in neurodevelopmental pathways to common and divergent phenotypes in childhood disorders, the examination of early visual attention in these populations offers an important avenue for current research.

Objectives:

To evaluate differences in attentional disengagement between typically developing (TD) preschoolers and those at risk for developing ASD due to 1) FXS or 2) heritable factors due to an older sibling with ASD.

Methods:

Data were taken from a longitudinal study of neurodevelopment in children with disabilities. Assignment to risk groups was made at recruitment. The sample included 21 ASIB preschoolers (n_{males}=15; M_{age}=5.09 years), 19 with FXS (n_{males}=14; M_{age}=5.11 years), and 21 TD (n_{males}=15; M_{age}=4.46 years).

Groups did not differ by age (*p*=.274). Participants viewed the gap-overlap eye-tracking task using the SR Eyelink system, and saccadic reaction times (RT) for gap, overlap, and baseline conditions were recorded. Disengagement was calculated as the difference in RT between the overlap and baseline conditions. Given the small within-group sample and heterogeneity characteristic of at-risk populations, nonparametric methods were utilized to test differences in median disengagement time.

Results:

Median disengagement times for each group were: q_{ASIB}=88.8 ms, q_{FXS}= 119.5 ms, and q_{TD}=74.3 ms. Results of the Independent-Samples Kruskal-Wallis test suggest that the groups differ (H(2) = 6.0, *p*=.050) with pairwise comparisons showing a difference between TD-ASIB (*p*=.049) and TD-FXS (*p*=.025), but not for ASIB-FXS (*p*=.748).

Conclusions:

Consistent with previous findings, the present study found longer disengagement latencies in the ASIB and FXS groups relative to TD but no differences between ASIB and FXS preschoolers. Results suggest that atypical visual attention patterns observed in both of these risk groups are similar and present in early childhood. These findings provide important information regarding ASD risk and the convergent developmental pathways that lead to an ASD diagnosis. Impaired attentional control could be related to ASD features in both groups, particularly as it relates to executive functioning deficits, anxiety, or atypical social learning. Continuing longitudinal research will examine earlier attentional vulnerabilities among these etiological risk groups earlier in life and their relation to ASD diagnostic outcomes as those data become available.

19 **164.019** Diminished Spontaneous Social Orienting in School-Age Children with ASD: ABC-CT Feasibility Study

***K. Chawarska**[1], A. Naples[1], J. McPartland[1], S. J. Webb[2], M. Murias[3], C. Sugar[4], R. Bernier[2], G. Dawson[5], S. Jeste[4], C. A. Nelson[6] and F. Shic[7], (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (4)University of California, Los Angeles, Los Angeles, CA, (5)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Boston Children's Hospital, Boston, MA, (7)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA*

Background: Deficits in spontaneous orienting to social (SSO) stimuli have been reported as early as at 6 months in infants who are later diagnosed with ASD (Chawarska et al., 2013; Shic et al., 2014) as well as in toddlers newly diagnosed with ASD (Chawarska et al., 2012; 2016). Young children with ASD have the greatest orienting difficulties in the presence of ostensive cues for engagement such as eye contact and speech (Chawarska et al., 2012; Shic et al, 2014) expressed in lower level of attention to the social scene and to the face of an interactive partner. Early individual differences in SSO have been linked with social and language outcomes 2-3 years later (Campbell et al., 2014). It is not clear however, if SSO deficits are also present later in development and if they follow the same pattern as those observed in the early stages of autism.

Objectives: To evaluate if school-age children with ASD display impairments in SSO. We hypothesized that school-age children with ASD will show diminished attention to faces (%Face) in conditions involving ostensive cues for engagement and lower attention to social scenes (%Scene) in general.

Methods: Children with ASD (n=23) and typically developing (TD) controls (n=25) age 4 to 11 years completed the free-viewing SSO eye-tracking task validated previously in infant and toddler studies (Chawarska et al., 2012; 2013) as part of their participation in the Autism Biomarker Consortium for Clinical Trials (ABC-CT) study. Four conditions were presented in which actress: spoke directly to the camera (Speech), initiated Joint Attention (JA), made sandwich (Sandwich), and looked at moving toys (Toys). Group differences were analyzed using linear mixed models (LMM) with diagnosis and condition as factors and IQ as a covariate.

Results: A LMM analysis of %Face indicated effects of diagnosis (p=.009), condition (p<.001) and their interaction (p<.003) as well as IQ (p<.001). Compared to TD controls, children with ASD had lower %Face in the Speech and JA conditions (p<.001, p=.018), but not in the Toys and Sandwich conditions (p=.099, p=.860). LMM analysis on %Scene indicated no effect of diagnosis (p=.25), but significant condition (p<.001) and diagnosis x condition interactions (p<.001). Within subject comparisons indicated that, in the TD group, attention to the scene in the Speech condition was either *comparable* (JA and Toys) or *higher* (Sandwich) than in other conditions. In the ASD group, attention to the scene during the Speech condition was *comparable* to JA condition, but *lower* than in Toys and Sandwich conditions. Lower %Scene and %Face during the SSO task was associated with higher total SRS scores in the ASD group (Pearson r(22)=-.5 and r(22)=-.45, ps < .05).

Conclusions: Increasing attentional capacity in school-age children resulted in less pronounced differences in the overall attention to the scene. However, this increased capacity did not eliminate ASD-specific impairment in attention to faces of interactive partners. The study replicates and extends earlier findings and suggests that the SSO task represents a promising biomarker for ASD from prodromal stages of the disorder to early school age.

20 **164.020** Examining Distraction and Avoidance Information Processing Mechanisms Among Children with Autism Spectrum Disorder

***A. J. Harrison**[1] and M. M. Slane[2], (1)Educational Psychology, University of Georgia, Athens, GA, (2)University of Georgia., Athens, GA*

Background:

Research ubiquitously supports that children with ASD demonstrate impairments in social attention such as a reduction of attention to social stimuli in the majority of contexts (Guillon, Hadjikhani, Baduel, & Rogé, 2014). Less is known about the mechanisms that contribute to diminished social attention in ASD. The social motivation theory posits that individuals with ASD simply find social stimuli less rewarding and do not show the same preference for social stimuli that typically developing children do (Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012). Other research suggests that competition from circumscribed interests (Cis) may better explain the emergence of the social attention deficit in ASD (Sasson, Turner-Brown, Holtzclaw, Lam, & Bodfish, 2008).

Objectives:

Use an information-processing paradigm (commonly used to examine attention biases in individuals with internalizing disorders) to examine profiles of attention in children with ASD. Evaluate whether children with ASD demonstrate a causal mechanism accounting for diminished social attention more in line with avoidance of social stimuli as compared to distraction by circumscribed objects.

Methods:

The current study compared attentional allocation patterns in children ages 6 to 17 years diagnosed with ASD (n = 16) to a typically developing (TD) control group (n = 19). The study utilized an ASD-specific passive viewing task to examine information processing styles (Harrison & Gibb, 2014). The task was designed so that each quadrant or area of interest (AOI) depicted two social images, a familiar face (FS) and a control face (NFS), and two objects, a parent identified CI (FCI) and an unfamiliar control object (UFO). This presentation allows for the examination of the proportion of attentional allocation across stimulus type.

Results:

Initial analyses using a 2 (diagnostic group: ASD, TD) x 4 (AOI: FS, NFS, FCI, UFO) repeated measures ANOVA to examine differences in mean dwell time for each of the four stimulus types. Results from this study did not reveal a diagnostic group by stimulus type interaction. However, children with ASD and TD children demonstrated systematic differences in attentional allocation. More specifically, children with ASD demonstrated less attention than TD children to all stimulus types: CI objects, $F(1, 33) = 5.21$, $p = .03$, control objects, $F(1, 33) = 10.77$, $p = .002$, familiar faces, $F(1, 33) = 4.52$, $p = .04$ and unfamiliar faces, $F(1, 33) = 12.24$, $p = .001$.

Conclusions:

These initial results demonstrate that children with ASD are attending to all stimuli less than TD children; however, information regarding which mechanism is contributing to diminished attention was not revealed from these analyses. Follow-up analyses will examine group by stimulus type interactions using several other dependent eye tracking variables. More specifically, rather than examining overall total dwell time, an adjusted estimate of attentional allocation will be calculated for each participant to take into account individual variation in total attention. The proportion of time spent looking at each quadrant or AOI as compared to total attention across each trial will allow for an examination of individualized patterns of attentional allocation.

21 **164.021** Executive Function in More-Able Kindergartners with ASD Predicts Concurrent Academic, Social, and Behavioral Outcomes

Y. B. Choi[1], *N. Benrey*[2], *E. S. Sheridan*[1], *C. Lord*[3] *and S. H. Kim*[4], *(1)Psychiatry, Weill Cornell Medical College, White Plains, NY, (2)Weill Cornell Med School, New york, NY, (3)University of California Los Angeles, Los Angeles, CA, (4)Psychiatry, Center for Autism and the Developing Brain, White Plains, NY*

Background: Impairments in executive function (EF) in ASD may emerge as early as preschool years, but studies examining EF skills in young children with ASD are limited. More in-depth examinations of EF skills as predictors of academic and social outcomes in young children with ASD will help us examine when and how impairments in school readiness skills emerge prior to school entry and build treatment programs targeting these skills beginning as early as the preschool years.

Objectives: We used innovative, recently-validated EF tasks in order to examine the association between EF skills and concurrent academic achievement, peer connections, and externalizing/internalizing problem behaviors in more-able kindergarteners with ASD.

Methods: Participants included 42 more-able children with ASD (no cognitive and structural language delays; *mean age* =63.7 months; SD=6.0). Working memory (Pick the Picture [PTP]), inhibitory control (Arrows [ARR]), and attention shifting (Something's the Same [STS]) were assessed based on child-friendly, tablet-based EF tasks, EF Touch (Willoughby et al., 2010) and behavioral regulation was assessed based on a well-established, highly engaging, Head Toes Knees Shoulders (HTKS) task (Ponitz et al., 2008; *n*=28). Academic achievement was measured based on the Woodcock Johnson achievement test (WJ), internalizing/externalizing behaviors based on the Child Behavior Checklist (CBCL), and peer connections based on the Penn Interactive Peer Play Scale (PIPPS). Regression analyses were conducted to examine whether EF skills significantly predicted subsections of WJ–letter word identification (LW), passage comprehension (PC) and applied problem (AP), CBCL internalizing, and externalizing behaviors and PIPPS interaction and disconnection during peer play, while controlling for age, gender, race and maternal education. For a subset of children (*n*=27, *mean age* = 60.6 months; *SD*=3.8); analyses were repeated while controlling for FSIQ as an additional covariate.

Results: Regression analyses indicated significant effects for following variables ($p<0.05$). Accuracy for attention shifting (STS) from EF Touch significantly predicted performance on the WJ math achievement (AP) the PIPPS interaction and CBCL internalizing problem sub-scores. Accuracy for working memory (PTP) was significantly associated with performance on all three sections from WJ as well as interaction and disconnection sub-scores from the PIPPS. Accuracy for inhibitory control (ARR) from EF Touch significantly predicted WJ reading achievement (PC) and CBCL internalizing problems. Response time for the EF ARR task was also a significant predictor of WJ AP and the PIPPS play interaction. Last, behavioral regulation (HTKS) was significantly predictive of scores for reading (WJ-LW). When IQ was controlled, the effects of attention shifting (STS) on WJ-AP and inhibitory control (ARR) on CBCL internalizing behaviors remained significant.

Conclusions: Our results demonstrate the potential link between impairments in EF skills and academic and social success as well as other clinical features in more-able kindergarteners with ASD. The most robust effects were found for one's ability to shift attention and inhibit responses on math achievement and internalizing problems respectively. These findings provide preliminary evidence of EF deficits in children with ASD and implications for incorporating EF training into intervention prior to school entry.

22 **164.022** Exploring the Conditions of Typical and Atypical Social Attention in Autism: A Gaze Contingent Eye Tracking Study

J. S. Black[1] *and M. Bindemann*[2], *(1)School of Psychology, University of Kent, Canterbury, United Kingdom of Great Britain and Northern Ireland, (2)School of Psychology, University of Kent, Canterbury, United Kingdom*

Background:

Attending to faces is extremely important for understanding social cues and it is thought that atypical social attention may contribute to social difficulties in Autism Spectrum Disorder (ASD). However, research findings are mixed as to whether faces have the same special status in attention for people with ASD as in typical development. Methodological differences across studies make it hard to reach a consensus about social attention in ASD and why it may appear typical or atypical in experimental studies. Additionally, the Social Motivation Theory of autism predicts that individuals with ASD will attend to non-social objects of particular interest to them, rather than faces, and previous research has found that objects of Circumscribed Interest (CI) may disrupt social attention when co-occurring with people in a scene.

Objectives:

The present study employed visual scenes containing people and objects of CI to which adults with ASD have previously been found to attend atypically. A novel gaze contingent window technique explored the allocation of attention across these scenes among adults with and without ASD. This technique provides a measure of top down allocation of attention by removing opportunities for automatic attentional capture in peripheral vision.

Methods:

In Experiment 1, a gaze contingent window in a black screen revealed 4° visual angle around the point of fixation of a scene containing people and CI objects. Regions of interest (ROIs) corresponding to faces, bodies, CI objects, and background were defined. In Experiment 2, participants saw an array of gift boxes, which, upon fixation, revealed a different image of either a face, an object of CI, or a neutral object. Measures of fixation duration and number of fixations within each area were recorded. Participants also later rated how much they liked each image and how interesting they found it to explore explicit interest in the stimuli.

Results:

Experiment 1 found that all participants had longer fixations to face regions of scenes than any other region, with no group differences in the percentage of fixations in each ROI. However, in Experiment 2, whilst there were no group differences in mean fixation duration to each object category, participants in the TD group made a higher proportion of fixations to faces than the ASD group.

Conclusions:

Experiment 1 showed that when background information is removed from a scene, social attention appears typical in adults with ASD, with faces holding attention longer than other objects once fixated. However, Experiment 2 found suggested reduced social attention in participants with ASD. This could be because social cues are more important to establish context within natural scenes as in Experiment 1, than in Experiment 2 where images were displayed in isolation without context. Therefore, adults with ASD may be able to preferentially allocate information to social information when it may be informative, but lack the motivation to do so when it is not. Further time course analyses will help to elucidate these results.

23 **164.023** Face Recognition and Processing in Children with Autism

***C. Wang**, Nankai University, Tianjin, China*

Background: It was reported that typically developing (TD) children are able to recognize the familiar faces and voices when they are four years old and they also prefer to focus on the more socially revealing features of face, such as eyes rather than mouth; in contrast, individuals with ASD seem to lack these early social predispositions, and have problems to recognize the familiar faces (Boucher, et al, 1998) and unfamiliar faces (Wilson, et al, 2007).

Objectives: This study aims to explore the influence of familiarities on the background and faces during face recognition and processing in children with autism.

Methods: Nineteen children with ASD ages from three to seven (M=5.34, SD=1.10, M:F=16:3) and nineteen age-matched TD (M=5.04, SD=0.36, M:F=10:9) were recruited and required to watch a set of pictures. Their gaze behaviours were measured via an integrated Tobii TX300. These pictures contained faces with three different familiarity degrees (familiar, repeatedly unfamiliar, unfamiliar) and backgrounds (familiar and unfamiliar). A multi-factor, repeated measurement ANOVA with factors areas of interest (AOI: whole face, eyes, mouth and background), faces, backgrounds and groups (ASD, TD) was applied to gaze fixation durations.

Results: The results showed that TD children spent longer viewing familiar faces than unfamiliar faces (F(2,36)=16.449, p=0.000). Both TD and ASD children spent longer time viewing familiar background than unfamiliar background (TD: F(1,18)=24.915, p=0.000; ASD: F(1,18)=21.989,p=0.000). Compared to familiar faces, both ASD and TD children had increased fixation duration on backgrounds when viewing unfamiliar faces (ASD: F(1,18)=24.883, p=0.000; TD: F(1,18)=5.411, p=0.032). While watching familiar faces, ASD children spent longer time viewing eyes and mouth (Mouth: F(2,36)=6.800, p=0.003; Left eye: F(2,36)=8.169, p=0.001; Right eye: F(2,36)=11.144, p=0.000).

Conclusions: In summary, ASD showed impairments on face cognition and processing. Both ASD and TD showed preference to familiar faces and backgrounds.

24 **164.024** Global Motion Perception in ASD: A Meta-Analysis

***R. Van der Hallen**[1,2,3], C. Manning[4], K. Evers[2,3,5] and J. Wagemans[3,6], (1)Department of Psychology, Education and Child Studies, Erasmus University of Rotterdam, Rotterdam, Netherlands, (2)Laboratory of Experimental Psychology, Department of Brain and Cognition, KU Leuven, Leuven, Belgium, (3)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (4)Department of Experimental Psychology, University of Oxford, Oxford, United Kingdom, (5)Parenting and Special Education Research Unit, KU Leuven, Leuven, Belgium, (6)Laboratory of Experimental Psychology, Brain & Cognition, KU Leuven, Leuven, Belgium*

Background: Visual perception in individuals with autism spectrum disorder (ASD) is often characterized by enhanced perception of local elements and impaired perception of global patterns. Deficits in global motion perception, mostly coherent motion and biological motion, seem to support this characterization, although the evidence is inconsistent. A proper quantitative review of the available data, in which the overall effect size of each study is assessed and the influence of potential moderators is investigated, is lacking. Yet, it is of critical importance to understand performance of global motion in order to evaluate theories of perception in ASD.

Objectives: To evaluate all experimental data on global motion perception, and (a) assess whether the available data are in favor of the hypothesis of enhanced perception of local elements or the hypothesis of impaired global perception in individuals with ASD compared to typically developing controls, and (b) evaluate which moderator variables rule the diversity within the literature.

Methods: A large meta-analysis was conducted, combining 48 articles on biological motion and coherent motion, including approximately 1,000 individuals with ASD and controls. All data were coded and transformed to the standardized mean difference metric d and used in a linear three-level random effects model, accounting for random sampling fluctuation, between-outcome variance and between-study variance. Differences in paradigm, task, stimulus and participant characteristics were taken into account and evaluated as potential moderators.

Results: The results revealed a small mean effect of -0.30, with 95% confidence limits from -0.17 to -0.44, indicative of global motion processing difficulties in ASD. This mean negative effect was apparent for both biological motion as well as coherent motion paradigms, and appeared to be independent of the paradigm, task, dependent variable, age or IQ of the groups.

Conclusions: The results of our meta-analysis indicate that individuals with ASD are less sensitive to global motion perception, as present in both coherent motion and biological motion paradigms. However, the differences in neural mechanisms that might underlie this behavioral difference remain unclear. Recommendations for future motion research are made in the hope of refining current theories on vision in ASD and atypical development in general.

25 **164.025** Habituation in Children with Traits Related to Autism Spectrum Disorder (ASD)

I. Arora[1], *A. Bellato*[2], *D. Ropar*[3], *T. Gliga*[4], *C. Hollis*[5] *and M. Groom*[6], *(1)University of Nottingham, Nottingham, United Kingdom, (2)The University of Nottingham, Nottingham, United Kingdom of Great Britain and Northern Ireland, (3)University of Nottingham, Nottingham, United Kingdom of Great Britain and Northern Ireland, (4)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (5)School of Medicine, University of Nottingham, Nottingham, United Kingdom, (6)Faculty of Medicine and Health Sciences, University of Nottingham, Nottingham, United Kingdom*

Background: Abnormalities in habituation have been documented in ASD (McDiarmid, Bernardos and Rankin, 2017). These atypicalities have been attributed to sensory hyperresponsivity and hyperarousal in the literature. However, behavioural studies in the literature are inconsistent, possibly due to the diversity in stimuli used, alongside heterogeneity in the population being tested. Further, evidence suggests that there might be atypical salience of social information in individuals with ASD-related traits.

Objectives: This study investigated whether children with lower social skills show reduced habituation as compared to children with higher social skills. Further, we measured habituation to different types of stimuli to assess the stimulus-dependence of these effects.

Methods: 64 children between the ages of 4 to 12 years (mean age= 108.32 months, SD=21.696, 33 males and 31 females) took part in the study. The children were recruited as part of a local science event at the University Of Nottingham, U.K. and had no known diagnosis. We used an eye-tracking paradigm that measured participants' attention to a repeating stimulus and a novel stimulus, presented alongside each other across multiple trials (adapted from Vivanti et al., 2016). Building on their paradigm, which used simple dynamic shapes (*baseline condition*), we added a *social condition* (with faces breaking into smiles) and a *non-social condition* (clocks with moving arms) to match the social condition in complexity and localized movement. We measured participants' verbal ability using the British Picture Vocabulary Scale (BPVS). Social skills were measured using the Social Aptitude Scale, a parent-report measure sensitive to risk of ASD (Liddle, Batty and Goodman, 2009). The median SAS score in the sample was used to divide the sample into groups of higher and lower social ability.

Results:

Preliminary analyses have been conducted on this data. First, a repeated-measures mixed-design ANOVA was conducted to investigate individual differences in information sampling as measured by number of fixations to the screen. Results revealed a significant interaction: Gender x Condition (F(2, 45)= 3.766, p= 0.031). Follow-up analyses revealed that females demonstrated significantly more looking than males in the social condition only (t (62)= -2.047, p= .045). There was also a significant Gender x SAS group effect (F(1, 46)= 4.462, p= 0.040). Follow-up analyses revealed that only in females, lower social ability was associated with significantly lower number of fixations to the screen across conditions (t (25)= -2.601, p= .015). Given these differences in fixations, only proportion scores (ratio of looking towards the new versus repeating stimulus) were used to analyse habituation. Preliminary analyses did not reveal any differences in habituation based on stimulus type, gender, verbal or social ability.

Conclusions: Results indicate differences in information sampling based on gender, wherein social stimuli appear to be more salient for females than males. Further, social ability impacts information sampling differently in females than in males. While preliminary analyses indicate no differences in habituation based on social ability for different types of stimuli. In the poster, I will present a more fine-grained analysis of the habituation parameters. Further, data from clinical samples will also be presented.

26 **164.026** Higher Autism Traits in the General Population Are Related to Reduced Intuition and Reduced Reasoning Bias.

M. Lewton[1], *C. Ashwin*[2] *and* ***M. Brosnan***[3], *(1)University of Bath, Bath, United Kingdom, (2)University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland, (3)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

A defining feature of being human is the ability to think rationally, however, typically humans have a propensity to base judgements on prior beliefs and experiences, rather than on a more logical and complete reasoning process. Dual Process Theory proposes both intuitive 'Type 1' and deliberative 'Type 2' processing. Type 1 (intuitive) processing is autonomous and typically involves rapid, effortless, parallel, non-conscious processing that is independent of working memory and cognitive ability. Type 2 (deliberative) processing, on the other hand, involves slower, effortful, sequential, conscious processing and is heavily dependent on working memory and related to individual differences in general cognitive ability. Within Dual Process Theory, Type 1 processing is assumed to yield default responses unless intervened upon by Type 2 reasoning processes. However, The Dual Process Theory of Autism proposes that both those with autism and those with higher autistic-like traits from the general population have a relative predisposition towards Type 2 processing.

Objectives:

To identify the relationship between autistic-like traits and two assessments of judgements based on intuition and prior beliefs and experiences.

Methods:

206 British adult participants aged between 18 and 62 years (M = 27.25, SD = 8.89) took part in the study, comprising 105 males and 99 females. Autistic-like traits were assessed using the original 50-item version of the Autism Spectrum Quotient (AQ). The Cognitive Reflection Task (CRT) has 3-items each of which has a potentially intuitive and deliberative answer. Eight syllogistic reasoning problems were presented, four of the problems had correct answers consistent with real world validity – congruent, and four problems had answers inconsistent with reality - incongruent. A 'Belief Bias' was calculated by subtracting the incongruent total from the congruent total. General non-verbal cognitive ability was assessed through Raven's matrices.

Results:

A linear multiple regression was run under 2 models with AQ as the dependent variable: 1) with the demographic variables of sex, age and general non-verbal cognitive ability as the predictors; and 2) adding intuition (CRT) and Belief Bias as predictors. Both models were significant (F=8.22, p<.001; F=12.42, p<.001; respectively). Age was a significant variable in both models, older people having higher AQ scores (t=4.89, p<.001; t=3.83, p<.001; respectively). In addition in Model 2, both Belief Bias (t=-3.74, P<.001) and Intuition (CRT: t= -2.44, p<.05) were significant, higher AQ scores being predicted by lower intuition and lower belief bias. General non-verbal cognitive ability was not a significant predictor (t=1.13, ns).

Conclusions:

This is the first study to show that higher autistic-like traits in the general population relate to a reduced propensity to base judgements on intuitive prior beliefs and experiences. This is consistent with the Dual Process Theory of Autism, which proposes that higher autistic traits (and autism) are related to a reduced default to Type 1 processing and greater predisposition to Type 2 (deliberative) processing. AQ was not significantly predicted by general non-verbal cognitive ability, highlighting that higher autistic-like traits may relate to a predisposition to engage in deliberative reasoning, but not to reasoning ability per se.

27 **164.027** How Young Adults with Autism Spectrum Disorder (ASD) Spontaneously Attend to Real-World Scenes: Use of a Change Blindness Paradigm and Eye-Tracking

M. Hochhauser[1] *and O. Grynszpan*[2]*, (1)Ariel University, Ariel, Israel, (2)LIMSI CNRS UPR3251, Université Paris-Sud, Orsay, France*

Background: Change blindness paradigms involve tasks that hinder automatic visual detection of change. The detection of changes in the environment is typically dependent on attentional processes. Studies in autism spectrum disorder (ASD) have demonstrated mixed evidence of strengths in change detection tasks. To our knowledge, eye-tracking has never been used before to investigate this issue.

Objectives: a) Compare performances of TD and ASD young adults when detecting marginal versus central change; b) Use eye-tracking to compare first fixations and total fixation time on change between the groups.

Methods: Twenty ASD and 20 matched TD young adults aged 19- 25 years viewed 36 pairs of digitized real-world images. The images in a pair differed by only one item and were displayed in a 'flicker paradigm' whereby this item alternately appeared and disappeared. This item was either a central or a marginal detail of the scene. Upon change detection, response times were collected and visual fixation on the changing item were recorded by an eye-tracker.

Results: ASD young adults were significantly slower in response time and time to first fixation than TD young adults but did not have significantly longer fixation duration.

Conclusions: ASD young adults showed reduced processing speed and did not outperform TD young adults in attention to marginal details in real-world scenes nor demonstrate different gaze behavior, challenging current theories on higher abilities of ASD individuals to process local details.

28 **164.028** Illusion Strength and Associated Eye Movements in Children with Autism Spectrum Disorder While Viewing Shepard and Ebbinghaus Illusion Displays

O. Landry[1]*, K. Royals*[1]*, I. Sperandio*[2]*, S. Crewther*[3] *and P. Chouinard*[1]*, (1)La Trobe University, Bendigo, Australia, (2)University of East Anglia, Norwich, United Kingdom, (3)La Trobe University, Bundoora, Australia*

Background: Previous research examining visual illusion susceptibility in ASD has found inconsistent results. Chouinard et al (JADD, 2016) demonstrated that illusions with strong within-object relational properties (e.g. the Shepard's tabletops) were associated with reduced susceptibility as a function of AQ, whilst illusions with strong between-object relational properties (e.g. Ebbinghaus) were not. Chouinard et al. (Front Hum Neuro, 2017) also demonstrated that eye-movements moderate illusion strength. From these results, the authors speculated that individuals with ASD may exhibit reduced susceptibility to specific types of illusions, and that differential scan patterns may underlie these differences.

Objectives: To investigate whether participants with ASD show reduced susceptibility to the Shepard illusion, while simultaneously showing typical levels of susceptibility on the Ebbinghaus illusion, and whether individual differences in scan patterns relate to illusion strength.

Methods: The participants included 18 individuals with ASD (12 males, mean age = 11.4 yrs, age range = 6.5 to 15.5 yrs) and 18 typically developing participants (12 males, mean age = 11.4 yrs, age range = 6.0 to 14.7 yrs), matched on age and Raven's Progressive Matrices raw scores. The participants completed four trials of each illusion, in pseudorandom order (Shepard's tabletops and Ebbinghaus illusions). Presentation was computerized, with participants adjusting one stimulus to match another. Eye-tracking was used to measure scan patterns while participants completed the task. To allow meaningful comparisons between illusions, we computed normalised indices of susceptibility for each illusion as: ((Perceived Size of Stimulus B - Perceived Size of Stimulus A) / (Perceived Size in Stimulus A + Perceived Size of Stimulus B)); B denoting the stimulus one would expect participants to make larger judgements in perceived size. Participants also completed control tasks to measure basic abilities in visual acuity and discrimination.

Results: The children with ASD (M = .14, SD = .10) were less susceptible to the Shepard's tabletops illusion than the typically developing children (M = .20, SD = .05), t (28) = 2.41, p = .043. There were no differences between groups on the Ebbinghaus. There were no differences between groups on any eye-tracking measures (saccade time, saccade distance, average saccade velocity, average saccade count, average pupil size, average block duration, time spent fixating). A medium strength correlation (r = .62, p = .024) was found between time spent fixating on the standard and illusory susceptibility to the Shepard, but only among participants with ASD.

Conclusions: We conclude that reduced illusory susceptibility in ASD is confined to certain types of illusions, particularly those with strong within-object relational properties. We suggest, based on the absence of evidence for differences in eye-tracking measures, that differences in illusion strength in ASD depend on perceptual mechanisms required to experience visual illusions.

29 **164.029** Imitation of Atypical Biological Kinematics in Autistic Adults Is Associated with Sensorimotor Integration

M. Andrew*, S. J. Bennett, D. P. Clowes and S. J. Hayes, Research Institute Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom*

Background: Novel sensorimotor actions are learned during voluntary imitation. Over repeated imitation attempts, a sensorimotor action model is configured by processes that represent the executed observed biological kinematics. Although voluntary imitation is functional from early development, autistic individuals generally show low-fidelity imitation of novel actions (DeMyer et al., 1972; Hayes et al., 2016). Notably, in these studies the imitation stimuli (e.g. typical and atypical kinematics) were presented in a random trial order. This non-predictable trial order was suggested to underpin low-fidelity imitation by attenuating the integration of sensorimotor information between trial *n*, and trial *n+1*. To this end, we attempted to influence imitation of biological kinematics in *Experiment 1* by presenting stimuli in a constant trial order that is known to facilitate sensorimotor integration between trials. To further examine sensorimotor integration in *Experiment 2*, a visuomotor-interference task was introduced between trial *n*, and trial *n+1,* to interfere with inter-trial sensorimotor processing.
Objectives: Examine the contribution of sensorimotor integration processing during voluntary imitation in autism.

Methods: Autistic, and control, adults observed single point-light models moving horizontally on a monitor and imitated using a stylus on a digital graphics tablet. A control model contained typical biological kinematics and displayed a bell-shaped (peak velocity occurs at 44% of the movement trajectory) velocity profile. An experimental model contained atypical biological kinematics and displayed peak velocity that occurred earlier (18%) in the movement trajectory. In *Experiment 1* (autistic, n = 15; control, n = 15) and *2* (autistic, n = 15; control, n = 15), the typical (30 trials) and atypical (30 trials) models were presented in a constant trial order, counterbalanced across participants. In *Experiment 2*, participants performed an additional incongruent (continuous circle drawing) visuomotor task in the inter-trial period.

Results: The discrete (time to peak velocity) and continuous (root mean square error) kinematic data in *Experiment 1* indicated autistic adults significantly (*ps* < 0.05) adapted imitation by reducing error across the imitation trials. We showed no adaptation effect in *Experiment 2* when autistic participants performed a secondary visuomotor interference task in the inter-trial period.

Conclusions: These data indicate functional voluntary imitation in autistic adults, and importantly that the reported deficits (DeMyer et al., 1972; Hayes et al., 2016) in voluntary imitation in autism may have been associated with an imitation context that prevented sensorimotor integration and adaptation across trials. The finding from the secondary task supports the suggestion that atypical imitation and motor learning in autism (Haswell et al., 2009) is associated with atypical sensorimotor integration.

30 **164.030** Intact Orientation Perception Bias in Autism Speaks Against the Decreased Divisive Normalization Model

S. Van de Cruys[1]*, S. Vanmarcke*[1]*, J. Steyaert*[2] *and J. Wagemans*[3]*, (1)Laboratory of Experimental Psychology, Brain & Cognition, KU Leuven, Leuven, Belgium, (2)Katholieke Universiteit Leuven, Leuven, Belgium, (3)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium*

Background: One recent, promising account of Autism Spectrum Disorders (ASD) situates the cause of the disorder in an atypicality in basic neural information processing, more specifically in how activity of one neuron is modulated by neighboring neurons. The canonical neural computation that implements such contextual influence is called divisive (or suppressive) normalization. The account proposes that normalization is reduced in ASD. This idea is inspired by the excitatory/inhibitory imbalance hypothesis of ASD, and by findings of decreased contextual influences in perception and cognition in this population.
Objectives: We tested one fundamental prediction of this model for low-level perception, namely that individuals with ASD would show reduced cross-orientation suppression (leading to an illusory tilt perception).

Methods: 11 young adults with an ASD diagnosis and 12 age-, gender-, and IQ-matched control participants performed a psychophysical orientation perception task with compound grating stimuli. Their illusory tilt perception was derived from psychometric function fits used as a measure of the strength of the divisive suppression by context.

Results: Suppression did not differ significantly between groups, indicating typical divisive normalization in individuals with ASD. In fact, all individuals with ASD showed a considerable orientation bias. There was also no correlation between illusory tilt perception and autistic traits as measured by the Social Responsiveness Scale.

Conclusions: These results provide clear evidence against the decreased divisive normalization model of ASD in low-level perception, where divisive normalization is best characterized. We evaluate the broader existing evidence for this model and propose ways to salvage and refine the model.

31 **164.031** Learning from Digital Media: The Effects of Social Engagement

L. A. Bird *and M. L. Allen, Lancaster University, Lancaster, United Kingdom of Great Britain and Northern Ireland*

Background:
Digital learning is revolutionising education, it's increasing prevalence in the classroom has inspired new approaches to teaching. Many language interventions for children with autism spectrum disorder (ASD) are now being delivered via digital technology, such as tablet-devices, due to their accessibility and easily tailored functions. Despite the extensive use of digital learning evidence of its effectiveness remains scarce and contradictory. Furthermore, how children potentially engage with technology, and the effect this has on learning has not yet been explored, which is particularly important for children with ASD whom characteristically struggle with social functioning.
Objectives:

The present research compared how children with ASD engage with iPads and traditional storybooks, and examined the effect this had on the learning and retention of novel words.
Methods:

Two groups of children between 4-11 years participated, 21 children with ASD (10 iPad, 11 book) and 21 children with other developmental disorders (DD; 10 iPad, 11 book). Both groups were matched on receptive vocabulary age equivalents (ASD iPad M: 6.1 years, book M: 6.76 years; DD iPad M:6.39 years, book M: 6.17 years). During a story book interaction presented as either a traditional book or on the iPad, participants heard 2 novel words 4X times each. Word learning was then assessed using a picture based referent selection task immediately, and again after a 24-hour delay. Social engagement with the task and experimenter was also assessed using observations of experimental footage.
Results:

A mixed factor analysis showed no difference in word learning performance between presentation medium ($F(1, 37) = .040$, $p = .843$, $\eta p^2 = .001$), suggesting neither books or iPads are a superior instrument, nor detrimental to learning. Further validation of this was provided by a non-significant interaction between task delay*group*condition (F(1, 37) = .385, p = .539, ηp² = .010) also suggesting both groups learned and retained words at a similar rate. However, controlling for disengagement from the task revealed an advantage of iPad-based learning across the test delay (F(1, 36) = 4.481, p = .041, ηp² = .111).

Social engagement was analysed using a multivariate analysis which showed a significant effect of presentation medium (V = .179, F(8, 30) = 2.286, p = .048, ηp² = .379, observed power = .777). Closer inspection revealed increased engagement via medium-directed attention with the iPad (M = 46.24) compared to the book (M = 18.25). However, medium-directed pointing revealed the opposite effect, with children in the book condition (M = 1.68) pointing towards the medium more than children in the iPad condition (M = .15).

Conclusions:

Word learning occurred at a similar level between books and iPads for both participant groups. However, an advantage for iPad-based learning over traditional books was found when disengagement from the task was controlled for. Social engagement measures revealed an increase in medium-directed attention towards the iPad, but an increase in pointing towards the book; suggesting children are more focused when content is presented on an iPad, however engage more socially when using traditional books.

32 **164.032** Learning in a Probabilistic Environment in the EU-AIMS LEAP Cohort: How Do Individuals with Autism Spectrum Disorder Perform and How Does This Relate to Restricted, Repetitive Behaviour and Associated-ADHD Symptomatology?

D. V. Crawley[1], *L. Zhang*[2], *H. den Ouden*[3], *J. Ahmad*[1], *C. H. Chatham*[4], *E. J. Jones*[5], *A. San Jose Caceres*[1], *J. Tillmann*[6], *T. Charman*[7], *J. K. Buitelaar*[8], *D. G. Murphy*[9] *and E. Loth*[1], *(1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)F. Hoffmann-La Roche AG, Basel, Switzerland, (3)Donders Institute for Brain Cognition and Behaviour, Nijmegen, Netherlands, (4)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (5)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (6)King's College London, London, United Kingdom of Great Britain and Northern Ireland, (7)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (8)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (9)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

Cognitive flexibility denotes the ability to shift thoughts and actions in response to changes in the environment. It requires learning from reinforcement and adapting to new situational demands. Impairments in cognitive flexibility have been proposed to underlie restricted, repetitive behaviour (RRB) in ASD, and to explain some behavioural deficits seen in often co-occurring ADHD. Yet, evidence for cognitive inflexibility in ASD and its relationship with symptomatology is mixed. Probabilistic reversal learning (PRL) tasks examine choice behaviour in an unstable environment, and perseverative errors (PEs) are frequently used to index cognitive inflexibility. Computational models add critical information beyond composite scores like PEs, to reveal how individuals learn over time, and the strategies they use.

Objectives:

1. To examine case-control differences in PRL task performance in a large cohort;
2. To study learning trajectories across development and quantify differences in cognitive mechanisms using computational models;
3. To investigate the relationship between PRL task measures and RRB and associated-ADHD symptomatology.

Methods:

Participants were 317 ASD individuals aged 6-30 years and 250 age-matched typically developing (TD) individuals recruited as part of EU-AIMS LEAP (Charman et al., 2017). They were split into: children (6-11), adolescents (12-17) and adults (18-30). Participants learned to choose the 'most often' rewarded stimulus, from a choice of two, with an 80:20 reward/punishment ratio. Feedback contingencies were reversed at the task midpoint. Win-stay lose-shift scores were calculated in both phases (acquisition/reversal); PEs were derived from the reversal phase (den Ouden et al., 2013). Hierarchical Bayesian analysis was then used to fit 3 computational models using the R-based package, hBayesDM: Reward-Punishment, Experience-Weighted Attraction (EWA) and Fictitious-Update. IQ scores were covaried in each model after z-transform. RRBs were assessed using the Repetitive Behaviour Scale-Revised. ADHD symptomatology was measured using the DSM-5 ADHD rating scales.

Results:

There was an overall group effect, whereby ASD individuals made significantly more PEs than controls and showed less win-stay and more lose-shift behaviours (all p<.001, d=0.23-0.33), however post-hoc analyses revealed this was only significant in adolescents (all p<.005, d=0.38-0.54). Model comparisons revealed the best estimate for children in both groups and ASD adolescents was the Fictitious-Update model; for TD adolescents the Reward-Punishment model outperformed the others; while for adults in both groups the EWA model was superior. Learning rates of each age group's winning model significantly correlated with PEs (all r_s=.34-.68, all p<.001). The only significant relationship between PRL task measures and symptomatology to survive multiple comparisons was that of lose-shift behaviours and both hyperactivity/impulsivity and inattention in ASD adults (Figure 1; both r_s=0.32, $p_{corrected}$<.003).

Conclusions:

Impairments in cognitive flexibility were only found in ASD adolescents. Combined with the model comparisons, findings suggest that different strategies are employed by different age groups when learning in a probabilistic environment, and that these strategies transition during adolescence, with potentially different developmental trajectories for ASD and TD individuals. The relationship between task performance and ADHD symptoms in ASD adults has important implications – a better understanding of how learning cognitive flexibility develops in ASD and its relationship with symptomatology will inform effective interventions.

33 **164.033** Local and Global Face Identity Discrimination in Children, Adolescents and Adults with Autism Spectrum Disorder

K. Ainsworth[1], *D. Tullo*[1], *M. Pietracupa*[1], *J. Guy*[1,2] *and A. Bertone*[1], *(1)McGill University, Montreal, QC, Canada, (2)Experimental Psychology, University of Oxford, Oxford, United Kingdom*

Background:

Autism Spectrum Disorder (ASD) is differentiated from other neurodevelopmental disorders by its unique perceptual phenotype (Bertone et al, 2010), defined by a relative facility for processing non-social, spatial information with concurrent difficulty in perceiving complex, socially laden information exemplified by face perception (Simmons et al., 2009). Some suggest that atypical face perception in ASD has a perceptual origin, resulting from abnormally local or detailed processing strategies (Behrmann et al., 2006) that change with age (Guy et al., 2016). The ability of high-functioning autistics to discriminate facial identities is selectively decreased when access to local facial cues is minimized (Morin et al., 2015). However, these results, are based on autistics who score average or higher on IQ tests; therefore, little information is available for individuals who are 'lower functioning'.

Objectives:

The objectives of this study were twofold:

1. When access to local cues are diminished, do autistics who are 'low functioning' exhibit an atypical performance profile?
2. Does identity discrimination ability differ as a function of age, and if so, are such differences related to the differential use of local vs. global facial processing?

Methods:

Nineteen autistics (17 male, 2 female), aged between 9 and 21 years, completed the Wechsler Abbreviated Scale of Intelligence (WASI-2) as well as the Social Responsiveness Scale (SRS-2). Participants then completed a simple, 2AFC facial identity discrimination task where they answered 'same' or 'different' to two synthetic face stimuli (Wilson et al, 2002) presented simultaneously on a computer screen. First, face pairs were presented front-facing, allowing for identity judgements to be based on local facial cues (e.g., comparing noses). The second condition presented a stimulus view-change, where face pairs had one front facing and one side facing stimulus (20 deg.), resulting in a decreased access to local information, and a greater reliance on a global analysis to complete the task.

Results:

A 3 x 3 ANOVA (condition x developmental group) revealed a significant effect of condition (F (2, 32) = 38.4, $p <0.001$), suggesting that autistics found the front-front condition (facilitating local strategies) significantly easier than the front-side condition (facilitating global strategies). A significant correlation was found between chronological age and performance in the front-front condition (r = 0.49, n = 19, $p = 0.03$) despite no significant correlation with IQ or SRS scores.

Conclusions:

Results reveal a similar performance profile for individuals on the 'lower functioning' spectrum of ASD compared to individuals who are 'high-functioning' (e.g. Guy et al 2016). Thus, this study contributes to understanding face perception in autistics with low IQ: a group who are less well defined in ASD visual perception research. Results indicate a divergent developmental trajectory, upon which, locally-oriented face perception improves as a function of age while global processing does not. Eye tracking data was also collected for this study and so future developments of this project will seek to assess whether atypical face perception in ASD may have a non-social origin by examining these data in conjunction with objective viewing strategies.

34 **164.034** Lower-Level and Top-Down Processing Underpins Motor Contagion in Autism Spectrum Disorders

N. C. Foster[1], *S. J. Bennett*[2], *J. Causer*[1] *and S. J. Hayes*[2], *(1)Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom, (2)Research Institute Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom*

Background: A person becomes significantly more variable when performing a horizontal movement if they concurrently observe another person executing a vertical (incongruent) arm movement, compared to a horizontal (congruent) arm movement. Increased movement variability is a consequence of the observed movement properties interfering with the sensorimotor processes controlling the ongoing movement (Kilner et al., 2003). The interference effect is called 'motor contagion' and is underpinned by a sensorimotor system directly linking perception and action (Prinz, 1997). Motor interference effects have been reported in autism and indicate intact lower-level sensorimotor processing (Sowden et al., 2016) and top-down control (Hamilton et al., 2007). In the present study, we further examined motor contagion in autism to establish if lower-level and top-down processes operate within an embedded system that leads to combined additive interference effects.

Objectives: (1) examine the contribution of end-point and trajectory information on motor contagion.

Methods: Twenty-two autistic adults and twenty-two matched control participated in the study. The autistic adults were diagnosed by a clinical assessment and ADOS, and the study was approved by the local ethics committee. Participants performed cyclical horizontal arm movements whilst simultaneously observing different stimuli. The stimuli were horizontal (congruent end-points and trajectory), vertical (incongruent end-points and trajectory), and curvilinear (congruent end-points and incongruent trajectory). Mean data for *deviation* and *peak position* were submitted to separate 2 group x 3 stimulus repeated measures ANOVA. Alpha was set at $p < 0.05$.

Results: Although *deviation* was significantly greater in the autism group than the control group ($p < 0.05$), both groups demonstrated motor contagion. *Deviation* and *peak position* were significantly higher in the vertical compared to the horizontal conditions (*ps* < 0.05), with additional significant increases in *deviation* and *peak position* between the curvilinear compared to the vertical condition (*ps* < 0.05).

Conclusions: The observation of vertical incongruent arm movements during motor execution led to motor contagion in autistic and control adults. Increased *deviation* and *peak position* is underpinned by sensorimotor processes representing the observed movement properties in the sensorimotor system at a similar time as the motor commands are controlling the executed horizontal movement. Importantly, increased *deviation* and *peak position* was found when viewing a curvilinear stimulus that had an incongruent trajectory, but congruent end-points. The additive contagion effects found in the curvilinear condition indicated motor interference was modulated by combined processing of the movement trajectory and end-points. These findings indicate lower-level sensorimotor, and top-down, processing is intact in autism.

35 **164.035** Making Sense of the Perceptual Capacities in Individuals with and without Autism

A. Remington *and J. Brinkert, UCL Centre for Research in Autism and Education, London, United Kingdom*

Background:

Recent studies report that, for autistic people, perceptual capacity (the amount of sensory information processed at any one time) is increased in the auditory (Remington et al., 2016) and visual domains (e.g. Remington et al., 2012). This increase in capacity may be responsible for both positive (superior auditory perception skills) and negative (increased distractibility) aspects of the condition. The question remains, however, whether this increase in capacity is associated with the real-life sensory experiences of autistic individuals. Those on the autistic spectrum often have altered sensory experiences compared to their neurotypical peers. In particular, sensory hypersensitivity is often reported to be distressing and uncomfortable by autistic individuals. Several theories (e.g. Baron-Cohen et al., 2009; Dunn, 1997) have proposed that sensory symptoms, in particular hypersensitivity - the heightened acuity of sensory experiences – may be linked to altered attention patterns. We hypothesise that increased perceptual capacity may be one such process underlying the atypical sensory sensitivities seen in the condition.

Objectives:

The current study aimed to explore the relationship between perceptual capacity and sensory hypersensitivity. Understanding this association may help inform the creation of therapeutic interventions to minimise sensory distress.

Methods:

Eighteen autistic and 19 neurotypical participants between 18-35 years, matched in age and cognitive ability took part in an auditory test of perceptual capacity (developed by Fairnie et al., 2016). The task, a dual-task paradigm, involved performing an auditory search task in the presence of varying numbers of distractors, while also performing a secondary detection task. Participants also completed a self-report sensory questionnaire (the Sensory Perceptual Quotient by Tavassoli et al., 2014) to quantify overall sensory symptoms in daily life (e.g. "I would be able to hear the sound of a vacuum cleaner from any room in a two-storey building.").

Results:

In line with initial predictions, a positive correlation (r_s= .42, p=.01) between level of perceptual capacity and sensory sensitivities was found. This shows that extra perceptual ability is related to the sensory perception of real-life events.

Conclusions:

The findings indicate that an increased perceptual capacity is associated with increased levels of sensory responsiveness in every-day life. Crucially, this allows a reframing of increased sensory sensitivity in terms of the increased perceptual capacity, rather than a filtering deficit or an insufficient focus. This offers a target for interventions, education and therapy and could assist in the development of improved sensory environments which are adapted to a persons' perceptual capacity.

36

164.036 Personification in Autism: This Abstract Will be Very Sad If You Don't Read It.

***A. Remington*[1]**, *O. Negri[2] and R. C. White[3], (1)UCL Centre for Research in Autism and Education, London, United Kingdom, (2)UCL Centre for Research in Autism & Education, London, United Kingdom, (3)Department of Experimental Psychology, University of Oxford, Oxford, United Kingdom*

Background:

In online forums, autistic individuals describe a special relationship with objects. They report, for example, that papers in a filing cabinet feel unloved, or that the last crisp in a packet is lonely. Given that approximately half of all autistic individuals experience alexithymia (Bird & Cook, 2013), a condition characterised by difficulties identifying one's own emotions, the suggestion that object personification may be a feature of autism seems almost paradoxical. Why would a person experience sympathy for objects, when they struggle to understand and verbalise the emotions of other people as well as their own?

Objectives:

This study investigated whether descriptions of object personification seen in online forums were representative of a large subset of the autistic population. Furthermore, it sought to understand and compare the experiences of autistic and non-autistic personifiers.

Methods:

An online survey was used to assess autistic traits (Autism Quotient, Allison, Auyeung, & Baron-Cohen, 2012) and tendency for personification (Anthropomorphism Questionnaire, Neave, Jackson, Saxton, & Honekopp, 2015, with a bespoke questionnaire designed for the current study). Follow-up interviews were carried out with a subset of respondents – eight autistic and eight non-autistic adults – who reported high levels of personification. Participants were asked about their experiences of personification, both positive and negative.

Results:

350 adults completed the survey, 87 with a professional diagnosis of autism and 263 who reported being non-autistic. There were significantly more personifiers in the autistic group (56%) than in the non-autistic group (33%, χ^2 = 12.9, p < .001). Autistic personifiers reported experiencing the phenomenon more often (31% reporting daily personification) than non-autistic personifiers (16% daily, χ^2 = 4.73, p = .03). Overall scores for the Anthropomorphism Questionnaire were higher in the autistic group (t(312) = 2.34, p = .02) and the pattern across the two subscales revealed group differences. On the Childhood Subscale the average scores were very similar (t(312) = .67, p = .50) however the autistic group more strongly endorsed statements from the General Subscale (t(312) = 3.97, p < .001), suggesting that anthropomorphism more commonly persists into adulthood for autistic individuals than for those without the condition.

Interview data indicated that all participants felt that personification was an automatic process. Additionally, individuals from both groups described personifications as comforting, promoting a sense of safety and friendship with agents of personal significance, as well as experiencing concern and feelings of sympathy and empathy toward agents. For some, these feelings caused distress, and were considered intrusive. Autistic individuals stressed the important role personified agents played in their life, particularly when growing up, easing loneliness and helping with developing an understanding of emotions and relationships.

Conclusions:

Together, our results indicate that object personification occurs commonly among autistic individuals, and perhaps more often (and later in life) than in the general population. However, the lived experiences of personifiers with and without autism seem similar. Given that in some cases, these experiences are negative, it is important to now consider the reasons for the increased personification, and identify structures for support.

37 **164.037** Memory Deficits, Communicative Ability, and Self-Monitoring Limit Utility of Existing Forensic Interviewing Methods for Youths with High Functioning Autism Spectrum Disorder

***J. L. Johnson**, G. S. Goodman and B. De Vault, Psychology, University of California, Davis, Davis, CA*

Background: Individuals with Autism Spectrum Disorder (ASD) exhibit deficits in autobiographical memory, and, in legal application eyewitness memory, compared to typically developing individuals (TD), particularly on free recall tasks (e.g., "Tell me what you remember about X"). Such free recall accounts in ASD are reportedly sparse, lack coherence, and include irrelevant or idiosyncratic details. In eyewitness memory, free recall accounts are the preferred statements used by legal investigators. Interview protocols, derived from TD memory abilities, which aim to elicit accurate accounts, may be ineffective as they rely on cognitive and social abilities that may be diminished in ASD (e.g., narrative ability, pragmatic understanding, self-monitoring, and use of organizational frameworks at encoding/retrieval).
Objectives: This study compared memory for details (events, people, actions, and setting/object) in youths with and without high functioning ASD (HFASD) as well as compared the efficacy of two forensic interview protocols for use with ASD samples.

Methods: Forty-eight youths [age: 13.96(2.47)] experienced a semi-distressing event involving four confederates. Half of the participants had a diagnosis of HFASD (n = 24). Two to three weeks later, they returned for a memory interview, half receiving the Cognitive Interview and other half the 10-Step (shortened NICHD derivative version) protocols to aid in retrieving details. Parents rated youths' language (pragmatic difficulties) and executive functioning (self-monitoring ability). Free recall details were scored as general theme events, or more specific people-, action-, or setting/object-related.

Results: Controlling for age, working memory, and attempt duration, a 2 (Diagnosis: TD vs. HFASD) x 2 (Interview Protocol: CI vs. 10) ANCOVA revealed deficits for the HFASD group on proportion of events remembered, F (1, 41) = 8.37, p < .01, η_p^2 = .17. Planned comparisons revealed these differences for the CI groups only, F (1,41) = 6.44, p = .02, η_p^2= .14. For detail categories, a 2(Diagnosis) x 2 (Interview Protocol) x 3 (Detail: people, actions, objects/setting) repeated measures ANCOVA, revealed diagnostic group differences, F (1,41) = 21.61, p < .001, η_p^2 = .35 as well as a within Detail effect for both groups, F (1, 41) = 26.41, p < .001, η_p^2 = .39. Both groups demonstrated the lowest and greatest accuracy for details related to actions and people, respectively, F's (2,40) ≥ 84.70, p's < .001, η_p^2 = .81-.83. Regression models predicting detail accuracy revealed that pragmatic ability ($\beta \leq -.41$, p <.01) and self-monitoring X Interview Protocol ($\beta \geq .39$, p <.05) predicted a substantial portion of the variance in the proportion scores for actions (R^2 = .58, F = 11.78, p <.001) and setting/objects actions (R^2 = .51, F = 8.78, p <.001).

Conclusions: While deficits were observed, HFASD group did exhibit similar memory trends for type of detail reported relative to TD peers, and remembered most events. Lower accuracy was associated with pragmatic difficulty and receiving the CI while having low levels of self-monitoring. Moreover, the HFASD group did not seem to benefit from either protocol's strategies. Results are discussed with legal implications in terms of modifying cognitive demands of existing protocols.

38 **164.038** Modulating Attentional Biases of Adults with Autistic Traits Using Transcranial Direct Current Stimulation: A Pilot Study

***M. C. English**, E. Kitching, M. T. Maybery and T. A. Visser, School of Psychological Science, University of Western Australia, Perth, Australia*

Background: Pseudoneglect is the propensity for neurotypical individuals to over-attend to the left-side of centrally-presented visual stimuli and is driven by relatively greater lateralization of spatial attention to the right hemisphere (RH) than the left. However, this attentional bias appears to be reduced or absent for individuals with autism spectrum conditions relative to healthy controls, and for neurotypical individuals with high levels of autistic-like traits (ALT) relative to those with low levels of ALT. This reduced bias likely reflects a reduction in the lateralization of spatial attention to the RH for these individuals.
Objectives: The aim of the present study was to determine whether non-invasive transcranial direct current stimulation (tDCS) delivered to the right posterior parietal cortex (PPC) could alter attentional biases in High ALT individuals, such that attentional bias is relatively more comparable to that reported in Low ALT individuals. If tDCS does influence attentional biases in High ALT individuals, this would 1) provide evidence for reduced RH lateralization for spatial attention in High ALT individuals; and 2) indicate that attentional biases, and therefore relative levels of hemispheric activation, are not resistant to modulation via external stimulation.

Methods: The Autism Spectrum Quotient (AQ) was administered to an undergraduate student cohort (n=702), and 38 students invited to participate in the study from the initial pool. Students were categorized as Low ALT (n=18) or High ALT (n=16) if their Autism Spectrum Quotient scores fell below or above the median AQ score for the entire cohort (Median AQ = 107). In separate sessions, participants received approximately 10 minutes of anodal, cathodal, and sham tDCS, while completing the greyscales task – a task that provides an index of attentional lateralization.

Results: The main outcome of the study was that tDCS over the right PPC was particularly effective at modulating attention biases in our High ALT group, but ineffective at inducing attentional changes in the Low ALT group. Critically, a repeated measures ANOVA found an interaction between ALT Group and Stimulation Type, F(2,34)=7.00, p<0.01. Follow-up tests revealed a significant increase in leftward bias as a result of anodal tDCS relative to sham levels in the High ALT group, t(15)=4.09, p<0.001, while no such change was evident in the Low ALT group, t(17)=0.58, p=0.57. The effect of cathodal tDCS on attentional biases was substantially weaker, with the High ALT group falling just short of significant levels, t(15)=2.05, p=0.06 and Low ALT group showing no effect of stimulation, t(17)=0.95, p=0.35.

Conclusions: This study has shown that relatively lower levels of pseudoneglect expressed by High ALT individuals can be increased to a level that is more comparable to what is seen in Low ALT individuals. This finding is important as it suggests that if attention can be modulated using tools like tDCS, other aspects of attention relevant to autism (i.e. global processing, face processing) that are also linked to relative levels of hemispheric activation might also stand to benefit from similar techniques.

39 **164.039** Patterns of Attention to Non-Social Stimuli in Children with Autism Spectrum Disorder

***Y. J. Chen**[1], C. Harrop[2], M. Sabatos-DeVito[3], J. Bulluck[2] and G. Baranek[1], (1)Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC*

Background: Aberrant attention patterns in Autism Spectrum Disorder (ASD) have been widely reported. Eye-tracking offers a non-invasive way to examine visual attention; however, most ASD studies have focused on attention to social stimuli (e.g. Jones & Klin, 2013) with very few studies

examining attention to non-social stimuli. The impact of low-level sensory features (e.g. motion, modality) on attention patterns in ASD has not been comprehensively studied.
Objectives: In this eye tracking study, we aimed to test how the sensory properties of non-social stimuli impacted the allocation of attention in ASD and how patterns of attention associate with clinical sensory profiles.

Methods: Forty children [15 ASD, 15 Typically Developing children (TD) and 10 Developmental Delay excluding ASD (DD)] ages 4 to 13 years were included. Parents provided data on child sensory response patterns via the Sensory Experiences Questionnaire, Version 3.0 (SEQ-3; Ausderau et al. 2014). Children completed a passive-viewing eye-tracking task designed to measure attention to non-social stimuli; six novel, objects with interesting visual and auditory qualities were presented in the center of the screen in either unimodal (static or dynamic) or multimodal (dynamic+auditory) format. Stimuli were shown on the screen one at a time for 15 seconds in a random order.

Results: There were no group (ASD/TD/DD) differences in total attention to stimuli (F(2, 79)=1.48, p=.23). However, there was a condition effect: all subjects spent more time attending to dynamic and dynamic+auditory stimuli compared to static (F(2, 79)=8.94, p<.001). There were no group or condition effects for time to first fixation, suggesting initial orientation was similar across groups and conditions. However, first fixations were longer to both dynamic and dynamic+auditory stimuli compared to static (F(2, 79)=23.43, p<.001). There was no condition effect for the number of individual fixations, however children in the ASD group fixated fewer times overall than DD and TD controls (F(2, 79)=9.89, p<.001). Associations between clinical sensory response patterns and attention were found in the ASD group only; Hyperresponsivness correlated positively with both total fixation duration (r=.57 to77, all p's<.05) and mean fixation duration (r=.61 to.79, all p's <.01) across all conditions. Time to first fixation for dynamic and dynamic+auditory stimuli correlated negatively with hyperresponsiveness scores (both p's<.05).

Conclusions: Children in all three groups had comparable rates of overall attention and initial orientation to non-social stimuli in our study, with more attention to dynamic and dynamic+auditory versus static stimuli. Thus, sensory attributes (e.g. motion) appeared similarly salient to children regardless of diagnosis. Our findings using non-social stimuli are partially consistent with Chevalier et al. (2015) showing no group differences in static and dynamic stimuli when presented independent of social interaction. We conclude that overall attention and initial orientation to non-social stimuli is comparable across groups, with some sensory qualities, such as motion, producing a facilitatory effect on visual attention for all children. However, we found enhanced attention (i.e. looking more quickly and for longer periods to non-social stimuli) was only associated with clinical measures of hyperresponsiveness in children with ASD, suggesting the need for future mechanistic research.

40 **164.040** Planning and Efficiency on the Tower of London Test in ASD

L. C. Baxter[1]*, A. Nespodzany*[2]*, B. B. Braden*[3] *and C. J. Smith*[4]*, (1)Radiology, Barrow Neurological Institute, Phoenix, AZ, (2)Barrow Neurological Institute, Phoenix, AZ, (3)College of Health Solutions, Arizona State University, Tempe, AZ, (4)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: Planning is a critical component of executive functioning that facilitates the proper execution of goal-directed behavior. Deficits in executive functioning can underlie many of the challenges faced by individuals with autism spectrum disorder (ASD), and many studies show that individuals with ASD exhibit poor planning compared to neurotypical (NT) individuals.
Objectives: To investigate the effect of ASD on planning ability in adults.

Methods: Participants were recruited through the community and underwent screening for ASD prior to cognitive assessments. Inclusion/exclusion criteria included IQ > 80, male, and general good health. NT participants (n = 38, age 18-64, M = 38, SD = 15.24) were age- and IQ-matched to individuals in the ASD group (n = 52, age 18-70, M = 38, SD = 17). Participants performed a Tower of London test, a commonly used neuropsychological test requiring planning. The test requires participants to arrange beads on pegs in specified patterns in as few moves as possible, where consecutive trials get progressively more difficult. Total moves, initiation time (time spent planning), execution time, and total number of correct trials (completed without making extra moves) was recorded. SPSS (v19) was used to test mean differences between ASD and NT groups, and linear regression modeling was conducted to test the relationship between initiation time and number of trials completed correctly for each group.

Results: NT subjects completed significantly more correct trials than did their ASD counterparts, and the ASD group made significantly more moves across all trials. The two groups did not show significant differences in the amount of time they used to plan moves. However, linear regression revealed that there was a significant and negative relationship between planning time and total move count for the ASD group, but not for the NT group. Thus, for individuals with ASD, more time spent planning moves resulted in the making of fewer unnecessary moves.

Conclusions: Compared to healthy controls, adults with ASD displayed deficits in planning on a Tower of London task. While both ASD and NT groups showed similar variability in time spent planning, planning time was an important determinant of correctly completing the task for only the ASD group. In summary the study indicates that though some individuals with ASD had difficulty in motor planning, those who utilized longer planning periods had the best performance. NT individuals completed the task with more ease than did the ASD individuals, with little to no benefit from longer planning periods. Since no instruction was given regarding using planning as a strategy, it is difficult to know whether the use of planning was incidental or deliberate. This study suggests that increased emphasis on planning may improve some aspects of executive functioning in individuals with ASD.

41 **164.041** Probabilistic Learning in a Volatile Environment in Individuals with and without Autism Spectrum Disorder

L. Lemmens[1,2]*, J. Wagemans*[1,2] *and S. Van de Cruys*[1,2]*, (1)Laboratory of Experimental Psychology, Brain & Cognition, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium*

Background: Predictive coding has recently been proposed as a framework to understand Autism Spectrum Disorder (ASD). It assumes that the human mind processes information by making and testing predictions, and that violations to these predictions result in prediction errors. One possible explanatory account argues that individuals with ASD tend to ascribe High and Inflexible Precisions to Prediction Errors (HIPPEA), irrespective of the context. Ascribing high weights or precisions to all prediction errors could be an advantageous strategy for probabilistic learning within a stable environment, but would hamper learning in a volatile and unstable environment.
Objectives: In order to gain insight into these mechanisms of precision-setting in an unstable environment in individuals with ASD, we administered a Probabilistic Learning Task in a Volatile Environment (PLTVE). Based on the Probabilistic Reversal Learning task of Behrens et al.

(2007), the PLTVE is designed to evaluate whether ASD individuals can estimate the volatility of the context and use this estimate to flexibly adjust their precision-setting of prediction errors. To investigate the influence of noise on precision-setting in ASD, we extended this task by adding variability in irrelevant dimensions of the presented stimuli. Based on the HIPPEA framework, we hypothesize differences in probabilistic learning to be more pronounced when variability in irrelevant dimensions is present.

Methods: In a behavioral experiment we presented the PLTVE to an ASD group (11-27 y) and a typically developing (TD) group (13-26 y). The PLTVE is a two-alternative forced choice task, in which the probabilistic rule about which feature out of three potentially relevant dimensions is rewarded, changes unannounced. The number of (ir)relevant dimensions and whether the relevant dimension was cued or not was manipulated in three experimental phases (uncued unidimensional - cued three-dimensional - uncued three-dimensional).

Results: Overall, no differences in consistency on the PLTVE task were found between the TD and the ASD group over all 3 phases. In phase 1 and phase 2, the average consistency of both groups approximated the reward probabilities. In phase 3, average consistency was lower than the reward probability for both groups. However, results revealed an interaction effect of group and lose-shift/win-stay strategy, with TD participants making more use of the win-stay strategy and ASD participants making more use of the lose-shift strategy. In addition, participants in the ASD group were more likely to give up trying to find the correct rule in phase 3, compared to participants in the TD group.

Conclusions: The present results suggest that individuals with and without ASD can adapt to a more volatile environment. When variability was increased, both TD and ASD individuals had more difficulties with probabilistic learning. Interestingly, our results reveal that individuals with ASD make less use of positive feedback (i.e. prediction confirmation) and more use of negative feedback (prediction error) in their choice for the next trial, indicating that they do assign different weights to most recent trials. In addition, individuals with ASD seem to withdraw more frequently when confronted with high amounts of uncertainty (phase 3).

42 **164.042** Pupillary Responses to Manipulations of Stimuli Type and Synchrony in Children with Autism Spectrum Disorder

M. Segers[1], *J. M. Bebko*[1], *B. L. Ncube*[2] *and R. A. Stevenson*[3], *(1)York University, Toronto, ON, Canada, (2)Psychology, York University, Toronto, ON, Canada, (3)Western University, London, ON, Canada*

Background: Individuals with ASD have been shown to have a decreased sensitivity to the timing of multisensory inputs that are linguistic in nature, but not to simple, non-social stimuli. These difficulties have been theoretically and empirically linked to speech perception and communication difficulties. It is unclear if difficulties with socio-linguistic processing are a *social* or a *linguistic* issue. Pupillary responses (dilation and constriction) are reliable indices of cognitive operations including preference, mental load, and incongruity.
Objectives: The current study is the first to measure pupillary responses to dynamic, temporally manipulated audio-visual stimuli to infer cognitive processes involved in perception of non-social, social, and social-linguistic stimuli. The aims of the current study were threefold:

1) Determine if differences between pupillary responses to non-social and social-linguistic information are the result of difficulties in *social* or *linguistic* processing.

2) Determine if processing of asynchronously presented stimuli can be indexed through pupillary change, and if responses differ between typical development (TD) and ASD.

3) Determine if pupillary responses to stimuli relate to clinical symptomatology in ASD.

Methods: Participants included 39 children with ASD (Age; M=12.3, SD=3.2) and 32 TD children (Age; M=12.4, SD=3.0) who were matched for chronological and mental age using the WASI-II (Wechsler, 2011). Each participant was presented with audiovisual stimuli in 6 conditions in a 2x3 design. Stimuli were one of three types, non-social (a video of the children's game Mousetrap), social non-linguistic (a video of an actress making verbal, non-speech sounds), and social-linguistic (the same actress speaking). Each of these stimulus types were presented synchronously or asynchronously (1000ms delay, collapsed across visual-leading and auditory-leading). Pupillary responses were captured and recorded using a Tobii X60 eye-tracker. Participants' parents completed the Autism Quotient- Child Version as a measure of symptom severity.

Results: Children with ASD showed smaller pupillary responses to social information than TD children for both the social-linguistic (*p*=.009) and social non-linguistic (*p*=.005) conditions. However, there was no group difference in pupillary response between groups for the non-social condition (*p*=.376; Figure 1). Analysis of temporal processing was more equivocal. No significant Group x Stimulus x Synchrony interaction was apparent in the mean pupillary responses. However, more in-depth waveform analyses showed significant effects of synchrony in both the social non-linguistic and the socio-linguistic conditions (p's<0.001), but not in the non-social condition (Figure 2). Furthermore, responses to asynchronous stimuli were significantly correlated with symptom severity in the social non-linguistic (*p*=.01) and social-linguistic (*p*=.03) conditions, but not the non-social conditions (*p*=.16) such that smaller pupillary responses were associated with more severe symptomatology.

Conclusions: These data suggest that the atypical response to socio-linguistic sensory information in individuals with ASD is a result of the *social* components of the information. This held for both overall processing differences seen with synchronous stimuli, and differences observed in multisensory temporal processing. Finally, differences in multisensory temporal processing of social stimuli were significantly correlated with symptom severity, providing convergent evidence that differences in early-stage physiological processing (i.e., pupillary change) may contribute to symptomatology, including communication issues.

43 **164.043** Reduced Competition and Visual Field Asymmetries in a Dual-Stream Attentional Blink Paradigm in Individuals with High Levels of Autistic Symptomatology

J. L. Ringo[1], *L. Jefferies*[2,3] *and J. Burack*[4], *(1)Educational and Counselling Psychology, McGill University, Montreal, QC, Canada, (2)School of Applied Psychology, Griffith University, Gold Coast, Australia, (3)Menzies Health Institute Queensland, Southport, Australia, (4)Educational & Counselling Psychology, McGill University, Montreal, QC, Canada*

Background: The attentional blink (AB) paradigm has been used to explore the temporal and spatial dynamics of visual attention (Raymond, Shapiro, & Arnell, 1992). In a typical AB paradigm, two target letters are embedded in a rapid stream of digit distracters. Although identification accuracy of the first target is normally very high, identification of the second target is impaired when it appears in close temporal proximity to the first. A notable exception to this occurs when the second target is presented directly after the first target (at the ordinal position known as Lag 1). Using a dual-stream AB paradigm, in which two streams of distractors are displayed, one to the left and one to the right of fixation, Verleger et al.

(2009) showed that when T1 and T2 are presented in opposite streams, T2 is identified more accurately when it is presented in the left visual field. This left visual field advantage did not occur when T1 and T2 were presented in the same stream. They conclude that this is evidence for a right-hemisphere advantage when singling out targets in time.
Objectives: English, Maybery, and Visser (2015) showed a tendency in individuals with autistic traits to attend less to the left side suggesting a reduction in right hemisphere activation. Accordingly, we used a dual-stream AB paradigm, to further assess the nature of visual field asymmetries in individuals high in autistic traits.

Methods: Eighty-two young adults were allocated to either High-AQ or Low-AQ groups based on scores on the autism-spectrum quotient (AQ; Baron-Cohen, 2001). Each participant completed a dual-stream AB task in which two target letters were embedded in streams of digit distracters. One stream was presented to the left of a central fixation point, the second stream appeared to the right of fixation. The two targets appeared randomly and unpredictably in either the same stream as one another or in opposite streams. On a third of trials, the second target appeared immediately after the first (Lag 1); on another third of the trials the targets were separated by a single digit distracter (Lag 3); on the remaining trials, the targets were separated by 8 distracters (Lag 9). The stimulus onset asynchrony between items in the stream was 80 ms.

Results: The Low-AQ grouped showed the anticipated differences, and T2 was identified more efficiently in the left than right visual field. Visual field differences were markedly absent for the High-AQ group, who identified T2 equally well in both hemifields.

Conclusions: Individuals with High- as compared to Low-AQ scores displayed the lack of an attentional bias for the left visual field, extending evidence of diminished neural asymmetry in autism. This suggests that enhanced perceptual processing or snappy attentional gating might eliminate hemispheric competition leading to similar results in the same and different streams, regardless of the visual field in which T2 appeared. The apparent absence of hemispheric asymmetry that is characteristic of typical individuals may reflect a cognitive strength in right hemisphere functioning, leading to similar perceptual processing in both visual fields.

44 **164.044** Reduced Perceptual Narrowing in Autism: Evidence from the Other-Race Face Effect

__S. Schwartz__ and B. S. Hadad, University of Haifa, Haifa, Israel

Background: Over development, the perceptual system becomes more efficient and specialized for the stimuli at hand in its close environment. This perceptual narrowing is a fundamental process, emerging already in infancy for several types of stimulation, such as faces, language, and music. Specifically, for faces, advantage is seen for processing faces from one's own race, over faces from other races. Despite the adaptive value of this narrowing in perception, recent evidence implies for reduced narrowing in individuals with ASD. The findings, however, are inconsistent, in particular for faces.
Objectives: Our research purpose was to explore other-race effect (ORE) in autism, looking for both quantitative differences in the magnitude of the effect, and for qualitative differences in the way own-race versus other-race faces are processed. We hypothesized that individuals with ASD would exhibit (a) lower processing advantage for own-race faces, and (b) comparable inversion effect for own- and other-race faces, indicating similar type of processing for the two races and reduced specialization to the more frequent faces.

Methods: Participants (24 TD and 19 high-functioning ASD adults) were simultaneously presented with two faces and were asked to indicate whether the two faces were same or different (see Figure 1). Discrimination was tested for each face race (Caucasian vs. Asian) on separate blocks. Within each race, morphed faces were created to manipulate discrimination difficulty, and orientation was manipulated to examine inversion effect.

Results:

Quantitative differences in ORE: The results for the upright faces showed that although ORE was exhibited for both groups, it was smaller for the ASD group [$F(1,42)=7.32$, $p<0.009$]. As can be seen in Fig. 2, this pattern resulted specifically from the reduced specialization to the own-race faces in the ASD group.

Qualitative differences in ORE: Comparing inversion effect for the two race-faces revealed that while inversion effect was larger for the Caucasian faces in the TD group [$F(1, 23)= 4.23$, $p<0.05$], no such differences in the sensitivity to orientation between the two races were observed in the ASD group [$F<1$].

This pattern of results was obtained for the relatively easier morph levels but did not reach significance for the more difficult morph levels (20% and 40%), presumably because of an overall extremely low performance under these conditions.

Contrary to recent views, individuals with ASD also showed overall lower sensitivity in perceptual discrimination of faces [$F(1, 42)=4.62$, $p<0.037$], as well as an overall reduced inversion effect [$F(1, 42)= 3.85$, $p<0.056$], suggesting both qualitative and quantitative differences in face perception between the two groups.

Conclusions: The present data suggests that contrary to prevailing views, perceptual discrimination of faces is overall weaker in ASD compared to TD individuals, and demonstrates lower sensitivity to orientation effects. But more importantly, the data indicates that the perceptual system in autism does not become specialized, to the same extent seen in typicals, in processing the more frequent faces it encounters.

45 **164.045** Relation of Anxiety on Attentional Flexibility and Attentional Disengagement in Children with Autism Spectrum Disorder: Results from the ABC-CT Feasibility Study

__E. Baker__[1], E. Pompan[2], B. Nguyen[3], P. Renno[2], Q. Wang[4], S. J. Webb[5], F. Shic[6], A. Naples[4], C. Sugar[7], M. Murias[8], R. Bernier[5], G. Dawson[9], C. A. Nelson[10], J. McPartland[4], S. Jeste[7] and S. Johnson[11], (1)UCLA Center for Autism Research and Treatment, Los Angeles, CA, (2)University of California Los Angeles, Los Angeles, CA, (3)Center for Autism Research and Treatment, UCLA, Los Angeles, CA, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (6)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (7)University of California, Los Angeles, Los Angeles, CA, (8)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (9)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (10)Boston Children's Hospital, Boston, MA, (11)UCLA, Los Angeles, CA

Background:
Attentional flexibility has been shown to differentiate infants at high risk for autism spectrum disorder (ASD) from infants at low risk for ASD

(Elsabbagh et al., 2009). Similarly, children with anxiety have deficits in attentional flexibility, including difficulty disengaging attention between tasks (Eysenck & Calvo, 1992). Approximately 40% of children with ASD have a co-occurring anxiety disorder, a rate significantly higher than the 2.4% estimated in the general population (Costello et al., 2003). Despite the increased prevalence, little is known about factors that contribute to heightened rates of anxiety in children with ASD. Measuring attentional flexibility in school-aged children with a diagnosis of ASD and anxiety symptoms may inform how early attentional deficits contribute to the phenotype.

Objectives:

Our primary objective was to evaluate group differences in attentional flexibility and determine how anxiety symptoms in children with ASD relate to disengagement of attention.

Methods:

Typically developing (TD) children (n=26, M_{years}=6.6 *SD*=1.98) and children with ASD (n=19, M_{years}=8.25 *SD*=2.03), recruited from study NIMH# 1U19MH108206-01—PI: McPartland, viewed a central stimulus with an animated peripheral (target) stimulus as eye movements were recorded using an SR EyeLink 1000 Plus eye tracker. The following conditions were presented: 1. Baseline Condition, where the central stimulus disappears at precisely the same time as the appearance of the target stimulus; 2. Gap Condition, where the central stimulus disappears 200 ms before the target stimulus appears; and 3. Overlap Condition, where the central stimulus and target stimulus are presented at the same time. The principal dependent variable was average reaction-time (RT) of the first fixation toward the target. RT was log-transformed to normalize the spread of distribution. Anxiety symptoms were measured using the *Behavior Assessment System for Children, Version 3* (*BASC-3*).

Results:

The ASD group had elevated scores of anxiety symptoms when compared to the TD group (*t*(43)= 3.44, *p*<.01). Average RT to the target stimuli in the ASD group (Baseline_*M*=5.46 Baseline_*SD*= .20, Gap_*M*=5.31 Gap_*SD*=.14, Overlap_*M*=5.63 Overlap_*SD*=.29) was faster than the TD group (Baseline_*M*=5.57 Baseline_*SD*=.17, Gap_*M*=5.42 Gap_*SD*=.19, Overlap_*M*=5.74 Overlap_*SD*=.23) in all conditions, with a marked speed in the baseline and gap conditions (Baseline_t(43)= -2.14, *p*=.04; Gap_t(43)= -2.14, *p*=.03; Overlap_t(43)= -1.4, *p*=.17). In the ASD group, anxiety symptoms negatively correlated with RT baseline average (*r*= -.5, *p*=.03).

Conclusions:

The ASD group had faster RTs to the target stimulus than the TD group in all three conditions, with particular speed in the baseline and gap conditions, suggesting temporal facilitation of attentional disengagement. Increased anxiety symptoms were related to faster engagement to the target stimulus in the baseline condition for the ASD group. This may be due to elevated rates of anxiety symptoms and thus increased vigilance and awareness of the overall environment. Further examination of attentional flexibility in children with anxiety and ASD may provide insight into the cognitive mechanisms of anxiety in this population and increased prevalence.

46 **164.046** Relational Memory in High-Functioning Children with Autism Spectrum Disorders

R. H. Mogensen[1], *M. B. Hedegaard*[2], *L. R. Olsen*[3], *J. Skewes*[4] *and L. Gebauer*[5], *(1)Center for Music in the Brain, Department of Clinical Medicine, Health, Aarhus University and Aarhus University Hospital, Aarhus, Denmark, (2)Department of Psychology and Behavioural Sciences, Aarhus University, Aarhus, Denmark, (3)Cognitive Science, Aarhus University, Aarhus, Denmark, (4)Interacting Minds Centre, School of culture and society, Aarhus University, Aarhus, Denmark, (5)Center for Music in the Brain, Department of Clinical Medicine, Aarhus University and Aarhus University Hospital, Aarhus, Denmark*

Background: Individuals with Autism Spectrum Disorders (ASD) show both memory strengths and weaknesses. As an example, individuals with ASD seem to have intact memory for single features but diminished relational memory (i.e. memory for information consisting of combinations of different features). A number of studies have identified such pattern in memory performance in adults with ASD (e.g. Bowler, Gaigg, & Gardiner, 2009; Bowler. Gaigg, & Gardiner, 2014). However, only few studies have examined, whether this pattern also is present in children with ASD, and the results from these studies are not clear-cut (Lind, Bowler, & Raber, 2014; Maister, Simons, & Plaisted-Grant, 2013). Further, diminished relational memory in ASD might be related to an enhanced perceptual focus on local information, but this relationship has not yet been addressed directly.
Objectives: The aim of this study was to examine, whether children with ASD show impaired memory for relational information, i.e. combinations of two features: an object and its location.

Methods: 15 high-functioning children with ASD (Mean age: 13.0 years) and 16 typically developed (TD) children (Mean age: 12.4 years) participated in the study. Diagnoses were confirmed using ADI-R, and WISC-IV was used to measure verbal comprehension and working memory. Relational memory and memory for single features was examined by use of a computer-based paradigm inspired by Bowler et al. (2014). This paradigm included two tasks measuring memory for single features (objects or locations) and one task measuring memory for relational information (combinations of objects and locations). Each memory task consisted of a series of study-phases followed by corresponding test-phases, during which the participants were asked only to click on previously studied and recognised stimuli (objects, locations, or combinations of objects/locations). Perceptual style was measured using the Children's Embedded Figure Test (CEFT), in order to examine the relation between local processing style and a diminished ability to encode and recognise relational information.

Results: In the relational memory task, we found no between-group difference on how many correct and previously studied combinations of objects and locations the two groups were able to recognise. However, the children with ASD clicked on significantly more unstudied (incorrect) combinations of objects and locations than the TD group in this task. The groups performed equally well on the two single-feature memory tasks, which confirms previous findings of intact memory for single features in individuals with ASD. We did not find any group difference in degree of local processing style as measured with the CEFT, and processing style did not predict performance on the three memory tasks in any of the groups.

Conclusions: The ASD group gave significantly more incorrect answers in the relational memory task compared to the TD group, indicating that the children with ASD applied a less precise mnemonic strategy when solving this task. These findings represent important knowledge on altered basic memory processes in children with ASD. Difficulties in encoding and recognising relational information may affect these children's foundation for picking up and recalling new information, and may ultimately affect both social and non-social learning.

47 **164.047** Rhythm Perception in Music By Adolescents with Autism Spectrum Disorder

C. Rimmer[1], *H. Dahary*[1], *T. Fernandes*[2], *S. Sivathasan*[2] *and E. M. Quintin*[2], *(1)McGill University, Montreal, QC, Canada, (2)Educational & Counselling*

Psychology, McGill University, Montreal, QC, Canada

Background:

Individuals with Autism Spectrum Disorder (ASD) have demonstrated strength in perceiving musical stimuli, with most studies focusing on pitch and melody perception and memory (Heaton, 2009). Few studies have assessed musical rhythm perception of individuals with ASD (Lim, 2009; DePape, Hall, Tillmann, & Trainor, 2012) and found typical performance when processing and producing simple and complex rhythms, which seems associated with visual perceptual skills (DePape et al., 2012). However, rhythm perception has not been investigated in relation to ASD symptomology. Further, previous studies have focused on individuals with high cognitive functioning. Thus, the relationship between rhythm perception, ASD symptomology, and cognitive skills remains to be investigated across levels of functioning.

Objectives:

The purpose of this research is to assess whether ASD symptomology is related to musical rhythm perception and to examine the influence of varying levels of cognitive functioning on performance of a music rhythms task.

Methods:

Twenty-seven adolescents older than 12 years old with ASD and varying levels of cognitive functioning (WISC-V Visual Comprehension Index: 45-111; Visual Spatial Index: 57-144) completed a rhythms perception task: an adapted version of the Beat Alignment Test (Iversen & Patel, 2008). Participants listened to short musical excerpts with overlaid beeps (on or off the musical beat) and identified whether the beeps matched the musical beat. Performance was analysed by calculating Hits (number of correct responses for off beat trials/number of off beat trials) minus False Alarms (number of incorrect responses for on beat trials/ number of on beat trials) (HiFA as per Tillman, Schulze, & Foxton, 2009). Teachers completed the *Social Responsiveness Scale-2* (SRS-2, Constantino, 2012) questionnaire as a measure of ASD symptomology.

Results:

The participants' performance, based on HiFA, was significantly better than chance, $p<.01$. A regression analysis revealed that VSI but not VCI predicted task performance. Regression coefficients indicated that individuals with a lower VSI score performed the Beat Alignment Test less accurately than those with a higher VSI score, $p<.01$. A regression also showed that scores on the SRS-2 Social Motivation Scale predicted performance on the Beat Alignment Test, such that higher difficulties in social motivation resulted in less accurate performance, $p<.05$.

Conclusions:

Our results are consistent with previous findings showing preserved rhythm perception for individuals with ASD, and that this ability is related to visual spatial skills. Given previous reports of musical strengths, we suggest music intervention including a rhythmic component as a strength-based approach for this population. Our results support previous research showing that there is a perceptual association between auditory rhythm and visual spatial frequency in the typical population (Sherman, Grabowecky, & Suzuki, 2013). These results also suggest that music interventions should be approached differently when working with individuals with ASD that have varying symptomology and lower cognitive skills compared to those with higher cognitive skills, particularly in terms of visual spatial skills. The current findings could also help guide the development of music interventions that target cognitive functioning; for example improving rhythmic skills may be associated with improvement in visual spatial abilities.

48 **164.048** Study of Working Memory in Children with Autism Spectrum Disorders

A. M. Bartolini girardot[1], *C. Clarisse*[2], *M. Viellard*[2] *and F. Poinso*[3], *(1)Autism Resources Center, Marseille, France, (2)psychiatry, autism resources center, Marseille, France, (3)Autism Resource Center, Marseille, France*

Background:

Several studies describe an alteration of executive functions in children with ASD with consequences on their functioning. However, few research demonstrate a profile of working memory on both the auditory and visual side, and examines correlations with social and behavioral alterations.

Objectives: The purpose of our study is to reveal a profile of auditory and visual working memory in children with ASD. Then, to study the correlations between the working memory capacities and the alterations of communication, social interactions and adaptive behaviors

Methods:

The population of this research is composed of 27 children with Autism Spectrum Disorders. Patients were recruited from the « *Autism Resource Centre* » of Child Psychiatric Unit of Hospital in Marseille (France).The average chronological age of the group is 10 years and 4 months, the average cognitive level is 105. Children's parents were assessed with the ADI-R (Autism Diagnostic Interview Revised). The children were assessed with ADOS-2, the Vineland 2 and the WISC 5.

Results:

Comparative analyzes demonstrate a better visual working memory than auditory working memory. The profile of the auditory memory shows that the immediate auditory memory is the most efficient. The results show that the more auditory working memory has to mentalize information manipulation the less it performs.

The correlation analyzes reveal positive correlations between auditory and visual work memories and autonomy abilities in everyday life. There is also a positive correlation between immediate auditory memory and communication abnormalities. The results show negative correlations between visual working memory and anomalies in social interactions, and a negative correlation between mental manipulation abilities and behavioral abnormalities

Conclusions:

These results demonstrate a specific working memory profile in ASD with a visual memory more powerful than the auditory memory. In general, working memory seems to be particularly related to the autonomous capacities of everyday life. The results also show specific links between the type of working memory, the possibilities of adaptations and the anomalies of communication, social interactions and behavior.

49 **164.049** Supporting Eyewitness Testimony By Individuals with Autism through Witness-Directed Interviews

K. L. Maras[1], *C. Dando*[2], *S. B. Gaigg*[3], *H. J. Stephenson*[1] *and S. Anns*[4], *(1)Psychology, Centre for Applied Autism Research, University of Bath, Bath, United Kingdom, (2)Psychology, University of Westminster, London, United Kingdom, (3)City, University of London, London, United Kingdom,* *(4)Psychology, City, University of London, London, United Kingdom*

Background:

Adults with autism may be more likely to be interviewed in the criminal justice system as a witness, victim or a suspect, yet they also experience specific memory difficulties that can impact their ability to recall episodic information in a coherent, relevant and complete narrative. Previous research has shown that current police interviewing techniques are ineffective in supporting these difficulties to obtain detailed, accurate memory recall from them. We developed the 'Witness-Aimed First Account' (WAFA) interview specifically with the aim of supporting executive function, social demand, narrative and episodic memory difficulties in autism to improve the quality of their accounts within a legally appropriate, non-leading framework and without constraining recall. In contrast to current police interviewing techniques, where uninterrupted and unbound, parameter-free recall from the outset is the gold standard, WAFA was developed to diminish socio-cognitive demands by encouraging participants to generate and direct their own discrete, parameter-bound topics from the video in phase 1, before freely recalling information within each parameter-bound topic in turn in phase 2.

Objectives:

The primary aim of this research was to test this new method of interviewing (WAFA) for eliciting detailed, yet accurate, eyewitness accounts from individuals with autism. A second aim was to explore whether differences between autistic and typically developing (TD) witnesses' recall would be diminished when the narrative structure of the to-be-remembered event was lost (i.e., whether TD witnesses would appear more autistic in their recall, ameliorating the relative disadvantage by autistic participants).

Methods:

This study adopted a 2 (Group: Autism vs Typically Developing) x 2 (interview: WAFA vs. Control standard 'achieving best evidence' police interview) x 2 (Video: Scrambled vs. Unscrambled) mixed design, where Video was within participants. Specifically, participants were interviewed about their memory for two specially developed videos depicting criminal events. One video was 'scrambled' whereby clip segments were re-ordered, thus removing the narrative structure of the video; the other video was watched intact (the order in which videos were presented and whether video A or B was scrambled was counterbalanced between participants). Participants were interviewed using the same interview (WAFA vs. Control) for both videos. In WAFA interviews, rather than having a free flow verbalization of the entire event – which is difficult and inevitably results in underperformance by autistic adults – participants self-segmented their free narrative recollection right from the beginning. Once complete, they then revisited each of the self-directed free narrative topics in turn, in the order that they were recalled. Interviews were transcribed and coded according to the types of details recalled (e.g., persons, actions, surroundings, objects), completeness (i.e., number of correct details recalled), and accuracy (i.e., errors/all details recalled).

Results:

Data collection is still underway but preliminary results are promising. Although witnesses with autism recall fewer person and action details compared to TD witnesses overall, tentatively, WAFA interviews appear to ameliorate this difference, whilst also increasing the accuracy of autistic witnesses' accounts without compromising completeness.

Conclusions:

Witnesses with autism can make reliable witnesses if their socio-cognitive difficulties are supported appropriately at interview.

50 **164.050** Testing the Ecological Validity of Executive Function Assessment in Autism with a Novel 'Tea-Making' Task

***L. Kenny**[1], A. Remington[2] and E. Pellicano[3], (1)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland, (2)UCL Centre for Research in Autism and Education, London, United Kingdom, (3)Macquarie University, Sydney, Australia*

Background: People on the autism spectrum often struggle to achieve personal and occupational outcomes commensurate with their intellectual potential. One possible explanation for this mismatch could be difficulties with executive function (EF): a collective term for the higher-order cognitive skills that facilitate goal-directed behavior. Over 250 peer-reviewed papers have reported on EF assessments of autistic people but the findings have been markedly inconsistent. One criticism levelled at current EF assessment is that it lacks ecological validity. Indeed, research testing the ecological validity of these assessments in autism is severely limited and so it is unknown if the relationship between performance on neuropsychological EF tasks and everyday executively demanding tasks differs in autism compared with non-autistic people. Further, it is relatively unknown the extent to which current EF tasks are empirically related to the personal and occupational outcomes that have been so widely documented in autism.

Objectives: The current study sought to test the ecological validity of current neuropsychological EF assessment in autism in two ways. First, we tested the verisimilitude of EF by comparing the performance of autistic and non-autistic adolescents on two measures of EF: a battery of common EF tasks (National Institutes of Health (NIH) Examiner battery) and a novel, ecologically-valid 'tea-making' task. Second, we assessed the veridicality of EF by testing whether performance on the NIH battery was related to autistic participants' quality of life and level of disability.

Methods: Data collection is ongoing. Participants assessed so far include autistic (n=20) and non-autistic (n=19) adolescents, between 12 and 19 years, group-matched by age (*p*=.15) and IQ (*p*=.30). A composite EF variable was generated by the NIH battery. The tea-making task involved preparing food and materials for a group study session while a researcher rated the number of executive errors committed (e.g. boiling the kettle extra times, failing to adapt to a change in task instructions). Performance on both tasks was scaled and standardized such that higher scores were indicative of better EF ability. Parents also completed The Pediatric Quality of Life Inventory (PedsQL) and The World Health Organization Disability Assessment Schedule (WHODAS-2).

Results: A 2x2 repeated-measures ANOVA comparing group (autistic and non-autistic) and EF assessment type (NIH and 'tea-making' task) yielded a significant main effect of group, $F(1,36)=8.00$, $p=.008$, $\eta_p^2=.18$. Autistic participants showed, on average, more EF difficulties compared to non-autistic participants. There was, however, no main effect of EF assessment type, $F(1,37)=.001$, $p=.99$, $\eta_p^2<.001$ and no significant group x EF assessment type interaction, $F(1,37)=.29$, $p=.59$, $\eta_p^2=.008$. There were also no significant correlations between performance on the NIH battery and PedsQL, $r(16)=-.28$, $p=.26$ or WHODAS-2, $r(16)=.23$, $p=.36$, scores when age and IQ were controlled for among autistic participants.

Conclusions: Both the neuropsychological and ecological assessments of EF employed here were sensitive to group differences. This study demonstrated that, for autistic people, the verisimilitude of EF assessment is comparable with typical development. Yet, the absence of any relationship with parent reported quality of life or level of disability draws into question the veridicality of EF assessment in autism.

51 **164.051** The Ability to Retell a Story: Children with ASD in Comparison to Typical Development

Y. Kimhi[1,2]*, L. Kadosh*[2]*, G. Tubul-Lavy*[3] *and N. B. Bauminger-Zviely*[4]*, (1)Levinsky College of Education, Tel Aviv, Israel, (2)Bar Ilan University, Ramat Gan, Israel, (3)Ono Academic College, Kiryat Ono, Israel, (4)School of Education, Bar Ilan University, Ramat Gan, Israel*

Background:

Oral retelling is the restating of a text that was heard or read. Retelling demonstrates one's ability to identify relevant information of the previously heard (or read) text and integrate these ideas into a coherent narrative. Examining oral story retelling abilities enables delineating different levels of comprehension and is therefore an efficient strategy for discovering whether a child understands what he or she has heard or read. Impaired reading comprehension has been reported for children with ASD (Autism Spectrum Disorder) yet, research regarding oral retelling abilities in ASD is scarce.

Objectives:

1. To examine group differences (ASD/TD) in oral story retelling abilities (macrostructure and microstructure characteristics) in both channels (reading and listening).
2. To examine within group differences regarding oral story retelling abilities in the different channels (after reading / after listening).
3. Correlations between ToM and story retelling abilities.

Methods:

Participants included 40 third grade school-age children: 20 cognitively able children with ASD and 20 children with typical development. Groups were matched on SES, VIQ, CA and gender. VIQ was assessed by the PPVT-III (Dunn & Dunn, 1997). Story retelling was compared in two tasks: retelling following listening to the text and retelling following individual reading of the text. The Katzenberger Hebrew Language Assessment (KHLA; Katzenberger, 2016) was used to assess the children's ability to retell the story they read / listened to. The KHLA is a standardized in-depth norm-referenced test of language for children in the elementary school age range. Two major KHLA dimensions were measured: essential (equivalent to macrostructure) and optional (equivalent to microstructure) characteristics. ToM was assessed by two second-order false-belief tasks; (a) "The Ice Cream Van Task" (Perner & Wimmer, 1985); (b) ToM faux pas task (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999).

Results:

Main findings showed that cognitively able school-age children with ASD demonstrated difficulties in comparison to their typically developing peers when retelling the story that they read / listened to, only in relation to one aspect of the macrostructural essential components (relation between text events), and not for the microstructural optional components. No differences emerged between the channels (reading / listening) in both groups, and retelling the optional microstructure components was easier than retelling the macrostructural essential components in both groups. ToM scores were positively correlated with the macrostructural essential components.

Conclusions:

This study presents an in-depth examination of the macro (essential) and microstructure (optional) story retelling abilities of cognitively able children with ASD in comparison to their typically developing peers. The contribution of this study is two-fold: the assessment of the abilities in relation to the different channels – reading and listening, and the analysis of the relation between story retelling abilities and ToM. These findings are important when considering classroom accommodations and modifications. Story retelling is considered an effective literacy and language enhancement strategy, and therefore crucial for developing academic abilities. Considering the academic difficulties typical of children with ASD, all strategies that may advance these abilities are important to study and develop.

52 **164.052** The Development of EF and Its Relationships with Social Function and Behavior Problem in the Children with High-Functioning Autism Spectrum Disorder

P. Yeh[1]*, C. H. Chiang*[2] *and Y. A. Lin*[3]*, (1)Psychology, National Chengchi University, Taipei, Taiwan, (2)Department of Psychology, National Chengchi University, Taipei City, Taiwan, (3)Tri-Service General Hospital, Taipei, Taiwan*

Background: Individuals with autism spectrum disorder (ASD) have diverse deficits in executive and social functioning. This is difficult to identify the core impairments that cause their problems.

Objectives: The study aimed to examine different domains of executive functions (EF) with heterogeneity of high-functioning ASD (HFASD) in relations to their symptom severity, adaptive behavior and social problems.

Methods: seventy-four 7- to-10-year-old HFASD and 44 typically developing (TD) controls were measured three domains of EF tasks: working memory (i.e., Leiter-R and subtest of WISC-III), inhibition(i.e., subtest of NEPSY-III and Flanker task) and flexibility abilities (i.e., subtest of NEPSY-III). Parent-reported were also assessed for children's executive functions and self-regulations (BRIEF), social communication (i.e., SRS, RBS-R, SCQ) and adaptive behavior (i.e., CBCL, VABS).

Results: HFASD group had worse performance on all EF tasks compared to TD group, particularly for inhibition tasks, showed the largest group differences. When intelligence was considered, the HFASD with non-intelligence (non-IG-HFASD, 70<FIQ<115) were weak in inhibition and flexibility abilities than TD group. However, these comparisons were not obviously observed between HFASD with high-intelligence (IG-HFASD, FIQ>115) and TD groups. In addition, there are respective impairments on inventory-based EF scales in the IG-HFASD and Non-IG-HFASD participants. Regression analysis revealed the problems of inhibition and shift abilities can predict restricted and repetitive symptoms as well as internalizing (e.g. anxiety) and externalizing symptom (e.g. attack).

Conclusions: Children with HFASD having better inhibition abilities are likely to have more disturbance of internalizing problems. The specific patterns of deficits in execute functions related to social behavior can be observed for HFASD with and without high-intelligence. The results highlight the uniqueness and universality of executive functions interpret heterogeneity in the cognitive profiles of children with HFASD, implying the possibilities for early intervention.

53 **164.053** The Dual Process Theory of Autism, Systemizing and Formal Logical Reasoning.

C. Singleton[1]*, C. Ashwin*[2] *and M. Brosnan*[3]*, (1)University of Bath, Bath, United Kingdom, (2)University of Bath, Bath, United Kingdom of Great Britain* *and Northern Ireland, (3)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

Autism Spectrum Disorder (ASD) has been characterised by a drive or bias towards deliberative, systematic processing relative to intuitive, social-emotional processing – the opposing bias typically being seen in the general population. Two cognitive theories provide a framework for considering relatively preserved or enhanced logical reasoning in people with ASD and people from the general population with high levels of autistic-like traits. Hyper-systemizing accounts, propose these groups are high in systemizing, which is characterized by a drive towards understanding and predicting rule-based systems. The Dual Process Theory of Autism on the other hand, proposes that autistic people and people high in autistic-like traits bias towards deliberative processing, which is characterised as slow, effortful, sequential, conscious processing that is heavily dependent on working memory and related to individual differences in general cognitive ability. This is contrasted with a bias away from intuitive processing which is characterised as autonomous processing which is typically rapid, effortless, parallel, and non-conscious, that is independent of working memory and cognitive ability. Sex differences have been reported inconsistently in these capabilities.

Objectives:

To identify sex differences in, and correlates of, self-reported systemizing, deliberation and intuition with a behavioural assessment of logical thinking in a general population sample.

Methods:

104 participants (52 male, 52 female, ages 18-66, mean 22, sd 6) from the general population completed an online assessment comprising the Systemizing Quotient-short (SQ) to measure self-reported drive to systemize and the Rational Experiential Inventory to measure self-reported deliberative and intuitive reasoning ability and engagement. The Test of Logical Thinking (TOLT) was then undertaken to behaviourally measure formal reasoning ability.

Results:

There were significant sex differences, with males scoring higher, in SQ (t=4.88, p<.001), deliberative ability (t=2.02, p<.05) and deliberative engagement (t=2.34, p<.05). There were no significant sex differences in intuitive reasoning ability and engagement or on the TOLT. A partial correlation (controlling for sex) identified that TOLT significantly correlated with deliberative ability (r=.26, P<.01) and deliberative engagement (r=.25, p<.05) but not the SQ nor intuitive ability or engagement. The SQ significantly correlated with deliberative ability (r=.36, p<.001) and deliberative engagement (r=.45, p<.001) but not intuitive ability or engagement. There were no significant correlates of age.

Conclusions:

In a general population sample, those who self-report a higher levels of deliberative ability and engagement also perform better on a test of logic and formal reasoning ability. This is consistent with the Dual Process Theory of Autism. Self-reported systemizing did not correlate with the test of logic and formal reasoning ability. The SQ has been characterised as assessing systemizing drive, which is higher in autism, as is deliberation. Consistent with this, the strongest correlation was between SQ and deliberative engagement. Sex differences were identified in self-reported deliberative ability and engagement, but were not reflected in actual performance. It may be, therefore, that self-assessments of such capabilities are vulnerable to response biases in the general population. The Dual Process Theory of Autism proposes autism is also associated with reduced intuition, suggesting this bias would not be evident in autism.

54 **164.054** The Effects of Stimulus Complexity and Social Realism on Emotion Recognition in Children with ASD.

***T. Hutchins**, UVM, Burlington, VT*

Background: The use of visual supports is a common strategy for facilitating social cognition and the understanding of emotions in children with autism spectrum disorder (ASD). Yet, while the processing of visual information is considered a relative strength in ASD, the deficits in processing social information are well-documented. Furthermore, very little is known about the stimulus characteristics that support (or impede) the understanding of social imagery. The purpose of this study was to examine the effect of stimulus complexity and social realism on emotion recognition in ASD and typical development.

Objectives: This study compared the ability of typically developing (TD) children and children with ASD (ages 6 – 12 years) to identify emotions (happy, sad, mad, scared, disgust, surprise) when presented with face stimuli that systematically varied in complexity (i.e., the amount of detail and the intricacy of the lines, patterns, and colors in the image) and social realism (i.e., how realistic an image). Our exploratory research questions were:

1) Is there a difference between TD and ASD groups in the ability to identify emotions when complexity and social realism vary?

2) Which stimulus characteristics predict better emotion recognition for each group?

Methods: Nineteen TD children and 18 age- and gender-matched children with ASD participated. Children viewed face stimuli (presented in counterbalanced order) on a video monitor. Face stimuli were carefully manipulated using photoshop to make incremental adjustments in stimulus complexity and social realism: two levels (low, high) for each dimension were developed using a 2x2 approach. Each image was presented for 4 seconds and children were asked to “tell me what emotion you see”.

Results: Data for each emotion were submitted to six 2 (group) x 2 (social realism) X 2 (complexity) mixed model ANOVAs. A main effect of social realism was found such that higher social realism was associated with more accurate emotion recognition. When verbal ability was controlled, this main effect disappeared. A group X emotion interaction approached significance for ‘mad’ faces such that the ASD group performed best under conditions of low realism and the TD group continued to perform best under conditions of high realism.

Conclusions: Better performance by both groups in conditions of high social realism could be explained by higher ecological validity. Alternatively, our ‘social realism’ condition may actually have captured ‘prototypicality’ or how well an image represents its category. Although the ability to extract prototypes is thought to be disrupted in ASD, some researchers have argued that it is not the ability to extract the prototype but to apply it flexibly. Thus, both the ASD and TD samples may have experienced an emotion recognition advantage under conditions of higher prototypicality in this experiment. Finally, ‘mad’ faces may be particularly dependent on configural processing and there is an atypical tendency in ASD toward part- rather than whole-processing.

55 **164.055** Which Visual Supports Work Best? an Examination of Visual Attention to Photograph and Cartoon Stimuli in Children with ASD.

T. Hutchins[1] *and C. Sedeyn*[2]*, (1)UVM, Burlington, VT, (2)Center for Childhood Communication, Children's Hospital of Philadelphia, Philadelphia, PA*

Background: The use of visual supports is a common strategy for facilitating receptive language, enhancing communication, and increasing appropriate behaviors among children with autism spectrum disorder (ASD). At the same time, ASD is often accompanied by atypical visual attention to social stimuli. Specifically, several studies have documented an atypical tendency in ASD to look more at the mouth region of the face at the expense of the eye region of the face. To complicate matters, some researchers have argued that children with ASD demonstrate strengths when processing visual information from cartoons, whereas others have argued that photographic stimuli confer benefits.

Objectives: This study used eye tracking to assess children's visual attention when presented with Social Stories that employed either photographs or BoardMaker (BM) images. Social Stories were chosen (as were these two stimulus types) because they represent one of the most popular interventions in ASD and, hence, have great ecological validity. Our exploratory research questions were:

1) Is there a difference between TD children and children with ASD in how they attend to faces (i.e., eye region, mouth region, and background regions of a scene) in BM and photographic stimuli in the context of a Social Story?

2) Do group differences in visual attention to stimuli correlate with age, autism severity, executive function (attention shifting), intellectual functioning, or weak central coherence?

Methods: Nineteen TD children and 18 age- and gender-matched children with ASD participated. Children viewed two Social Stories (presented in counterbalanced order) on a eye tracking screen-capture monitor. The stories were identical with the exception that one used photographs and one used BM images. The BM and photograph stimuli were carefully controlled so that the images were as similar as possible with regard to semantic content, size, color, and orientation of people and objects. Each 'page' of the Social Story was presented for 4 seconds and the number of fixations and fixation time were assessed for eye, mouth, and 'other' (background) areas of interest.

Results: With one exception, we found no differences between groups when viewing images of faces. The exception involved one instance in which the image represented a person’s full body as well as a range of objects (i.e., the other scenes depicted only faces). For this more complex scene, an interaction was observed such that the TD and ASD groups were no different in their looking patterns in the BM condition but they were different in the photograph condition. Moreover, we found that in ASD, a shift toward more mouth-looking in the photograph condition was negatively associated with attention shifting and verbal IQ and that a shift toward more background-looking was negatively associated with attention shifting, age, and central coherence.

Conclusions: Children with ASD demonstrate typical visual attention patterns to both BM and photographic stimuli representing faces but children with ASD employ an atypical scanning strategy when presented with photographic stimuli representing more complex social scenes. Professionals should consider the potential benefits of simple, cartoon-like imagery when presenting complex images in the conduct of intervention.

56 **164.056** The Influence of Genes and Environments on the Gap-Overlap Task

M. Siqueiros Sanchez[1]*, D. P. Kennedy*[2]*, E. Pettersson*[3]*, S. Bolte*[4]*, B. D'Onofrio*[2]*, P. Lichtenstein*[5] *and T. Falck-Ytter*[6]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (2)Psychological and Brain Sciences, Indiana University, Bloomington, IN, (3)Department of Medical Epidemiology and Biostatistics (MEB), Karolinska Institutet, Stockholm, Sweden, (4)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women’s and Children’s Health, Karolinska Institutet, Stockholm, Sweden, (5)Karolinska Institutet, Stockholm, Sweden, (6)Karolinska Institutet & Uppsala University, Uppsala, Sweden*

Background: Atypicalities in attention are often found in neurodevelopmental disorders, including autism. The “gap-overlap task” is an eye-tracking paradigm that assesses the ability to disengage attention from a stimulus and orient toward a new one (visual disengagement). Although related, visual disengagement is thought to be a distinguishable construct from basic oculomotor control. Support for this thesis mostly comes from animal studies and a few small studies in humans using electroencephalogram (Csibra, Johnson, & Tucker, 1997). By studying the degree of genetic and environmental influences to individual differences in the gap-overlap task, we can assess if visual disengagement is an etiologically distinct construct. This can be done with multivariate analysis of twin data, which allows for establishing the relative influence of shared versus unique contributions of genes and environments to the measure.

Objectives: To study genetic and environmental influences on the gap-overlap task.

Methods: Classical twin design. The sample consisted of 492 twins (120 monozygotic pairs; 126 dizygotic pairs) from the general population, ranging in age from 9-14 years, recruited from the Child and Adolescent Twin Study in Sweden (CATSS). The gap-overlap task was performed using a Tobii T120 eye tracker. In this task a central stimulus (CS) appears on a screen and is followed by a new stimulus that appears on the periphery (PS). The task has three conditions: (1) “The gap” where the CS disappears before the PS appears, (2) “The baseline” where the CS disappears simultaneously as the PS appears, (3) “The overlap” where the CS remains on screen when the PS appears. The dependent variable was the median saccadic latency of gaze arrival at the PS. Multivariate twin modelling was used to analyze the genetic and environmental contributions to the variances and covariance among saccadic latencies.

Results: A common pathway model provided the best fit for the data. The covariance between the conditions was best explained by one shared factor with a primarily genetic background (63%). Significant unique genetic effects were found for the baseline (17%) and the overlap (15%) conditions, but not for the gap condition. Shared environment did not influence the experimental conditions (neither common nor unique).

Conclusions: Performance in the gap-overlap paradigm is primarily influenced by genetic effects, most of which are shared between the three conditions. This is expected since all conditions engage basic oculomotor functions (shifting the gaze from one stimuli to another). We found unique genetic effects in the overlap condition, which is in line with the view that this condition captures a distinct attentional function in addition to oculomotor control. We found no unique genetic effects in the gap condition. Surprisingly, we found unique genetic effects in the baseline condition, suggesting that it may be problematic to operationalize “the disengagement effect” as the difference between the overlap and the baseline conditions (resulting in a less clean comparison due to different genetic factors influencing each condition), as it sometimes done, at this age. This study illustrates how twin studies can enrich our understanding of experimental measures frequently used in autism research.

57 **164.057** The Modality Shift Effect in Autism: Exploring Speed Accuracy Trade-Off and the Time Course of Crossmodal Switching.

D. Poole[1], *E. Gowen*[2] *and E. Poliakoff*[2], *(1)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (2)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom*

Background: Previous research in neurotypicals (NTs) has shown that people can selectively attend to a sensory modality (vision, touch, hearing). This is reflected in switch costs during experimental tasks in which participants typically respond more slowly and less accurately to a target stimulus preceded by a stimulus in a different modality (crossmodal) relative to a target preceded by a stimulus in the same modality (ipsimodal). There are findings suggesting that shifts in attention between visual and auditory information are less effective in autism, reflected in increased switch costs compared with NTs (Courchesne et al., 1994; Williams, Goldstein, & Minshew, 2013). There are also contradictory findings suggesting audio-visual switch costs are comparable to NTs (Haigh et al., 2016; Murphy, Foxe, Peters, & Molholm, 2014).
Objectives: This study investigated automatic crossmodal switching between visual, tactile and auditory targets in autism for the first time. The time course of crossmodal switching was investigated; we expected that participants with autism would not show a reduction in switch costs with increased duration between the targets based on previous evidence of impaired disengagement of attention. We also sought to characterise any differences in speed- accuracy trade-offs during crossmodal switching using Drift Diffusion modelling (Ratcliff and Mc Koon, 2008).

Methods: Autistic adults (n =24) and NT controls (n = 24) matched for age, IQ, gender and handedness completed a speeded discrimination task (pulsed vs continuous) to visual, tactile and auditory targets. Targets were separated by 1,000, 1,250 or 2,000ms inter trial intervals (ITIs). For each target, reaction times were compared for ipsimodal and crossmodal trials across the three ITIs. The EZ diffusion model (Wagenmakers, van der Maas, & Grasman, 2007) was used to extract estimates of drift rate (quality of information extracted from the target), boundary separation (response conservativeness) and non-decision time (time taken to encode the target and prepare a response).

Results: Clear switch costs were observed in the reaction time data for each target modality, but did not differ between the groups. Against our expectations, switch costs were not reduced with increasing ITI for either group. For visual and auditory targets, switch costs were apparent in increased drift rates and reduced non-decision time. For visual targets, participants with ASC exhibited an increased boundary separation. Furthermore, participants with ASC required longer non-decision times when responding to tactile targets preceded by auditory.

Conclusions: Switch costs did not statistically differ between the groups and were not reduced with increased ITI. The importance of considering speed accuracy trade-offs in ASC was highlighted by differences in diffusion model parameters. In particular, the increased non-decision time when switching from auditory to tactile information suggests that the interaction between these sensory modalities may be affected in ASC and warrants further investigation.

58 **164.058** Time Perception and Autistic Spectrum Condition: A Systematic Review

D. Poole[1], *M. Casassus*[2], *E. Poliakoff*[2], *E. Gowen*[2] *and L. Jones*[2], *(1)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (2)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom*

Background: Problems with timing and time perception have been suggested as key characteristics of Autism Spectrum Condition (ASC). Studies and personal accounts from clinicians, parents, caregivers and self-reports from autistic people themselves often refer to problems with time. Although a number of empirical studies have examined aspects relating to time in autistic individuals, there remains no clear consensus on whether or how timing mechanisms may be affected in ASC.
Objectives: A systematic review was conducted in an attempt to summarise the extant literature. This review considered a wider range of timing behaviours than previous reviews (e.g. Allman and Falter, 2015; Stevenson, et al. 2015). We also incorporated more information from the theories and cognitive models of timing developed in neurotypicals (NTs).

Methods: In March 2017, five databases were consulted. From an initial 597 records, 45 were selected and reviewed. These studies were organised according to different timing abilities tested: time sensitivity (the ability to discriminate stimuli based on temporal characteristics), perception of duration and higher-order time perception (referring to the capacity to think about time as a concept, where events take place within it, and the ability to be aware of one place in time and plan for events in the future).

Results: There was a tendency for studies in timing sensitivity to display differences in children, whereas adult performance was comparable to NTs. This may suggest at a developmental delay in time sensitivity in ASC. However, in many studies it is not possible to determine whether differences are the result of a true timing deficit, or instead reflect differences in decision criterion or in the attention to socially relevant stimuli. Perception of duration studies have also generated mixed findings, but studies which investigated memory effects on timing performance have highlighted divergent performance from NTs. To date, the few studies that have investigated higher order timing in ASC (e.g. concepts of time) have consistently observed differences from NT performance.

Conclusions: It remains unclear whether there is a timing deficit in ASC. Divergent performance on timing tasks could reflect differences in cognitive mechanisms unrelated to timing in ASC. Additionally, studies have tended to involve varied methods and sample characteristics which likely contribute to the heterogeneity of findings. A proposed schedule of work to address these issues will be presented.

59 **164.059** The Role of Attention in Maths and Reading Achievement for Children with and without an Autism Spectrum Disorder

M. Hanley[1], ***E. McDougal***[2] *and D. M. Riby*[3], *(1)South Road, Durham University, Durham, United Kingdom of Great Britain and Northern Ireland, (2)Psychology, Durham University, Durham, United Kingdom of Great Britain and Northern Ireland, (3)Department of Psychology, Durham University, Durham, United Kingdom*

Background:
Attention abilities provide the gateway for learning in all domains, including reading and maths. Although not a core feature of Autism Spectrum Disorder (ASD), attention atypicalities have been well-documented (Ames & Fletcher-Watson, 2010). However, little research has investigated the role of attentional atypicalities in academic achievement in ASD.

Objectives:

The purpose of this study was to (1) investigate the role of attention in maths and reading achievement for children with and without ASD, and (2) to characterise profiles of academic achievement in relation to attention in children with and without ASD.

Methods:

Twenty-seven children with ASD aged between 6 and 16 years (M = 10.75) and 61 typically developing children aged between 6 and 11 years (M = 8.94) completed standardised assessments, including the Wechsler Abbreviated Scale of Intelligence-II (WASI-II), the Test of Everyday Attention for Children (TEA-Ch), and the Wechsler Individual Attainment Test-II (WIAT-II), providing measures of FSIQ, selective, sustained, and divided attention, and reading and maths achievement.

Results:

Correlational analyses showed that attention abilities were related to reading and maths achievement, but differently for children with and without autism. For typically developing children, sustained attention was related to reading achievement (r = .216, p = .05), but for children with autism divided attention was related to both reading (r = .591, p = .002) and maths achievement (r = .729, p < .001). A hierarchical cluster analysis was performed to examine whether there were sub-groups within the data reflecting different profiles of achievement relating to attention. This produced a three-cluster solution that grouped children according to ability – a group with good divided attention and good reading/maths achievement; average divided attention and average reading/maths achievement; and poor divided attention with correspondingly poor reading and maths achievement. Seventy nine per cent of children in the poor achievement group were children with autism. Inspection of the profile of this group indicated that although FSIQ was in the average range (M = 86) as was reading achievement (M = 81), these children appeared to have a relative weakness with maths achievement (M = 73).

Conclusions:

Overall, the results highlight that attention abilities are important for academic achievement. The findings suggest that the ability to divide attention between two tasks (in this case, auditory and visual) may be more important than sustained or selective attention skills for academic achievement. They also show that divided attention may be particularly important for children with autism in relation to maths achievement. Identifying attention skills important for achievement in different domains can help with future interventions. Further exploration is needed in a real world context, using real-time measures of attention and learning, to gain a deeper understanding of how attention abilities support or constrain learning and achievement.

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164.060 The Role of Prior Knowledge in Perceptual Inference Is Preserved in Autism Spectrum Disorder

J. Van Overwalle[1,2]*, S. Vanmarcke*[1,2]*, I. Van de Put*[1]*, J. Wagemans*[1,2] *and S. Van de Cruys*[1,2]*, (1)Laboratory of Experimental Psychology, Brain & Cognition, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium*

Background:

Several researchers have exploited the Bayesian framework to propose an imbalance between bottom-up (sensory) and top-down (prior) information processing in Autism Spectrum Disorder (ASD). One recent Bayesian account about ASD is the ‘weak priors’ hypothesis. This hypothesis can be traced back to principles of older perceptual theories about ASD (Enhanced Perceptual Functioning and Weak Central Coherence), suggesting that perception of individuals with ASD is more determined by sensory input instead of by prior knowledge. However, studies empirically testing the ‘weak priors’ theory have generated contradictory results and alternative accounts of ASD exist that do not assume impaired acquisition of prior knowledge per se.

Objectives:

Here we aim to provide clear evidence for or against the ‘weak priors’ hypothesis by obtaining a distinct measurement of prior knowledge using Mooney images. On first viewing, Mooney images are experienced as meaningless black and white patches. After exposure to the source image however, prior knowledge causes the patches to (re)organize and be perceived as a meaningful whole. Hence, we can investigate the role of priors in Typically Developing (TD) individuals varying in ASD-like traits (study 1) and ASD individuals (study 2) by looking at improvements in recognition accuracy for Mooney images, before and after exposure to their source image.

Methods:

In the first study, 282 TD individuals (40 males, mean age 18.6 ± 1.91) performed the experiment and the Autism-Spectrum Quotient (AQ) questionnaire. In the second study, the experiment was completed by 23 adolescents with ASD (19 males, mean age 14.04 ± 1.49) and 24 matched TD individuals (20 males, mean age = 14.38 ± 1.28). The experiment in both studies consisted of six experimental blocks, each made up by three phases of 10 trials (10 different Mooney images). In the first phase, participants were asked to identify the object in the Mooney images (open response). Then the source images were presented in random order. After this exposure phase participants were presented with the same Mooney images as in the first phase and again had to try to recognize the image.

Results:

Participants of the first study had an average AQ score of 17.73 (range of 3-43), comparable with other studies, but there was no difference between the accuracy data of individuals with lower and higher AQ. Results of the second study also showed no difference between the accuracy data of TD and ASD individuals. GLMM analyses confirmed both findings.

Conclusions:

Our findings consistently did not support a difference in the impact of prior knowledge in perception, as a function of varying ASD-like traits or a clinical ASD diagnosis. These findings, thus, suggest that the fast formation and application of priors is preserved in ASD and go against the ‘weak priors’ hypothesis. Earlier studies reporting an intact use of priors in ASD are consistent with this result, while other studies do claim to have found evidence for weaker priors in ASD. Future research will have to systematically evaluate the differences in settings and priors concerned.

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164.061 The Self-Reference Effect on Perception: Undiminished in Adults with Autism and No Relation to Autism Traits.

D. M. Williams[1]*, C. Grainger*[2] *and T. Nicholson*[3]*, (1)University of Kent, Canterbury, United Kingdom, (2)Stirling, Edinburgh, United Kingdom, (3)University of Kent, Canterbury, England, United Kingdom*

Background: It is widely agreed that the self plays an important role in human cognition and perception, exerting influence across a range of domains and situations. The clearest empirical demonstration of this influence is the "self-reference effect" (SRE; Rogers et al., 1977), whereby information encoded in relation to the self has a mnemonic advantage over information encoded in other ways. This effect is apparent in a number of different paradigms and across different domains of processing. This SRE in *memory* appears diminished in ASD and related to the number of ASD traits manifested by neurotypical individuals (the fewer ASD traits, the larger the SRE). Here, we report the first experiments exploring the relation between ASD and the SRE in *perception*.
Objectives: To investigate the role of self-reference on perception in ASD.

Methods: Using a "Shapes" Task (Sui et al., 2012), participants learned to associate three different shapes (triangle, circle, square) with three different labels representing self, a familiar other, or an unfamiliar other (e.g., "you", "mother", "stranger"). Participants then completed trials during which they were presented with one shape and one label for 100ms, and made judgements about whether each shape-label pairing matched the learned contingency. Participants also completed measures of mentalizing (Reading the Mind in the Eyes and Animations tasks) and ASD traits/severity (Autism-spectrum Quotient). Bayesian analyses were employed to complement null hypothesis significance testing ($BF_{10} < 1$ = evidence for the null; $BF_{10} > 3$ = evidence for the alternative hypothesis).

Results: In Experiment 1, neurotypical participants (*n*=124) showed the expected SRE, detecting self-related matches more reliably and quickly than matches involving the familiar or unfamiliar other (all *p*s<.001, *d*s>0.97, BF_{10}>100). Most important, number of ASD traits was unrelated to the size of the SRE for either accuracy or RT (all *r*s <.10, *p*s >.27, BF_{10} <0.21). Hence, Bayesian association analyses strongly supported the null hypothesis. In Experiment 2, there were no differences between 22 adults with ASD and 21 age-, sex, and IQ-matched comparison adults in performance on the Shapes Task (see Figure 2). Despite showing large and significant mentalizing impairments (all *p*s <.01, *d*s >0.80, BF_{10} >23.00), participants with ASD showed the typical SRE for accuracy and RT, and there were no between-group differences in this respect (*p*s >.66, *d*s <0.13, BF_{10} <0.33). Moreover, there were no associations with ASD traits (measured using AQ or ADOS) in either group. Bayesian analyses favoured the null hypothesis.

Conclusions: These findings suggest that self-representation influences perception in a normal way in ASD. Considered alongside previous findings, the current results are relevant for theories about self-representation in ASD. Our interpretation is that first-order representations of self are typical in ASD and available to *bias* perception/cognition in a typical manner, contrary to the "experiencing-I" theory espoused by Millward et al. (2000). In contrast, we suggest that second-order (meta-) representations of self are impoverished among people with ASD (in keeping with the "absent self" theory; Frith, 2003), which leads to a diminished SRE on tasks that require reflections on/evaluations of self.

62 **164.062** The Use of Rewards at Home in Children with Autism Spectrum Disorders: A Parent Survey

A. Lambrechts[1], *E. Alonso*[2], *J. Cook*[3], *E. A. Ludvig*[4] *and S. B. Gaigg*[5], *(1)City, University of London, London, United Kingdom of Great Britain and Northern Ireland, (2)School of Mathematics, Computer Science & Engineering, Department of Computer Science, City, University of London, London, United Kingdom, (3)School of Psychology, University of Birmingham, Birmingham, United Kingdom, (4)Psychology, University of Warwick, Warwick, United Kingdom, (5)City, University of London, London, United Kingdom*

Background: Rewards act as a motivator for positive behaviour and learning. Although rewards are widely used in various settings and programmes with children with Autism Spectrum Disorder (ASD), it is unclear whether the same kinds of rewards are effective for children with and without ASD, in particular those children with complex needs.
Objectives: We investigated which rewards parents of ASD children use at home compared to parents of Typically Developing (TD) children and how effective they are.

Methods: In the context of a larger project on reward processing in autism, the parents of 33 ASD (age 4-15) and 22 TD children (age 5-8) completed a survey about 1) the tokens and activities they used as rewards at home 2) the toys, objects and activities that their children generally enjoy. For each item endorsed, parents also rated how enjoyable they were for their children on a 1(little) to 5(very) scale. Items included tokens (gold stars, stickers), snacks, sensory toys and activities (sand, water play), toys and activities with a social feature (action figures and dolls, seeing a friend), time for watching TV or playing on the computer, social rewards (praising, high fives, cuddles), sports and outdoors activities (playground, swimming), etc.

Results: First, there was no difference in the average number of items endorsed by parents of TD and ASD children overall. There were however differences in the individual items endorsed in each group. Using praise as a reward was endorsed by more parents of TD than ASD children (TD: 100%, ASD: 73%, p=.002) and praising was rated twice as rewarding for TD than for ASD children (TD: 4.3/5, ASD: 2.5/5, p=.001). More parents of TD children reported action figures and dolls (TD: 82%, ASD: 18%, p<.001), stuffed animals (TD: 73%, ASD: 27%, p=.001), books (TD: 91%, ASD: 45%, p<.001) and drawing and painting (TD: 82%, ASD: 39%, p=.001) to be enjoyable compared to parents of ASD children. Action figures and dolls (TD: 2.9/5, ASD: 0.5/5, p<.001) and stuffed animals (TD: 2.8/5, ASD: 0.8/5, p<.001) were also rated as more rewarding for TD than ASD children.

Conclusions: Overall many items were endorsed as rewarding by parents of TD and ASD children equally. Praise however was used by fewer parents of children with ASD and rated as less rewarding by those who used it compared to parents of TD children. In the context of education, it might be good to substitute praise for other rewards such as smiling or high fives which might be more accessible and rewarding for ASD children. In line with previous literature, action figures and dolls which elicit symbolic play were deemed rewarding by fewer parents of ASD than TD children. Perhaps less expectedly, stuffed animals, books and drawing and painting were reported to be enjoyable by fewer parents of ASD than TD children. It might be important to consider the roles these toys and activities support beyond reward (e.g. comfort, learning, shared interaction, artistic development) to offer appropriate substitutes to children with ASD (e.g. sensory toy, tablet, music).

63 **164.063** Thinking in Black-and-White: Adults with High Autistic Traits Sharpen Vague Predicates

T. Loucas, *G. Baddeley, E. N. Carter and L. Mellor, University of Reading, Reading, United Kingdom*

Background: Thinking in autism spectrum disorders shows atypical cognitive flexibility and processing of local information independently of context. Recent evidence suggests that decision-making is also atypical, being more consistent and conventionally rational in adults with ASD and non-ASD controls with high autistic traits (Farmer et al., 2017). There does not appear to be any investigation of black-and-white, logical thinking that is reported clinically in ASD. Vagueness, a property of natural language, may provide a window on logical thinking. Vague predicates (e.g.,

"tall") admit borderline cases; those where it is not clear whether the predicate applies. Thus, the truth of a statement like "X is tall" is indeterminant. This contrasts with sharp predicates where classical bivalent logic applies. Truth-gap theories are a suggested solution to this problem, which minimise the divergence from classical logic. Alxatib and Pelletier (2011) (AP) found evidence for gap theories in a truth-judgment task. They argued that if the predicate "tall" was sharp, rather than vague, participants would be equally likely to accept '"X is tall" is True' as to reject '"X is not tall" is False'. However, they found participants were more likely to accept the statement '"X is tall" is False' than reject '"X is not tall" is True', which is consistent with the presence of a truth-gap.
Objectives: If black-and-white thinking is characteristic of ASD, the indeterminacy of vague predicates may be problematic. We investigated if individuals with high autistic traits may, therefore, treat vague concepts as sharp, implying a rejection of any divergence from the classical bivalent logical paradigm.

Methods: Participants recruited via social media participated in an online experiment, including the adult Autism Spectrum Quotient and AP's truth-judgment task. They were presented with a drawing of a police line-up showing five men, ranging in height from 5'4" to 6'6", with 5'11" as a borderline case. They responded "True", "False" or "Can't tell" to a series of statements (e.g., "#1 is tall"; "#1 is not tall") about each man, presented in random order.

Results: Data from 121 participants (median age = 27 (range = 18-80) years; Male = 26, Female = 95) were analysed. A median split of AQ score (median = 12 (range = 2-33)) was used to create low (N = 63) and high (N = 58) autistic traits groups. Cochran's Q tests were run to compare the frequency of truth judgments to "#x is tall" and "#x is not tall" statements in the low AQ and high AQ groups. For the critical borderline case, the low AQ group were more likely to reject the statement '"#2 is tall" (i.e., judge it False) than accept the statement "#2 is not tall" (i.e., judge it True) (Q(1) = 8.33, p = .004). This was not the case for the high AQ group (Q(1) = 1.00 , p = .317).

Conclusions: Participants with high autistic traits, in contrast to those with low autistic traits, treated vague concepts as sharp, appearing to reject any divergence from the classical bivalent logic.

64 **164.064** Towards a Clarification of Attention to Faces in Atypical Development: Sustained Attention to the Face Is Task-Dependent in Autism Spectrum Disorder

T. Del Bianco[1], *I. Landi*[1,2], *N. Mazzoni*[1], *A. Bentenuto*[1], *I. Basadonne*[1] *and P. Venuti*[1], *(1)Psychology and Cognitive Science, University of Trento, Rovereto, Italy, (2)Bruno Kessler Foundation, Trento, Italy*

Background: Humans present a strong face-orienting response and a visual preference for faces from birth. Consistent evidence indicates that defective attention to faces and other humans characterizes Autism Spectrum Disorder (ASD).
Objectives: In our eye-tracking study, we aimed to investigate the face-orienting response and the subsequent attentive selection, by analysing the proportion of first looks to the face and the sustained attention to faces, in a group with atypical and typical development.

Methods: 20 young adults with ASD (mean age: 22.1, standard deviation: 3.8; mean IQ: 118, standard deviation: 10) and 24 young adults with typical development (mean age: 22.4, standard deviation: 3; mean IQ: 122.4, standard deviation: 8.1) participated our eye-tracking study. Each participant received three types of instructions in random order at the beginning of each trial, and watched scenes of a social interaction between three actors on the eye-tracker screen. The instructions identified three experimental conditions: free-viewing (FV), visual-search (VS) - where participants were asked to find an object - and gaze-reading (GR) - where participants were asked to identify which actor was paying attention to the conversation. We analysed and compared the Proportion of First looks from the centre to the face and the Proportional Looking Time to faces in the two groups.

Results: We found that the Proportional Looking Time to faces differed across groups (FV: W = 87, p-value < 0.001; VS: W = 36, p-value < 0.001; GR: W = 113, p-value = 0.002), with minor proportion in the ASD group in all conditions. Furthermore, Proportional Looking Time to faces was task-dependent in the ASD group only, with maximum proportion in the GR and minimum proportion in the VS condition (FV vs VS: W = 157, p-value = 0.002, FV vs GR: W = 13, p-value < 0.001, VS vs GR: W = 13, p-value < 0.001). The same measure did not significantly vary across conditions in the typical group. The face-orienting tendency was above chance in all groups and did not differ across groups and conditions.

Conclusions: Participants with ASD varied the time allocated to faces in a social scene depending on the instruction. This result cannot be explained by a lack of an initial bias to orient to the face, since the face-orienting tendency was similar in the ASD and the control group. We interpret the results with a possible delayed disengagement of attention from the item that the task-at-hand explicitly emphasized in the scene. Our finding suggests that persons with ASD may end disregarding relevant environmental stimuli, when their attention is explicitly directed to a specific element.

65 **164.065** Using the NIH Toolbox Cognition Battery to Characterize the Cognitive Profile of Children with Autism

D. R. Jones[1], *A. R. Dallman*[2], *C. Harrop*[2] *and B. A. Boyd*[3], *(1)University of Texas at Dallas, Richardson, TX, (2)University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)Juniper Gardens Children's Project, University of Kansas, Kansas City, KS*

Background: The NIH Toolbox Cognition Battery (NIH-TCB) is a clinically validated set of digital assessments for the assessment of several cognitive domains. While preliminary studies have implemented this measure in Intellectual Disability (ID), Fragile X syndrome, and Down syndrome (Hessl et al., 2016), to our knowledge, it has not been tested on children with autism spectrum disorder (ASD). Children with ASD are believed to possess an altered cognitive profile compared to typically developing children, characterized by executive dysfunction in several areas, including speed of processing, attention shifting, and cognitive flexibility, as well as increased detail orientation (Kenworthy et al., 2008).
Objectives: This study details preliminary data using the NIH-TCB to assess the cognitive domains of cognitive flexibility, processing speed, and attention shifting in children with and without ASD.

Methods: ASD children ages 3-17 and typically developing (TD) children matched on age are currently being recruited. This abstract details data from 18 children and adolescents with ASD (mean age = 9.4 years; SD = 3.9) and 14 TD controls (mean age = 7.1 years; SD = 2.8). TD children demonstrated a significantly higher IQ (mean IQ = 117.4; p=.01) than ASD children (mean IQ = 100.2), so this was controlled for in analysis. Children were administered an abbreviated version of the Stanford-Binet Intelligence Test, Fifth Edition (SB-5) and three NIH Toolbox Cognition assessments: 1) Flanker Inhibitory Control and Attention (Flanker); 2) Dimensional Change Card Sort (DCCS); and 3) Pattern Comparison Processing Speed (PCPS). These tasks were chosen in order to evaluate attention, cognitive flexibility, and speed of processing.

Results: Three ASD children were excluded from analysis, as they were unable to complete the assessment due to difficulties in attention or understanding the task. These children were all characterized by an IQ at or below the 5th percentile, although a select few children with an IQ in this range completed the assessment. ASD children exhibited cognitive deficits compared to TD children, with lower Age-Corrected Standard scores for the Flanker (t(27)= -2.9, p= .007), DCCS (t(27)= -3.6, p= .001), and PCPS (t(27)= -3.2, p= .004) assessments. IQ was strongly correlated with Age-Corrected Standard score for ASD (r= .69), but not TD children (r= .46) on the DCCS task. No significant correlations were found between IQ and Age-Corrected Standard score for the Flanker or PCPS tasks in either group. When controlling for IQ on the DCCS task, significant between-group differences continued to be observed in Age-Corrected Standard scores (F= 4.3, p= .047), supporting previous findings using the standard DCCS task in high-functioning autism (Faja & Dawson, 2014).

Conclusions: These preliminary findings replicate previously observed patterns of cognition in children with ASD. Children with ASD exhibited decreased cognitive flexibility, difficulties in attention switching and inhibition, and increased speed of processing compared to TD children. Although the current sample size is small, we anticipate 150 children with ASD and 75 controls by Spring 2018. These data support the potential of the NIH-TCB as a valid, integrated tool for the assessment of cognition in children with ASD.

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164.066 Visual Preference to Repetitive and Biological Movements in Children with Autism Spectrum Disorder

T. Li[1]*, Y. Hu*[2] *and L. Yi*[1]*, (1)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China, (2)Peking University, Beijing, China*

Background:

Individuals with Autism Spectrum Disorder (ASD) exhibit reduced interest in social stimuli and biological motions (e.g., Klin et al., 2009). Meanwhile, they have also been reported, mainly based on parent report and clinical observations, to show excessive visual attention to repetitive movements (e.g., the rotating wheels, Leekam et al., 2011). However, the visual preference to repetitive and biological movements has rarely been compared within one paradigm.

Objectives:

In this study, we attempted to measure ASD children's visual preferences to repetitive and biological movements using a preferential looking paradigm. By carefully matching the properties of stimuli (e.g., color and shape), we aimed to investigate the preferences of children with ASD to the movements (repetitive, biological, and random) per se.

Methods:

We adapted the Social Attribution Task (SAT, Heider & Simmel, 1944), in which typical developing (TD) people could attribute geometric animation as a social story and perceived the intention enacted by the geometric shapes. The general setting, modified from SAT, was a little triangle moving in a location surrounded by a fence with several breaches. In the biological movements, the little triangle moved as it was trapped in the fence and intended to find an exit, it tried several breaches and succeed eventually. In the repetitive movements or random movements, the little triangle moved along an oval track or in random directions with the same speed.

Twenty-six 5- to 7-year-old high-functioning children with ASD and 22 age- and ability-matched TD peers participated in the experiment. Children were shown a pair of videos (approximately 35 s) selected from the three types of movements randomly. This procedure repeated for 12 trials. Children's eye-movements were recorded by a Tobii Pro X3-120 eye tracker during the whole experiment.

Using the looking time on random movements as the baselines, we calculated the average proportional looking time on the repetitive and biological movements as repetitive preference index (RPI) and biological preference index (BPI), respectively. When repetitive and biological movements were shown together, the average proportional looking time on the repetitive movements divided by the looking time on biological movements was defined as repetitive-biological ratio (RBR).

Results:

We found that (a) both group of children preferred the biological movements to random movements, with their BPIs significantly higher than the chance level (50%), see Figure 1; (b) the RPI of the ASD group was marginally higher than chance level, p = .06, while TD group shown no preference to repetitive movements compared to chance level, p > .1; (c) when repetitive movement and biological movement were displayed spontaneously, ASD group spent almost the same time on the two movements, and their RBR was significantly higher than their TD peers (Figure 2).

Conclusions:

Our study found that like TD children, children with ASD showed similar visual preference to biological movements relative to the random movements. However, compared with TD children, children with ASD still show the visual preferences to the repetitive movements. Our study provided evidence for the visual preference for the repetitive and biological movements in ASD.

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164.067 Visual Working Memory in Adolescents with Autism Spectrum Disorder

K. R. Bellesheim[1]*, J. L. Sokoloff*[1]*, K. E. Bodner*[2]*, K. M. Boland*[1]*, N. Cowan*[1] *and S. E. Christ*[1]*, (1)Department of Psychological Sciences, University of Missouri, Columbia, MO, (2)Thompson Center for Autism & Neurodevelopmental Disorders, Columbia, MO*

Background: Impairment in working memory (WM) performance has been reported in individuals with Autism Spectrum Disorder (ASD; Geurts et al., 2014) though questions remain regarding which core processes of WM are impaired (e.g., capacity, attention, and/or filtering ability). A recent investigation (Bodner et al., in prep) found that visual WM performance was relatively spared in adults with ASD when memory load was low; however, at higher memory loads, ASD participants exhibited difficulty in optimally allocating WM capacity.

Objectives: The current research investigated whether this selective WM impairment extended to youth with ASD (ages 11 to 15) and whether differences existed in the neurocognitive profile of girls and boys with ASD.

Methods: Sixty participants [29 with ASD (12 females); 31 without ASD (17 females)] completed a computerized visual WM task assessing WM capacity and attentional control. Full-scale IQ for all participants fell at or above 75 (ASD mean = 100.6; non-ASD mean = 106.4). For each trial, participants were shown a visual array consisting of four or six colored circles and squares. After a short delay, memory for one of the stimuli was probed, and participants responded whether the shape was the same or different color from when first presented. Note that participants were informed beforehand that one of the shapes (e.g., circles; high-frequency probes) was more likely to be probed than the other shape (e.g., squares; low-frequency probes) – thus prompting participants to allocate their attention and memory capacity accordingly. Trial blocks were presented with 80% high-frequency and 20% low-frequency probes. Further, for half of the blocks, shapes in the visual array were presented simultaneously (all at once). For the other half, visual array shapes were presented serially (one at a time).

Results: Primary dependent variables were WM capacity (Cowan's *k*; Cowan, 2010) and attentional control. Preliminary analyses of WM capacity data revealed a significant three-way interaction between group (ASD, non-ASD), presentation type (simultaneous, serial), and memory probe (high frequency, low frequency) [$F(1,45)=4.94$, $p=.03$, $\eta_p^2=.10$]. In the simultaneous presentation condition, participants in the ASD group devoted relatively less capacity to high frequency probes as compared to participants in the non-ASD group. A main effect of group and group-by-sex interaction also trended towards significance ($p<.10$ in both instances). The non-ASD group had a higher capacity than the ASD group which was primarily driven by poorer WM performance in males as compared to females with ASD. No group differences or interactions were observed for attentional control ($p>.05$ in all instances).

Conclusions: Youth with ASD demonstrated selective impairment in WM capacity: when visual information was presented all at once, the ASD group was impaired on the high-frequency probes compared to the non-ASD group. Although preliminary, our data suggest that boys with ASD may display a different profile of WM capacity than girls. Future research should evaluate WM capacity and attention control across the lifespan as well as investigate the relationship between WM performance and everyday functioning.

68 **164.068** Visuospatial Cognition and Dimensions of Autistic Traits: Reduced Lateralization of Attention and Superior Search Relate Specifically to Social Difficulties

***M. T. Maybery**, M. C. English, D. W. Tan, I. Raiter and T. A. Visser, School of Psychological Science, University of Western Australia, Perth, Australia*

Background: Research has identified two visuospatial cognitive characteristics of individuals with high levels of autistic-like traits (ALT) – facility in embedded figures search and reduced left-visual-field (LVF) attentional bias – relative to individuals with low ALT levels. However, ALT are multi-dimensional, with social and non-social factors essentially independent for instruments such as the Autism-Spectrum Quotient (AQ). Therefore to advance understanding of atypical cognition on the autism spectrum and its likely neural correlates, we isolated contributions of two ALT dimensions.

Objectives: Our aims were to (1) check the independence of the Social Difficulties (SD) and Patterns/Interests/Details (PID) AQ factors; (2) investigate whether facility in embedded figures search and reduced LVF attentional bias can be attributed to elevated SD traits, elevated PID traits, or their combination; and (3) examine the relationship between search performance and LVF bias as potential support for a link to differences in right hemisphere function.

Methods: First, 702 volunteer undergraduate students were screened for SD and PID AQ scores. Next, volunteers were invited for further testing if their scores fell in the upper or lower 30% for each of the SD and PID distributions. This provided a 2 x 2 design (High SD-High PID [n=25]; High SD-Low PID [n=25]; Low SD-High PID [n=26]; Low SD-Low PID [n=25]), with the four groups matched on age and gender. These 101 participants (M_{age} = 20.61 years) then completed the Lueven Embedded Figures Test (L-EFT) and a greyscales task to assess LVF bias.

Results: Across the 702 screened students, SD and PID scores were independent, correlating $r = 0.02$, $p = 0.58$. On the greyscales task, High SD students showed a reduced LVF advantage (M=54.53%; SE=2.98% left responses) compared to Low SD students (M=61.94%; SE=2.16% left responses; $F(1,97)=4.00$, $p<.05$) whereas High and Low PID students did not differ in LVF bias ($p=.53$). Similarly, on L-EFT accuracy, High SD students (M=76.69%; SE=.96%) outperformed Low SD students (M=73.16%; SE=1.41%; $F(1,97)=4.24$, $p<.05$) whereas High and Low PID scorers were close in accuracy ($p=.58$). Finally, there was a trend for superior L-EFT performance to correlate with reduced LVF bias ($r = -0.17$, $p= .097$).

Conclusions: Facility in embedded figures search and reduced left-visual-field bias are characteristics of individuals who report pronounced social difficulties rather than of individuals who report pronounced attention to patterns, special interests or sensory details. The independence of the social and non-social dimensions of autistic traits, and their contrasting patterns of association with visual search and attentional bias, caution against investigating autistic traits as a single spectrum. The superior visual search and reduced attention to the left side of space associated with social difficulties support speculation that each effect reflects reduced involvement of the right hemisphere relative to the left in visuospatial cognition.

Poster Session
165 - Genetics
5:30 PM - 7:00 PM - Hall Grote Zaal

69 **165.069** A Unique Cognitive Profile of ASD Evident in Siblings, Parents, and Grandparents of Individuals with ASD

***M. Losh**[1], L. Bush[2], K. Nayar[3], M. Lee[4], G. E. Martin[5], M. Winston[3], S. Crawford[6], J. Sideris[7], D. Achorn[8], S. Lapham[8], C. Persico[9], J. Ferrie[10] and D. Figlio[4], (1)Communication Sciences and Disorders, Northwestern University, Evanston, IL, (2)Northwestern Feinberg School of Medicine, Chicago, IL, (3)Feinberg School of Medicine, Department of Psychiatry and Behavioral Sciences, Northwestern University, Evanston, IL, (4)Northwestern University, Evanston, IL, (5)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (6)Communication Sciences and Disorders, Northwestern University, Chicago, IL, (7)Frank Porter Graham Child Development Institute, Chapel Hill, NC, (8)American Institutes for Research, Washington, DC, (9)University of Wisconsin-Madison, Madison, WI, (10)Economics, Northwestern University, Evanston, IL*

Background: Genetic liability to autism spectrum disorder (ASD) can be expressed in unaffected relatives through subclinical, genetically meaningful traits, or endophenotypes. Studying endophenotypes in unaffected relatives may help to decompose the complex ASD phenotype into more fundamental component features with clearer ties to underlying biology, which can be used to stratify families into biologically meaningful subgroups. This study makes use of three unique datasets of archival educational data available on siblings, parents, grandparents, and great-grandparents of individuals with ASD, to investigate cognitive profiles that may be related to ASD genetic liability.

Objectives: To explore the role of educational test data across multiple generations of individuals with autism and their family members, this study used archival test records from 1) a large population-based sample of children for whom later autism diagnostic information was available,

2) parents of individuals with and without autism, and 3) grandparents and great-grandparents of individuals with autism.

Methods: Three datasets comprising different archival academic test records were examined. First, individuals with ASD and their siblings were identified from a population-based sample of children attending kindergarten in Florida (n=292,407) who as preschoolers were administered a kindergarten readiness screener, the Dynamic Indicators of Basic Early Literacy Skills Kindergarten Readiness Test (DIBELS), which assesses letter and sound recognition. Academic testing for reading and math was also available at 3rd grade from children with and without ASD (n=1,281,005) from this sample. Childhood educational data from parents of individuals with ASD (n=144) and 75 controls were examined from the Iowa Tests of Basic Skills (ITBS), which assesses math, reading, and language from grades K-12. Childhood educational data from grandparents (n=19) and great-grandparents (n=2) of individuals with ASD was examined with data from Project Talent, a nation-wide study that assessed academic competencies, family background, and personal and educational experiences of high school students in 1960.

Results: Across all three samples and academic tests, a pattern of discordant skills was observed. In preschool age screening data, a discordant pattern of strong letter recognition and weaker sound recognition scores was strongly predictive of ASD (OR=2.74; *p*<.0001) and ASD-sibling status (OR=1.42; *p*<.0001). Later in development, greater discordance between reading and math scores was strongly predictive of ASD status (OR=2.03; *p*<.0001; sibling data will be processed and analyzed). In parents, results again revealed discordance between reading and math scores among ASD parents, where reading scores exceeded math scores. Multinomial regression predicted ASD-parent status with 74% accuracy and specificity of 95%. In grandparents and a small sample of two great-grandparents, 85% of the sample showed better reading vocabulary scores than math (with nearly 3/4 of the sample scoring below the 50th percentile on math). Greater discordance between reading vocabulary and math was associated with ASD endophenotypes in adulthood, with a small to medium effect size (*r*=.27; *p*=.31).

Conclusions: These findings suggest a unique cognitive profile of discordant cognitive skills evident in siblings, parents, and grandparents of individuals with ASD. This profile predicts endophenotypes in adulthood, and may be used to help inform understanding of the pathogenesis of ASD.

70 **165.070** AUT-Priori: A Web-Based Tool for Autism Gene Prioritization

A. J. Griswold[1], *D. Van Booven*[1], *E. R. Martin*[1], *M. L. Cuccaro*[1], *J. P. Hussman*[2] *and M. A. Pericak-Vance*[1], *(1)John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL, (2)Hussman Institute for Autism, Catonsville, MD*

Background: Autism is highly heritable with a complex genetic etiology. Large scale genome and exome sequencing studies have implicated hundreds of genes with a range of genomic variation from common variants of small effects to pathogenic *de novo* coding loss of function variants. However, as the pace of functional genomic analyses in autism increases, such as large scale transcriptomic and epigenomic studies, a new challenge arises of defining which of the many possible candidate genes are truly related to autism but not previously identified with genetic variants. Reducing these sets of genes to a subset for critical follow-up examination can presently be a time-consuming and laborious task.

Objectives: To create a publicly available web-based resource to aide in prioritization of autism biology related genes utilizing tissue, cell specific, and developmental gene expression patterns as well as available genomic data.

Methods: The data underlying this application is populated from existing publicly available resources including adult tissue specific gene expression (GTEx), developmental and spatial time course of brain gene expression (Brainspan and Human Brain Map), and gene expression profiles of single neuronal cell types (scRNA-seq). Furthermore, we have retrieved genomic variation-based priority metrics including probability of intolerance from the Exome Aggregation Consortium and the Gene Scoring metrics from the SFARI Human Gene database. The expression and genomic variation data then feed into a support vector machine (SVM) that requires a background training dataset. By default this background training data is the SFARI VIP gene list, but a custom training set can also be user defined. Based on the output of the SVM, the genes are then prioritized in terms of likely genetic impact based on similarity to previously identified genes. This tool is implemented in an R environment based on the kernlab package (v0.9-25) with a graphical component coded in R Shiny. An alpha release is currently available at https://umiami-hihg-bioinf.shinyapps.io/autism-query-tool/

Results: Implementation of these techniques in a user-friendly environment produces a unique resource for the autism genetics research community. While each of the underlying data repositories are publicly available, AUT-PRIOIRI-GENE offers a synthesis of these in a single location. Furthermore, it is highly customizable as the user is able to enter a list of gene symbols (manually or by file upload), select tissue, region, or gender specificity from data sources where available, and define a training dataset for prioritization. The resulting hierarchical clustering and clustered expression heatmaps, annotation tables, and prioritization scores are all downloadable from the server. While optimization continues, this process takes less than a minute for a gene set of 200 genes.

Conclusions: AUT-PRIORI-GENE provides an easily accessible tool to prioritize a most likely autism-related gene from a user defined list. This is a critical downstream step for those engaging in high-throughput functional genomics studies to aide in unraveling the complex underlying genetics of autism.

71 **165.071** Clinical and Neurophysiological Phenotype of Phelan Mcdermid Syndrome: Communication Disorder or Autism?

L. Ponson[1], *M. Gomot*[2], *R. Blanc*[3,4], *C. Barthelemy*[5], *S. Roux*[6], *A. Munnich*[7], *N. Hernandez*[8], *E. Houy-Durand*[9], *S. Romana*[10], *V. Malan*[10] *and F. Bonnet-Brilhault*[11], *(1)CHRU Tours, Tours, France, (2)UMR 930 Inserm-Universite Francois Rabelais Tours, Tours Cedex 09, France, (3)Université Paris Descartes, Boulogne Billancourt, France, (4)psychology, Université Paris Descartes, Boulogne Billancourt, France, (5)UMR 930 Inserm-Universite Francois Rabelais Tours, Tours, France, (6)Université François-Rabelais de Tours, UMR INSERM U930, Tours, France, (7)Service d'Histologie-Embryologie et Cytogénétique, Université Paris Descartes Paris France, Paris, France, (8)Université François Rabelais de Tours, Tours, France, (9)UMR930 Inserm, Université François-Rabelais de Tours, Tours, France, (10)Université Paris Descartes Paris France, Paris, France, (11)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France*

Background:

The 22q13 deletion syndrome also known as Phelan-McDermid syndrome is a neurodevelopmental disorder characterized by hypotonia, global developmental delay with intellectual disability, severely delayed or absent speech and minor dysmorphia. Behavioral symptoms of Autism spectrum disorder (ASD) are reported for half of patients carrying this deletion of various size and encompassing *SHANK 3* gene. *SHANK3* haploinsuffisancy has been proposed as one of the more common monogenic causes of ASD and used for monogenic mouse models of autism spectrum disorders. However extensive clinical characterization of patients carrying this deletion is lacking whereas it is essential to understand genotype-phenotype correlation and to define an appropriate therapeutic program.

Objectives:

The aim of our study was to better characterize autistic behaviours in PD syndrome and to test whether they are related to atypical information process reported in autism by combining genomic, behavioural dimensional and neurophysiological explorations.

Methods:

Eighteen patients (8 males, mean age 12,7 years SD=9,2) with known 22q13 terminal deletions were fully explored with behavioural, language and cognitive standardized assessments. Neurophysiological indices previously reported to be altered in autism (ie Eye tracking in a social/non-social task, and Mismatch auditory evoked potentials) were also recorded. In parallel with these clinical and neurophysiological investigations carried out in the child psychiatry department of the CHU of Tours, cytogenetic analyses were carried out in the Cytogenetics Department of the Necker Enfants-Malades Hospital in Paris. All participants or the children participants' parents gave written informed consent according to institutional guidelines. The experiment was approved by an ethical committee.

Results:

Autism spectrum disorder clinical features reported by parents through ADI-R (Autism Diagnosis Interview based on the 4-5 years old period) found exceeding cut-off scores in 56% of cases. Using ADOS-2 (Autism Diagnosis Observation Schedule for current period), 50% met ASD clinical criteria exceeding cut-off scores. However only 39% remain positive when both ADOS-2 and ADI-R were required. All the patients had intellectual disability (mild, severe, profound) and language disability. Deletion size was significantly correlated with expressive and receptive language disorder but not with ADI-R nor ADOS or Developmental Quotient scores. Considering neurophysiological recordings, lack of pupil dilation for human faces which is typically described in ASD was not observed in these patients. Atypical shortened latency of Mismatch Negativity response previously reported in ASD was not observed either whereas N250 pattern, related to language, was affected.

Conclusions: The main genotype-phenotype correlation in 22q13 syndrome was related to language disorder. Combined with cognitive deficits this may lead to behavioral autistic symptoms but with different neurophysiological networks compared to typical autism. Our results should have consequences for research on animal models for which it should be verified that they involve the targeted networks. They also recall the need of precise stratification of patients in autism failing which the spectrum obscures the underlying pathophysiology. Finally, these results highlight the indication for early speech therapy rather than intensive autism program to treat patients with Phelan McDermid syndrome.

72 **165.072** Cord-Blood Based Methylome-Wide Association Study of the Social and Communication Disorders Checklist

A. T. Massrali[1]*, H. Brunel*[2]*, S. Baron-Cohen*[3] *and V. Warrier*[2]*, (1)Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (2)University of Cambridge, Cambridge, United Kingdom, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Differentially methylated CpGs (DMCs) have been reported in both cortical tissues and in the blood in autistic individuals compared to non-autistic individuals. However, it is unclear if methylation of CpGs in cord blood is associated with scores on the Social and Communication Disorders Checklist (SCDC) – a measure that is phenotypically and genetically correlated with autism.

Objectives: We sought to investigate if: 1. There are significant DMCs that are associated with scores on the SCDC; 2. The SCDC methylome-wide association study (MWAS) is enriched for specific pathways, DMCs identified in the autism post-mortem cortical tissues, and transcriptionally dysregulated genes in the autism post-mortem cortex.

Methods: We conducted a MWAS on parent-reported SCDC scores in 701 8-year-olds from the Avon Longitudinal Study of Parents and Children. Enrichment analyses were conducted using modified hypergeometric tests and two-sided Kolmogorov-Smirnov Tests.

Results: MWAS did not identify any significant CpGs at a significant threshold < $5x10^{-8}$. However, after FDR correction, nominally significant CpG sites ($P < 0.05$) were enriched in 24 GO processes including neuronal projection and neuron part. Significant DMCs identified in the post-mortem anterior cingulate cortex in autism showed a significant tendency towards low P-values in the SCDC MWAS ($P = 7.7x10^{-9}$, two-sided Kolmogorov-Smirnov test). Nominally significant DMCs were replicably enriched for transcriptionally dysregulated genes in the autism post-mortem cortex in two independent samples.

Conclusions: Pathway specific enrichment identify several interesting pathways and propose an involvement of methylation signatures on neuronal pathways. The enrichment of transcriptionally dysregulated autism genes and DMCs in the post-mortem brain suggest an overlap in biological signatures between SCDC and autism.

73 **165.073** Distinct Sources of Genetic Risk for Autism from Social and Non-Social Domains

V. Warrier[1]*, N. The 23andMe Research Team*[2]*, N. iPSYCH-BROAD ASD Group*[3]*, T. Bourgeron*[4] *and S. Baron-Cohen*[5]*, (1)University of Cambridge, Cambridge, United Kingdom, (2)23andMe Inc, Mountainview, CA, (3)Aarhus University, Aarhus, Denmark, (4)University Denis Diderot Paris 7, Paris, France, (5)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Common genetic variation contributes to a substantial proportion of the variation in autism liability. There is considerable phenotypic and genetic heterogeneity within the autism spectrum. It is unclear how common genetic variation in social and non-social domains in the autism spectrum contribute to the liability in the condition.

Objectives: To investigate the genetic architectures of social traits (self-reported empathy, cognitive empathy, social and communication difficulties, and social relationship satisfaction) and non-social traits (systemizing) related to autism in large cohorts and map their contribution to autism liability.

Methods: We investigated the contribution of social and non-social traits for autism using GWAS for multiple traits (5000 > N > 140000) in three cohorts: ALSPAC, 23andMe, and the UK Biobank. Self-reported empathy was measured using the Empathy Quotient (EQ), cognitive empathy was measured using the Reading the Mind in the Eyes Test, Social and Communication Difficulties was measured using the Social and Communication Disorders Checklist, Social Relationship Satisfaction using two brief questionnaires: family relationship satisfaction and friendship satisfaction, and Systemizing was measured using the Systemizing Quotient-Revised (SQ-R).

Results: Using GWAS autism data from the iPSYCH consortium and the PGC, we identified a positive genetic correlation between autism and higher systemizing, lower social relationship satisfaction, and lower self-reported empathy. However, there is no genetic correlation between systemizing and the social traits i.e. social relationship satisfaction, self-reported empathy, and social and communication disorders. We further demonstrate that social autistic traits are positively genetically correlated with each other. Both social and non-social traits are genetically correlated with measures of intelligence, with significant negative genetic correlations between social traits and measures of intelligence and significant positive genetic correlations between systemizing and measures of intelligence. Finally, we demonstrate that the positive genetic correlation between systemizing and autism is independent of the genetic correlation with measures of intelligence.

Conclusions: Our results suggest that there are at least two independent sources of genetic liability for autism stemming from social and non-social traits. This is the first empirical evidence of distinct pathways to autism liability from common genetic variants.

74 **165.074** Epigenetic Alterations in Childhood Reflect Prenatal Exposure to Maternal Infection

M. Brucato[1]*, S. Andrews*[2]*, Y. Qian*[3]*, G. C. Windham*[4]*, D. Schendel*[5]*, L. Schieve*[6]*, C. J. Newschaffer*[7]*, A. P. Feinberg*[8]*, L. A. Croen*[3]*, M. D. Fallin*[9] *and C. Ladd-Acosta*[10]*, (1)Internal Medicine/Pediatrics, Johns Hopkins University School of Medicine, Baltimore, MD, (2)Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Division of Research, Kaiser Permanente, Oakland, CA, (4)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (5)Public Health, Aarhus University, Aarhus, Denmark, (6)Centers for Disease Control and Prevention, Atlanta, GA, (7)AJ Drexel Autism Institute, Philadelphia, PA, (8)Johns Hopkins University, Baltimore, MD, (9)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (10)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD*

Background: Prenatal exposure to maternal immune activation (MIA), particularly infections and fever, has been linked with altered neurodevelopment in the offspring, yet we have a limited understanding of causal mechanisms.
Objectives: We sought to explore the potential biological consequences of prenatal exposure to maternal infections.

Methods: We examined 929 children, aged 2-5 years, in the Study to Explore Early Development, phase I (SEED I) with both genome-scale whole blood DNA methylation data, from the Illumina 450K array, and *in utero* infection exposure data, ascertained via structured maternal phone interview. We used linear models, adjusted for cell type composition, sex, ancestry, and other unwanted variation via estimated surrogate variables, to identify differentially methylated loci associated with prenatal exposure to any infection, at any time in pregnancy or during a specific trimester.

Results: We found one site in an intergenic region on chromosome 5 that was significantly (q-value = 0.005) hypomethylated in children whose mothers had an infection during the preconception period. We also identified 2 genomic loci, within the *IQSEC1* and *EPS8L3* genes, showing significant decreases in DNA methylation (q-value=0.014 for *IQSEC1* and q-value = 0.036 for *EPS8L3*) among children whose mother had an infection during her third trimester. The differences in percent methylation increased in magnitude when comparing children whose mothers reported infections in every trimester of pregnancy (n=56) to those whose mothers reported no infections during pregnancy (n=589). This may reflect a dose-response relationship between a cumulative prenatal infection exposure and methylation at the identified sites. Although we detected these differences in blood, reference datasets indicate that methylation at the intergenic locus on chromosome 5 is strongly correlated across blood and brain. This site is also predicted to be near an enhancer-like region in human astrocytes. *IQSEC1* is thought to be involved in synaptic transmission, as both a scaffolding and signaling protein. It is highly expressed in brain tissues, particularly the frontal cortex, as well as whole blood. *EPS8LS* is not well studied but is likely involved in actin regulation, which is important in neuronal structures like the postsynaptic density and dendritic spine.

Conclusions: Our findings suggest that epigenetic changes related to prenatal infection exposure can present in childhood samples, and can provide candidate loci for studies examining potential epigenetic mediation of prenatal MIA exposure and atypical neurodevelopment.

75 **165.075** Evidence for Widespread Associations between Broadly Expressed Genes in Blood Leukocytes and Neural Systems Response to Speech in Autism

M. V. Lombardo[1]*, T. Pramparo*[2]*, V. Gazestani*[2]*, L. Eyler*[2]*, K. Pierce*[2] *and E. Courchesne*[3]*, (1)University of Cyprus, Nicosia, Cyprus, (2)Univeristy of California, San Diego, La Jolla, CA, (3)Neurosciences, Univeristy of California, San Diego, La Jolla, CA*

Background: It has recently been suggested that complex phenotypes (e.g., ASD) may be understood through an omnigenic model, whereby a vast majority of genes may have some non-zero effect on the phenotype (Boyle, Li, & Pritchard, 2017, *Cell*). Genes broadly expressed across many tissues including the brain are numerous and may contribute significantly to the phenotype. This idea suggests broadly expressed genes measured in-vivo in non-brain tissue (e.g., blood) could be relevant for explaining variability in ASD neural phenotypes.
Objectives: To examine how widespread variation in the blood leukocyte transcriptome is associated with in-vivo neural systems response to speech in ASD subtypes and typical development. The omnigenic model predicts that association signals would be widespread across most of the transcriptome and that co-expression modules highly enriched in broadly expressed genes would harbor most of the ASD-relevant association signal.

Methods: Three age-matched groups of toddlers (mean age ~29 months) were investigated - two ASD subtypes classified as either good (n=40) or poor language outcome (n=41) (Lombardo et al., 2015, *Neuron)*, and n=37 typically developing toddlers. Neural systems response to speech was measured using fMRI during natural sleep using a story-language paradigm identical to prior work (Lombardo et al., 2015, *Neuron*). RNA was measured on all individuals using Illumina microarray chips as described in previous work (Pramparo et al., 2015, *JAMA Psychiatry*). Weighted gene co-expression network analysis (WGCNA) was used as feature reduction step. Partial least squares (PLS) analysis was used to reveal large-scale gene expression-fMRI associations. Association signal across modules was then tested for enrichment with tissue-specific or broadly expressed gene lists directly taken from Boyle et al.'s analysis of GTEx data.

Results: Only one latent variable gene expression-fMRI pair showed a statistically significant association between module eigengene variation and neural systems response to speech (LV1: d = 83.58, p = 9.99e-5). LV1 accounts for 20.7% of the covariance between gene expression and fMRI data and is spatially constrained to primarily prefrontal and temporal cortex. Reliable non-zero association signal in at least one group was present in 64% of modules (20/31) comprising 74% of all genes investigated. Of these 20 modules, 65% (13/20) were highly enriched for broadly expressed genes (OR = 57.57, p = 0.002). Of the 13 modules where a non-zero association was present in an ASD language outcome subtype, 84% (11/13) were highly enriched in broadly expressed genes (OR = 53.16, p = 0.0001). Other tissue-specific gene lists (e.g., brain, blood, lymphocyte) were not heavily enriched in many modules or over-represented within modules containing non-zero effects.

Conclusions: Rather than finding little to no association between blood leukocyte transcriptomic signal and neural phenotypes for ASD, this work demonstrates that widespread signals in the blood leukocyte transcriptome, particularly within genes broadly expressed across many tissues including the brain, are relevant to ongoing early pathophysiology at the neural systems level in living ASD toddlers. These insights suggest much translational research potential for in-vivo monitoring of such pathophysiology in clinically important contexts (e.g., treatment) in living patients with ASD.

76 **165.076** FMR1 mRNA in Blood As a Predictor of Intellectual Functioning and Autism Severity in Fragile X Syndrome: Is There a Difference between Sexes?

***E. K. Baker**[1], M. Arpone[2], S. Aliaga[2], L. Bretherton[1], M. Bui[3], C. Kraan[1], A. Alliende[4], V. Faundes[5], L. Santa Maria[5], C. Rogers[6], M. Field[7], D. Amor[8] and D. E. Godler[9], (1)Murdoch Children's Research Institute, Melbourne, Australia, (2)University of Melbourne, Melbourne, Australia, (3)Centre for Epidemiology and Biostatistics, University of Melbourne, Melbourne, Australia, (4)Molecular and Cytogenetics Laboratory, INTA University of Chile, Santiago, Chile, (5)Institute of Nutrition and Food Technology (INTA), University of Chile, Santiago, Chile, (6)Hunter Genetics, GOLD Service, Newcastle, Australia, (7)Hunter Genetics, Newcastle, Australia, (8)Victorian Clinical Genetics Service, Melbourne, Australia, (9)Genetics, Murdoch Children's Research Institute, Melbourne, Australia*

Background: Fragile X Syndrome (FXS) is a common single gene cause of intellectual disability and co-morbid autism spectrum disorder (ASD). FXS is caused by a large trinucleotide CGG expansion (>200 repeats), termed full mutation (FM), within the *FMR1* gene located on the X chromosome. FM alleles are associated with epigenetic changes that result in decreased production of *FMR1* mRNA and loss of the FMR1 protein FMRP, which is essential for normal neurodevelopment. While males with FXS typically present with a more severe phenotype compared to females, the molecular mechanisms that underlie differences in cognitive functioning and severity of ASD presentation in both sexes have not been defined.

Objectives: This study aimed to characterise gender differences in the relationships between levels of *FMR1* mRNA in blood and FXS phenotypes, including symptoms of ASD and intellectual functioning in males and females with FXS.

Methods: This study used a large international FXS cohort recruited through genetic testing centres and family support organisations in Australia and Chile. 128 individuals (28.1% female) with FXS aged between 1 and 43 years participated in the study. The Autism Diagnostic Observation Schedule-2nd Edition (ADOS-2) was used to assess symptoms associated with ASD while intellectual functioning (Verbal IQ [VIQ], Performance IQ [PIQ] and Full Scale IQ [FSIQ]) was assessed with the Mullen Scales of Early Learning for those < 3 years, and an age appropriate Wechsler scale for those aged ≥ 3 years. *FMR1* mRNA was analysed using the real-time PCR relative standard curve method in blood samples collected at the time of assessment.

Results: FXS females performed better than males on all cognitive domains ($p < .001$; Table 1). Similarly, only 16 (45.7%) FXS females met the cut-off for ASD on the ADOS-2 compared to 77 (82.8%) males ($p < 0.001$). Genotype-phenotype analyses showed that *FMR1* mRNA levels in blood were strongly associated with FSIQ ($p = 8.1\times10^{-11}$; $n = 41$), VIQ ($p = .0002$; $n = 50$) and PIQ ($p = 9.8\times10^{-9}$; $n = 50$) in males, but not in females (FSIQ: $p = .394$, $n = 24$; VIQ: $p = .170$; $n = 25$; PIQ: $p = .438$; $n = 25$). In contrast, *FMR1* mRNA levels were strongly correlated with total ($r_s = -.651$, $p = .001$), Social Affect (SA; $r = -.565$, $p = .008$) and Repetitive and Restricted Behaviours (RRB; $r_s = -.633$, $p = .002$) Calibrated Severity Scores in females, but not males (Total: $r_s = -.081$, $p = .537$; SA: $r_s = -.175$, $p = .178$; RRB: $r_s = -.002$, $p = .987$.

Conclusions: This study shows that *FMR1* mRNA levels in blood are associated with symptoms of ASD in females with FXS, but not with intellectual functioning. In contrast, in males with FXS *FMR1* mRNA levels in blood are associated with intellectual functioning, but not symptoms of ASD. This dissociation by gender in the relationships between *FMR1* expression with type and severity of cognitive and behavioural phenotypes (e.g., intellectual deficits versus ASD symptoms) warrants further study.

77 **165.077** Genetic Investigation of Insistence on Sameness in Autism

***M. L. Cuccaro**, S. Luzi, E. R. Martin, A. J. Griswold, D. Dykxhoorn, H. N. Cukier and M. A. Pericak-Vance, John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL*

Background: Restricted and repetitive behaviors (RRBs), in conjunction with social and communication problems, are defining features of the neurodevelopmental conditions that comprise the autism spectrum. The RRBs are generally grouped into two subdomains: insistence on sameness (IS) and repetitive sensory motor behaviors (RSMB). IS is the more robust of the domains and appears to be independent of developmental level, reducing potential overlap with intellectual disability phenotype. To date, there has been limited study of the genetic basis for the IS trait.

Objectives: For this study, we propose to test for genetic association with IS in a large sample of individuals with autism for whom we have targeted sequence data. We hypothesize that multiple genetic variants will be associated with the IS score.

Methods: Using Autism Diagnostic Interview-Revised (ADI-R) items, we calculated IS scores for our dataset of 1931 participants from the Hussman Institute for Human Genomics and Simons Simplex Collection. The items making up the IS trait include *difficulties with minor changes, resistance to trivial changes, abnormal response to sensory stimuli, circumscribed interests, compulsions/rituals, sensitivity to noise*. All individuals were sequenced with a 17Mb custom capture covering 681 genes within regions identified by GWAS of ASD. We conducted the SKAT-O gene-based test and single variant tests using IS scores as continuous outcomes. A Bonferroni correction for the number of genes tested was used as a significance threshold.

Results: For the gene-based test our top four results were: ATXN1, ARHGAP40, BICD1 and GCOM1 with p-values of 5.6E-03, 5.8E-03, 6.2E-03 and 7E-03, respectively. When only missense variants were analyzed, the top three genes were PANK1, TIMM22 and ZNF397with p-values of 1E-02, 1.2E-02 and 1.3E-02 respectively. ATXN1 is located on the short arm of chromosome 6, it is a protein coding gene and is associated with spinocerebellar ataxia type 1 (SCA 1). ZNF397 is located on the long arm of chromosome 18 and is part of the zing finger family. This gene is well established for its role in and has shown prior association with ASD. Overall, we identified 32 genes with p-values of less than 0.05.

Conclusions: We did not find genome-wide association to the IS trait in our dataset. Our top nominally significant results suggest a possible role of several genes in the modification of the IS trait in individuals with ASD but need further investigation. We propose that the current findings serve as a first step in dissecting the genetic basis of the IS trait in ASD. Within this group of individuals there is still substantial phenotypic heterogeneity which hinders our ability to detect association. With respect to the current results, we would propose follow up studies that focus on the sequence of the reported genes and surrounding areas. More generally, our results suggest the value of identifying genes associated with phenotypic traits that are a part of ASD as an alternative to using the broader ASD diagnostic phenotype.

78 **165.078** Genetic, Molecular, and Phentoypic Characterization of the Autism-Associated FOXP1 Syndrome

J. Buxbaum[1]*, S. De Rubeis*[2]*, M. P. Trelles*[3]*, R. Lozano*[4]*, A. Kolevzon*[3]*, E. Drapeau*[2]*, P. M. Siper*[3]*, A. R. Durkin*[5]*, D. Di Marino*[6] *and Y. Frank*[4]*, (1)Department of Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (2)Seaver Autism Center for Research and Treatment, Icahn School of Medicine at Mount Sinai, New York, NY, (3)Seaver Autism Center, Department of Psychiatry, Icahn School of Medicine at Mount Sinai Hospital, New York, NY, (4)Icahn School of Medicine at Mount Sinai, New York, NY, (5)Psychiatry, Icahn School of Medicine at Mount Sinai, New York, NY, (6)Università della Svizzera Italiana, Lugano, Switzerland*

Background:

Haploinsufficiency of the forkhead-box protein P1 (*FOXP1*) gene leads to a neurodevelopmental disorder termed FOXP1 syndrome. Previous studies in individuals carrying *FOXP1* mutations and deletions have described the presence of autism spectrum disorder (ASD) traits, intellectual disability, language impairment, and psychiatric features.

Objectives:

The goal of the present study is to comprehensively and prospectively characterize the genetic and clinical spectrum of FOXP1 syndrome. In addition, gene expression studies of induced neurons (iNeurons) from patients and sibling controls are being characterized for gene expression and cellular changes.

Methods:

As of today, genetic and clinical data has been obtained and analyzed from 5 children and adolescents with mutations in *FOXP1* and 1 child with a duplication in the gene. Blood samples suitable for reprogramming into induced pluripotent stem cells (iPSC) were collected for 5 children and their unaffected siblings. Phenotypic characterization included gold standard ASD testing and norm-referenced measures of cognition, adaptive behavior, language, motor, and visual-motor integration skills. In addition, psychiatric, medical, neurological, and dysmorphology examinations were completed by a multidisciplinary team of clinicians. A comprehensive review of reported cases was also performed. All missense and in-frame mutations were mapped onto the three-dimensional structure of DNA-bound FOXP1.

Results:

We have identified 5 de novo mutations and 1 gene duplication. Reviewing prior literature, we found seven instances of recurrent mutations and another 34 private mutations. The majority of pathogenic missense and in-frame mutations, including all four missense mutations in our cohort, lie in the DNA-binding domain. Through structural analyses, we show that the mutations perturb amino acids necessary for binding to the DNA or interfere with the domain swapping that mediates FOXP1 dimerization. Individuals with FOXP1 syndrome presented with delays in early motor and language milestones, language impairment (expressive language > receptive language), ASD symptoms, visual-motor integration deficits, and complex psychiatric presentations characterized by anxiety, obsessive-compulsive traits, attention deficits, and externalizing symptoms. Medical features included non-specific structural brain abnormalities and dysmorphic features, endocrine and gastrointestinal problems, sleep disturbances, and sinopulmonary infections. Blood samples were reprogrammed into iPSC for 10 samples (5 cases and 5 unaffected siblings). iNeurons are being produced and characterized.

Conclusions:

This study identifies novel *FOXP1* mutations associated with FOXP1 syndrome, identifies recurrent mutations, and demonstrates significant clustering of missense mutations in the DNA-binding domain. Clinical findings confirm the role *FOXP1* plays in ASD and in development across multiple domains of functioning. As the in vitro studies progress, we will learn more about the pathobiology of this autism-associated syndrome.

79 **165.079** High-Resolution View of Genetic Architecture Underlying Autism

E. Larsen*, W. Pereanu and S. Banerjee-Basu, MindSpec Inc., McLean, VA*

Background: Over the last decade, several large-scale collaborative research initiatives have investigated genetic variations underlying ASD using genome-wide methodologies in well-defined cohorts. A complex genetic landscape has emerged with hundreds of genes and thousands of variants implicated in ASD revealing extreme heterogeneity.

Objectives: A central goal in autism research is to identify the core set of highly penetrant, causative ASD genes among the growing list of genes associated with the disorder. Towards this, we have conducted systematic assessment of a large set of genes curated in the autism genetic database (AutDB) to generate a ranked list of candidate genes.

Methods: Using a revised gene-scoring algorithm that relies on evaluation of individual variants (Larsen et al., 2016), we have analyzed a total of 11,287 variants in 921 genes associated with ASD that were annotated from 1383 research articles (AutDB data freeze of June 2017). Our assessment criteria included significance of genetic association, family structure (simplex, multiplex, multi-generational, or consanguineous), zygosity (heterozygous, homozygous, or hemizygous), inheritance pattern (de novo or transmitted), the type of variant (missense, nonsense, etc.), and the functional effect of the variant.

Results:

Here, we present the evidence score and categorization of all ASD-linked genes catalogued in AutDB. The level of evidence in terms of number and type of genetic variants are broadly distributed in this dataset delineating distinct categories of ASD genes. Importantly, we report the identification of a set of 21 ASD genes that occupies more than two standard deviations (SDs) above the mean score of genes analyzed in this study. Using integrated bioinformatics analyses we further characterize the top ranking ASD gene set for their convergent biological function. We show that mouse prenatal and postnatal lethality genes were found to be enriched in this top-ranking ASD gene set (hypergeometric distribution test; $p=3.0 \times 10^{-5}$ and $p=2.0 \times 10^{-8}$ respectively) replicating an earlier finding of involvement of essential genes in ASD.

Conclusions: The evidence-based classification of ASD genes presented here is anticipated to help interpret newly identified genes and variations in ASD individuals.

80 **165.080** Identification of Autism Spectrum Disorder with Salivary RNA

S. D. Hicks[1]*, M. Chroneos*[2]*, K. Wagner*[3]*, C. Tierney-Aves*[4] *and F. A. Middleton*[3]*, (1)Penn State Milton S. Hershey Medical Center, Penn State College of Medicine, Hershey, PA, (2)Penn State College of Medicine, Hershey, PA, (3)SUNY Upstate Medical University, Syracuse, NY, (4)Penn State Hershey Medical Center, Hershey, PA*

Background: Autism spectrum disorder (ASD) diagnoses rely heavily on parent-report measures and behavioral observations that lack specificity and can be influenced by situational variables. The identification of objective, accurate disease markers could improve clinicians' ability to diagnose and manage autism symptoms. Recent studies have demonstrated that epi-transcriptomic factors, including microRNA and other small RNAs, are altered in autism. Translation of these findings into clinical tools has been limited, in-part, by small sample sizes and older participants.
Objectives: This study characterized the oral micro-transcriptome of 179 children with autism spectrum disorder (ages 2-6 years) and 106 age-matched controls with typical development, to establish a panel of small RNAs with screening potential in autism spectrum disorder.

Methods: A prospective case-control design compared salivary RNA profiles of ASD (n=179) and TD (n=106) participants. ASD status was established by physician DSM-5 diagnosis and autistic traits were quantified with the Autism Diagnostic Observation Schedule, Second Edition. TD status was confirmed by physician assessment at a regularly scheduled well child visit. Adaptive behaviors were assessed in all participants with the Vineland Adaptive Behavior Scales, Second Edition. Salivary RNA was obtained in a non-fasting state with P157 swabs (DNA Genotek, Ottawa Canada) following oral tap-water rinse. RNA was quantified with high throughput sequencing on a NextSeq 500 Instrument (Illumina, San Diego, California). Human RNA reads were aligned in Partek flow using Refseq Transcripts v82 and miRBase v21 with the Shrimp2 algorithm. Microbial RNA was aligned to the human microbiome database using K-SLAM. RNA entities with read counts ≥10 in ≥10% of samples were interrogated for differential expression with Mann-Whitney U-test and RNA profiles were visualized with a partial least squares discriminant analysis (PLSDA). Thirty-five factors most crucial to PLSDA vector projection were used to construct a logistic regression model in the first half of samples (ASD=89, TD=53). This model was then tested in the remaining half of naïve "hold-out" samples (ASD=90, TD=53).

Results: Among the 285 samples, 1343 RNA factors were explored: 337 microRNAs, 85 small nucleolar RNAs, 170 mRNAs, and 751 microbial taxons. Seven RNA factors displayed significant differences between ASD and TD groups (FC>1.5; FDR<0.1). A PLSDA employing all 1343 RNA factors and 11 medical/demographic characteristics distinguished ASD and TD in two-dimensions while accounting for 7.5% of the variance in the dataset (Figure 1). The 35 factors with the highest variable importance in projection scores on PLSDA were used to create a logistic regression model of ASD status. This model included 14 microRNAs, 4 mRNAs, 13 microbial RNAs, and 1 small nucleolar RNA, while controlling for sex, disordered sleep, and gastrointestinal disturbance. It demonstrated an area under the curve (AUC) of 0.830 (95% CI: 0.733-0.913) in the training set and an AUC of 0.895 in the hold-out set on receiver operator characteristics curve (Figure 2).

Conclusions: Salivary RNA profiles represent a non-invasive, objective, and accurate source of biomarkers that may aid in ASD screening or diagnosis.

81 **165.081** Inherited and Multiple De Novo Mutations in Autism Risk Genes Suggests a Multifactorial Model

H. Guo[1,2]*, T. Wang*[2]*, H. Wu*[1]*, M. Long*[1]*, B. P. Coe*[2]*, R. Bernier*[3]*, E. E. Eichler*[2] *and K. Xia*[1]*, (1)Central South University, CHANGSHA, China, (2)Department of Genome Science, University of Washington, Seattle, WA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA*

Background: Large-scale, genome-wide and targeted sequencing analyses are dramatically accelerating the discovery of candidate genes associated with autism spectrum disorders (ASD), establishing dozens of novel high-risk genes. Despite these advances, only a small fraction of the genetic risk has been defined, the penetrance of most mutated genes is unknown, and genotype–phenotype correlations are only beginning to be understood.
Objectives: To better understand the genetic architecture, penetrance, and genotype–phenotype relationships of ASD mutations.

Methods: We targeted 188 autism candidate genes for sequencing in 2,926 families from the Autism Clinical and Genetic Resources in China (ACGC) cohort using a modified molecular inversion probe (MIP) method, which enables ultra-low-cost candidate gene resequencing in very large cohorts.

Results: We validated recurrent *de novo* likely gene-disruptive (LGD) mutations in 13 genes and identified three potential novel risk genes (*ZNF292*, *GRIA2* and RALGAPB) as well as genes associated with macrocephaly (*GIGYF2* and *WDFY3*). During this analysis, we identified transmission of private gene-disruptive mutations in genes predominantly associated with *de novo* mutations (DNMs) (e.g., *CHD8* and *KMT5B*) and showed that clinical reevaluation of carrier parents revealed mild neurodevelopmental or related endophenotypes. We also identified families with DNMs in two or more candidate genes. Combining available exome sequence data, we identified 10 such "double-hit" families involving well-known autism risk genes (*SCN2A*, *CHD8*, etc.). We show that such oligogenic cases occur more frequently in probands associated with more severe phenotypes, including social impairments and seizure burden.

Conclusions: Our data suggest a multifactorial model of multiple high-impact mutations in some ASD patients indicating that monogenic models may be too simplistic. Disease risk of genes associated with DNMs requires a much more comprehensive understanding of the full spectrum of mutation as well as patient follow-up in larger number of affected families in order to accurately determine penetrance and the role of additional rare mutations in different genes in modifying the ASD phenotype.

82 **165.082** Linkage Analysis and Fine-Mapping in Autism Pedigrees Confirms and Refines Regions on Chromosomes 7 and 12

E. R. Martin*, S. Luzi, L. Gomez, P. Whitehead, J. Jaworski, A. J. Griswold, M. L. Cuccaro and M. A. Pericak-Vance, John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL*

Background: Autism is highly heritable with complex genetic architecture. While genetic studies to date have identified more than 100 candidate genes, they have failed to explain all of the underlying genetic risk. Recent studies have been association studies or rare-variant studies looking

for de novo variants in small families. These studies do not take advantage of the information that can be gained in linkage analysis of multiplex families. Previous linkage studies, while suggestive, failed to firmly establish linkage regions. Furthermore, recent advances in genotyping technology and growing reference panels from sequencing studies now allow for high-quality imputation of dense genotype data, which should improve our ability to identify linkage and fine-map autism genes using association.
Objectives: We hypothesize that using dense imputation in our sample of large of well-characterized multiplex families with autism, linkage analysis will be a powerful tool to identify genomic risk loci for autism.

Methods: We have ascertained 250 families of European ancestry: 165 families with sibling pairs and 85 with more distant relative pairs. Individuals were genotyped on either the Illumina HumanHap550 or Illumina Human1M genome-wide genotyping platforms. GWAS data were imputed from Haplotype Reference Consortium (HRC version r1.1) panel within the Michigan Imputation Server. Non-parametric multipoint linkage analysis was performed using the MERLIN software, followed by data cleaning (Merlin and Pedwipe), LD pruning (r2=0.16), and manual inspection for potential double recombinants using the Progeny software. Family-based SKAT (famSKAT) was used to test for significantly associated genes within the significant linkage regions.

Results: Non-parametric multipoint analysis identified two regions of significant linkage. The first was chromosome 7q11.23-21.11 (LOD=5.8). This linkage region spans 3Mb with ~40 genes including HSPB1, a gene that responds to environmental stress by translocating proteins, and the YWHAG gene, which is highly conserved and mainly expressed in the brain. The second region of linkage was chromosome 12q14 (LOD=4.5) spanning a 2Mb and 26 genes, including GRIP1, which is important for the function of synapses and previously reported associated with autism. FamSKAT analyses confirmed that several genes within both chromosome 7 and 12 are associated with risk of autism in our families. Both of these regions had been implicated previously as harboring autism risk genes.

Conclusions: We demonstrate the power of linkage analysis with imputed GWAS data in large pedigrees. Our results confirm previously suggestive linkage on chromosomes 12 and 7 with several potential candidate genes confirmed by association studies. Of particular interest is the GRIP1 gene on chromosome 12, previously implicated in autism, and the 7q11.23 region that is deleted in William syndrome and includes several autism candidate genes. The findings of several genes associated with autism, suggests a potential role of rare regulatory and non-regulatory variants accounting for the linkage signal within these regions.

83 **165.083** microRNAs and Gene-Environment Interactions in Autism: Prenatal Maternal Stress and the SERT Gene

D. Q. Beversdorf[1], *A. Shah*[2], *J. Noel-MacDonnell*[3], *P. Hecht*[4], *B. J. Ferguson*[5] *and Z. Talebizadeh*[2], *(1)University of Missouri, Columbia, Columbia, MO, (2)Children's Mercy Hospital, Kansas City, MO, (3)Children's Mercy Hospital and University of Missouri-Kansas City School of Medicine, Kansas City, MO, (4)University of Southern California, Los Angeles, CA, (5)Radiology & Thompson Center for Autism & Neurodevelopmental Disorders, University of Missouri, Columbia, MO*

Background: Both genetic and environmental factors may play critical roles in autism. However, there is less understanding of the potential environmental factors or gene X environment interactions (GxE). Recent evidence suggests that maternal stress exposure may be important in autism. By surveying for history and timing of prenatal psychosocial stressors, we found autism mothers to have a higher overall incidence of stressors as compared to the other groups, which was subsequently confirmed by larger epidemiological studies. In all of these studies, though, a significant proportion of stress-exposed mothers had unaffected children. To explain why prenatal stressors might result in autism in some cases but not others, we began to explore GxE. The serotonin transporter (SERT) gene is well studied for its role in stress reactivity. The most widely studied variation is an insertion/deletion within the promoter region, resulting in long (L) or short (S) alleles. The S-allele has been linked to autism in some but not all studies. These contradictory findings could, in part, be explained by the presence of a gene/stress interaction. We have subsequently demonstrated in two independent samples that the association between maternal stress exposure and autism is greatest with maternal presence of the S-allele. There is emerging evidence that microRNAs may play a regulatory role in the serotonergic pathway and in prenatal stress.
Objectives: To examine the microRNA profile in this GxE setting in maternal blood samples.

Methods: In the present study, we explored the role of epigenetic factors by profiling microRNA expression in blood samples (n=34) from mothers of children with autism, with known pregnancy stress history. The samples were divided into 5 groups based on SERT genotypes (LL, LS, and SS) and prenatal stress level (High and Low).

Results: Among the 2500 mature microRNAs examined, 5-way ANOVA showed significantly differential expression (DE) of 119 microRNAs, 90 (76%) of which showed a similar pattern of expression in High vs Low stress groups (i.e., stress-dependent microRNAs). Intriguingly, two of them, miR-1224-5p and miR-331-3p, were recently reported by our group to exhibit stress-dependent expression in rodent brain samples from embryos exposed to prenatal stress. Another stress-dependent microRNA found in our study, miR-145-5p, has been reported in association with maternal stress. To assess the role of SERT genotype, we conducted a 3-way ANOVA on three SERT genotype groups exposed to a high level of prenatal stress. This analysis showed a smaller number of significantly DE microRNAs (n=20), 5 (25%) of which were among the stress-dependent DE microRNAs. These 5 microRNAs may be candidates for stress X SERT genotype interactions. One of them, miR-663a, has been previously reported to be DE in response to the serotonin-specific reuptake inhibitor, fluoxetine. These findings are remarkable as these changes were detected in samples from mothers several years after stress-exposed pregnancies. Persistent microRNA changes have been observed previously in other conditions, such as after cessation of smoking.

Conclusions: Our study provides evidence for epigenetic alterations in relation to a promising GxE model (prenatal maternal stress X the SERT gene) in autism.

84 **165.084** Modifiers of Severity in Autism Spectrum Disorder

S. P. Smieszek, *R. Igo and J. Haines, Population and Quantitative Health Sciences, Case Western Reserve University, Cleveland, OH*

Background:
Autism Spectrum Disorder (ASD) comprises a complex of neurodevelopmental disorders primarily characterized by deficits in verbal communication, impaired social interaction and repetitive behaviors. The genetic architecture has proved to be complex and encompasses profound clinical heterogeneity, which poses challenges in understanding its pathophysiology.

Objectives:

There is accumulating evidence that ASD is caused by rare inherited or spontaneous genetic mutations, such as copy number changes and single nucleotide alterations. However, the genetic causes that have currently been found only in s small proportion of cases. We conducted a large scale association analysis of the MSSNG whole genome sequencing data to elucidate potential modifiers of ASD severity.

Methods:

Using the additive linear model method (PLINK) we have directly tested association between 6,198,166 SNPs (Quality Control: MAF > 0.05, HWE $P < 1 \times 10^{-6}$, Mendelian errors, removal of samples with dis-concordant sex status, twins, samples with unreported relatedness) and Vineland Adaptive Behavior Scale Scores.

Results:

Interestingly, the top variants direct us to a region (part of the biggest META-significant haplostretch of SNPs, n=132) containing multiple variants on chromosome 3 including a highly interesting nonsynonymous SNV rs11539148 within *QARS* (NM_001272073:c.A821G:p.N274S MAF=0.0391). Furthermore, to leverage the size of the data we conducted a pathway enrichment analysis of the set of highly significant results ($P < 1 \times 10^{-6}$) using PARIS and DAVID software. The most significant categories included brain development and structural component of myelin sheath pathways. Genes categorized a neurological, developmental and immune related constituted 65% of all the genes contributing in these pathways. We took variants from contributing genes from significantly over-represented categories to test how much variability in the VABS scores can be explained by the variants. The cumulative effect of the single top pathway enrichment alone on affection status is 2% ($P = 6.34 \times 10^{-6}$). Furthermore we inspected eQTLs for the region and reassuringly we detected lower expression across multiple data-sets, a result consistent with our hypothesis.

Conclusions:

We detect a region that may be a hallmark of severity in ASD. As genetic predisposition may be different for almost every ASD individual, understanding the common mechanisms for endo-phenotypes may help elucidate ASD causal mechanisms.

85 **165.085** Monogenic Disorders Associated with ASD in a Large Portuguese Sample

F. Duque[1,2,3]*, J. Rosmaninho-Salgado*[4]*, C. Café*[1]*, S. Mouga*[1,5]*, D. Sousa*[1]*, A. Oliveira*[1,2]*, S. Ferreira*[6]*, P. Maciel*[7]*, I. Carreira*[6]*, A. M. Vicente*[8] *and G. Oliveira*[1,2,3,9]*, (1)Centro Hospitalar e Universitário de Coimbra - CHUC, Coimbra, Portugal, (2)University Clinic of Pediatrics, Faculty of Medicine, University of Coimbra, Coimbra, Portugal, (3)Faculty of Medicine, Institute for Biomedical Imaging and Life Sciences (IBILI) and Center for Neuroscience and Cell Biology (CNC), University of Coimbra, Coimbra, Portugal, (4)Serviço de Genética Médica do Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal, (5)IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine, University of Coimbra, Coimbra, Portugal, (6)Laboratório de Citogenética e Genómica, Faculty of Medicine, University of Coimbra, Coimbra, Portugal, (7)Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Braga, Portugal, (8)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL, (9)Centro de Investigação e Formação Clínica – Hospital Pediátrico – Centro Hospitalar e Universitário de Coimbra (HP-CHUC), , Portugal, Portugal*

Background:

Autism spectrum disorder (ASD) is a challenging neurodevelopmental disorder, with a multifactorial origin and a complex inheritance. The great majority of ASD cases are “idiopathic” (without a known etiology). At present, the etiology of autism can only be explained in about 15-20% of the cases. The extreme heterogeneity of ASD further complicates our understanding of its biology and pathophysiology. Some individuals with ASD have an identifiable genetic etiology, for example, known rare single-gene disorders. Syndromic autism refers to genetically well-defined disorders in which ASD is observed at higher than expected frequencies. The most common of these syndromes associated with ASD is fragile X (*FMR1*), accounting for 2-5% of cases of ASD. Other monogenic disorders associated with ASD include tuberous sclerosis (*TSC1, TSC2*), neurofibromatosis (*NF1*), Angelman syndrome (*UBE3A*), Rett syndrome (*MECP2*) and PTEN mutations in patients with macrocephaly and autism, among others.

Objectives:

To report a subset of individuals with single-gene disorder associated with ASD in a large Portuguese sample.

Methods: Participants included 1608 children and adolescents, ranging in age from 2 to 18 years old (mean ± SD; 13.4 ± 6.2 years old) and a Male/Female ratio – 4.6/1. Subjects were seen as part of an outpatient clinic in a tertiary Pediatric Hospital between 1995 and 2016. To be included, all participants had to have ASD diagnosis, according to, at least positive score in two for ADI-R, ADOS and fulfilment of DSM-5 criteria. Associated medical or genetic condition that presumably is the cause of autism was considered after a detailed medical history, a carefully physical and neurologic examination and, if still there was no diagnosis, a thoroughly laboratory evaluation, which included routine testing procedures for fragile X mutations (FRAXA and FRAXE) and molecular cytogenetic abnormalities studied by comparative genome hybridization array and sequencing techniques. We also conducted a metabolic investigation. Moreover, these ASD children underwent intellectual and functional adaptive evaluations with Griffiths Mental Development Scale and/or Wechsler Intelligence Scale and Vineland Adaptive Behavior Scale (VABS), respectively.

Results:

Our findings revealed 40 Fragile X syndrome (*FMR1*) (2.48%) and a rare FRAXE mutation, seven Rett syndrome, six Tuberous sclerosis, four *PTEN* mutations, three *KCNQ3*-mutation, two individuals of each syndrome – Angelman, CHARGE and Pitt-Hopkins like syndrome 2 (*NRXN1*). With one case of each, we report a Cornelia de Lange and a Rubinstein-Taybi syndrome with ASD. Comprehensive genotype-phenotype description will be presented. Also, we highlight some interesting and published results: putative missense mutations were identified in the *NLGN4* gene in two separate, unrelated, autistic patients, *G99S* and *K378R* are described.

Conclusions:

Most of the known genetic causes of ASD are also causes of ID, implying that these two identities share common genetic basis. Comprehensive cognitive and behavior phenotyping revealed moderate to severe developmental delay/intellectual disability among syndromic ASD, in our study. Our findings are concordant with contemporaneous investigation, with extreme heterogeneity of ASD further complicates our understanding of its biology and pathophysiology.

86 **165.086** Patient and Provider Factors Influence Completion Rates of Genetic Testing for Autism Spectrum Disorders

N. Abreu[1], *M. Chiujdea*[1], *N. Huntington*[2] *and S. J. Spence*[1], *(1)Autism Spectrum Center, Boston Children's Hospital, Boston, MA, (2)Developmental Medicine Center, Boston Children's Hospital, Boston, MA*

Background: Genetic testing is standard medical care for children with autism spectrum disorder (ASD) as results can assist with providing diagnostic certainty, guide medical decision-making, influence family planning and help prognosticate on other medical issues in the affected child. Despite the American Academy of Pediatrics, American Academy of Neurology, American College of Medical Genetics and Genomics, and American Academy of Child and Adolescent Psychiatry writing consensus statements that chromosomal microarray (CMA) should be performed as first-line testing for all patients with non-syndromic ASD, previous survey-based research has identified low rates of testing, especially CMA completion (15-20%). While patient factors like intellectual disability and seizures are associated with increased yield of clinically significant results on CMA testing, it is unclear if this knowledge may affect ordering practices. Providers also have different approaches to genetic counseling in autism and it remains unknown how the provider's perspective influences completion of CMA testing.
Objectives: To evaluate completion of CMA testing using a prospective cohort of newly diagnosed children with ASD and investigate factors contributing to test completion . Patient factors include age, gender and medical comorbidities. Provider factors include specialty and CMA recommendation practice.

Methods: 343 patients with a new diagnosis of ASD made between 2/1/15 and 1/31/16 were identified. Cases were selected using a mandatory online institutional quality improvement questionnaire completed by providers at the time of initial diagnosis. Laboratory data were analyzed through 8/1/17, allowing for a minimum of 18 months for genetic testing to be performed. Patient and provider factors were extracted from billing data and chart review.

Results: The sample had 75% males and a mean age at diagnosis of 49 months (range: 16 months to 17.5 years). Epilepsy occurred in 3% and global developmental delay or intellectual disability (GDD/ID) occurred in 38%. Completion rate of CMAs was 40.2%. Higher rates of CMA completion were seen in individuals with GDD/ID (52% with v. 33% without, $p<0.001$). There was a negative correlation with age at time of diagnosis ($r = -0.27$, $p<0.01$). There was no effect of gender (48% males v. 38% females, $p=0.14$) or comorbid epilepsy (45% with v. 40% without, $p=0.72$).

Providers recommended genetic testing in 86% of initial diagnostic visits and also referred to Genetics in 6.4%. There was a lower overall CMA completion rate when providers did not recommend genetic testing at the first visit (15%) compared to when recommended by the provider (44%) or when recommended and referred to Genetics (45%, $p < 0.01$). Patients seen by providers in developmental medicine were more likely to have completed CMAs compared to patients seen by providers in neurology (46% v. 27%, $p=0.02$).

Conclusions: In this prospective cohort at a single center with institutional guidelines recommending routine CMA testing for all individuals with non-syndromic ASD, the CMA completion rate remains low. Certain patient-related factors (e.g., GDD/ID and age) and provider-related factors (e.g., specialty and recommendation made at first visit) significantly impact CMA completion rates. Further investigation is needed into specific provider practices, additional patient variables and family attitudes.

87 **165.087** Protecting DNA: Shortened Telomere Length Is Associated with Autism Spectrum Disorder

B. B. Braden[1], ***C. R. Lewis***[2], *K. Agrawal*[1], *S. Ringenbach*[1] *and M. Huentelman*[2], *(1)College of Health Solutions, Arizona State University, Tempe, AZ, (2)Translational Genomics Research Institute, Phoenix, AZ*

Background: Autism Spectrum Disorder (ASD) is a common neurodevelopmental disorder, but the etiology of symptoms in most cases is not well understood. Recently, two papers introduced preliminary evidence associating shortened telomere length with ASD. Telomeres are repetitive non-coding DNA nucleotides that protect genes by capping chromosome ends. They progressively shorten with each cell division, providing a biological measure of aging. Shortened telomeres have been associated with many adverse health and age-related outcomes such as cancer and Alzheimer's disease. How telomere length may underlie symptoms associated with ASD is not well understood.
Objectives: We aimed to replicate the association of shortened telomere length with ASD in a large, well-characterized sample of children. We hypothesized children with ASD would have shorter RTL than age-matched typically developing (TD) controls.

Methods: Using blood leukocytes, we investigated the association between relative telomere length (RTL) and childhood ASD in males (ASD: $n = 186$; TD: $n = 107$). We used an established quantitative polymerase chain reaction method, and designed telomere and single-copy reference gene primers from an established protocol. We assessed RTL between groups using independent samples t-test ($p < 0.05$; one-tailed).

Results: With a subset of the entire sample (ASD: $n = 31$; TD: $n = 28$), who were well matched in age (ASD: 5.79±2.12 years; TD: 5.93±2.71 years), preliminary findings demonstrate that the ASD group had shorter RTL length compared to the controls [$t(57) = 1.69$, $p = 0.04$]. Continued analysis of the entire sample and correlational analyses with behavioral measures are in progress.

Conclusions: Findings replicated other recent studies, providing additional evidence that ASD is associated with shortened telomere length. Further investigations aimed at understanding the relationship between telomere length and symptoms associated with ASD are planned and warranted. Telomere length may be an important biological mechanism in understanding the etiology of ASD, and providing a novel treatment target for future interventions.

88 **165.088** Quantification of Genetic Risk of ASD for a Planned Child Based on the Genomes of Its Parents

ABSTRACT WITHDRAWN

Background: A key question that many parents planning to start a family confront is: what is the probability that this child we are planning to conceive will develop ASD? While, many copy number variants (CNVs) and other genetic defects of high penetrance for ASD have been identified in the literature, and numerous genome wide association studies have identified sets of single-nucleotide polymorphisms (SNPs) that confer risk for ASD, no study that the author is aware of has attempted to quantify the overall genetic risk per genome. With a genetic risk per genome quantified, one could then go a step further and examine the question of what is the genetic risk of ASD in a child that has yet to be conceived.
Objectives: Given two genomes representative of potential biological parents, determine the risk that a child conceived from these two individuals will develop ASD.

Methods: A genome wide risk model was constructed to represent genetic risk of ASD given a specific genome. To start with, a review of the literature was conducted to determine a set of variants that confer ASD risk. Variants in this context included CNVs and SNPs. Full chromosomal duplications or deletions were excluded as they generally result from spontaneous mutation. The search was broad in the sense that it was conducted to include autosomal variants, X-chromosome variants, Y-chromosome variants, and mitochondrial variants. For each variant, measures of relative risk and prevalence were obtained from the medical literature or in some cases estimated. In the case of SNPs, the measure of prevalence used was the global mean effect size. A model of overall risk was constructed assuming risk associated with any given variant is independent of the risk of any other variants that do not affect the same segment of DNA. In other words, risks are generally assumed to be multiplicative. Care was taken in this model to avoid double counting risk of specific SNPs with risk of CNVs covering the same section of DNA. This model was calibrated for each sex based on the estimated prevalence of ASD per sex from the literature. Using this genome wide risk model, a separate model of ASD risk in progeny was constructed given two genomes (biological parents) as inputs. This progeny risk model calculates a risk of ASD for a child of each sex using the parents' genetic data, and data from the literature on the probability of spontaneous mutation resulting in CNVs. The overall ASD risk in the progeny was then computed as a weighted average of the ASD risk of each sex.

Results: The progeny risk model provides a seemingly reasonable quantification of ASD risk. It would be desirable to test it with out of sample data. Its limitations include: no adjustments for non-independent interactions between variants, and no adjustments for environmental or epigenetic risks.

Conclusions: This study provides a practical application of genetic risk to a real-world question that parents confront when they are considering conceiving a child.

89 **165.089** Rare Copy Number Variation As Predictors for Treatment Response to Social Skills Training in Children with Autism Spectrum Disorder

K. Tammimies[1]*, I. Rabkina*[1]*, D. Li*[1]*, S. Stamouli*[1]*, M. Becker*[1]*, S. Berggren*[2]*, U. Jonsson*[2]*, N. Choque Olsson*[3] *and S. Bolte*[4]*, (1)Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (2)Karolinska Institutet, Stockholm, Sweden, (3)Clinical Neuroscience (CNS), Karolinska Institutet, Stockholm, Sweden, (4)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background: Social skills group training (SSGT) is one the most commonly used interventions for individuals with autism spectrum disorder (ASD). However, the response to SSGT can vary. Limited information exists of predictors of the SSGT treatment outcome. Chromosomal microarray (CMA), to analyze the presence of rare copy number variation (CNVs), is currently the recommended first-tier molecular diagnostic test for children with ASD. However, studies investigating the treatment outcomes in the individuals with CNVs are lacking.

Objectives: Analyze the association between rare CNVs and response to SSGT in children and adolescent with ASD

Methods: Saliva-derived DNA was used to genotype 207 consenting participants from the KONTAKT SSGT study (Choque-Olsson *et al.* J Am Acad Child Adolesc Psychiatry 2017; 56(7):585–592) using the Affymetrix Cytoscan HD microarray. CNVs were called using two different algorithms followed by annotation and selection of rare CNVs using population-based dataset. The rare CNVs were further stratified by size and gene context. The response to SSGT was measured using changes in the parental reported Social Responsiveness Scale (SRS-2) from baseline to post-treatment and 6-months follow-up. Secondary outcome measures included parental reported Adaptive Behavior Assessment System II (ABAS-II) and trainer reported Developmental Disabilities modification of the Children's Global Assessment Scale (DD-CGAS). Linear mixed models were used to test associations between rare CNVs and change in SRS-2 or other outcome measures. The outcome was considered first using data from all time points, then at the posttreatment or follow-up assessments specifically. We additionally investigated differences in the baseline phenotypic measures, such as full-scale IQ and ADOS-2 total scores, between individuals with and without rare CNVs

Results: A total of 101 rare CNVs or chromosomal abnormalities were identified in the participants. These included known microdeletion and duplication syndromes such as 7q11.23dup but also rare CNVs affecting newly identified ASD genes such as *CHD8*. Our analysis reveal that participants in the active KONTAKT SSGT group that were carriers of exonic CNVs had overall worse outcomes at all times point (β=12.1, p=0.018). This association was mainly driven by CNVs larger than 500kb, for which significant association was shown for both posttreatment (β=15.3, p=0.017) and follow-up (β=14.2, p=0.028). These results indicate a significant increase in the symptom severity after SSGT. Similar results were obtained for ABAS-II. However, no significant association was found for the trainer reported DD-CGAS outcome and rare CNVs. The individuals with rare CNVs had significantly lower IQ than non-carriers, but they did not differ in other baseline measures tested.

Conclusions: This is the first study to report that carriers with rare exonic CNVs had worse and even adverse outcome after completing SSGT. Our results suggest that currently used molecular diagnostic test CMA can potentially be used to pinpoint subgroup of individuals that do not benefit from SSGT. In the future, genomic testing will lead to recommendations on how to better tailor the limited resources in treatments for affected individuals thus enhancing the personalized medicine approach in ASD.

90 **165.090** SPARK (Simons Foundation Powering Autism Research for Knowledge): A US Cohort of 50,000 Families to Accelerate Autism Research

P. Feliciano*, L. Grosvenor, A. Daniels, W. K. Chung, L. A. Green Snyder and H. Zaydens, Simons Foundation, New York, NY*

Background:

The causes of autism spectrum disorders (ASD) and the cellular mechanisms leading to ASD are not completely understood. Clinical studies to understand the brain and behavior in ASD are challenged by lack of replicability, partly due to the heterogeneity of the condition and small sample sizes. These challenges have limited progress in the development of effective treatments for this condition, and there are currently no approved medications that treat the core symptoms of ASD. Although ~100 ASD genes have been identified from studies of thousands of individuals, larger studies are required to understand the genomic architecture of ASD and identify additional monogenic, oligogenic, polygenic and environmental risk factors and to enable research studies of more homogeneously defined groups of individuals with ASD.

Objectives:

To accelerate clinical research in ASD, we created SPARK (Simons Foundation Powering Autism Research for Knowledge) with the goal of recruiting and retaining at least 50,000 individuals with ASD and their family members into a longitudinal, recontactable research cohort in which individual genetic causes of autism are returned to participants.

Methods:

To date, we have enrolled over 30,000 individuals with ASD and over 50,000 of their family members. SPARK is recruiting approximately 1,000 additional participants with ASD each month, through a national network of 25 clinical sites and social and digital media campaigns. We have performed exome sequencing and SNP genotyping on the first 500 parent-affected offspring trios, and currently we are performing exome sequencing and genome-wide genotyping on 4,000 parent-affected offspring trios and 2,000 unaffected siblings.

Results:

Using exome sequencing of 500 ASD trios we identified *de novo* and inherited X- linked likely gene disrupting (LGD) variants in genes strongly associated with ASD in 4% of individuals and returned those results to participants using an innovative, centralized genetic counseling service. We have also identified *de novo* loss of function or damaging missense variants in 27 additional genes, including two *de novo* loss of function variants in *BSBK2*, a novel candidate gene for ASD.

Conclusions:

We have developed a large-scale research platform that is efficient and engaging and that can be applied to other human diseases. Data from this cohort of recontactable, genetically characterized individuals with ASD are available to the research community at https://sfari.org/resources /autism-cohorts/spark. Researchers can also apply to access to this unique cohort for recruitment into research studies. SPARK represents a new era of clinical research that combines online access to participants, ability to re-contact and recruit participants for new research studies, and genomic, environmental, and longitudinal behavioral and medical information on all participants. SPARK is founded on principles that emphasize a strong partnership between participants and researchers. SPARK is committed to providing aggregate and individual research results to participants to help keep the goals of research grounded in having a meaningful impact on the lives of individuals and families with ASD. We believe that the challenges and lessons learned from SPARK will be informative to a wide range of researchers working on other conditions.

91 **165.091** The Australian Autism Biobank: A National Initiative to Accelerate ASD Discovery Research

G. A. Alvares[1,2], *C. Dissanayake*[3,4], *V. Eapen*[4,5], *H. Heussler*[4,6], *F. J. Rose*[4] *and A. J. Whitehouse*[7], *(1)Telethon Kids Institute, University of Western Australia, Perth, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, QLD, Australia, (3)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (4)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Brisbane, Australia, (5)School of Psychiatry, University of New South Wales, Sydney, Australia, (6)Mater Research Institute, The University of Queensland, Brisbane, Australia, (7)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia*

Background: The clinical (phenotypic) and genetic heterogeneity of Autism Spectrum Disorder (ASD) presents an enormous challenge to understanding etiological pathways and clinical outcomes. With significant advances in genetic and biological research alongside rapid-pace technological innovations, there is an increasing imperative to establish large and comprehensive bio-resources to support discovery research. To date, there has not yet been any single collective effort to establish such a resource in Australia, which has its own unique ethnic and cultural diversity.

Objectives: The Australian Autism Biobank was initiated by the Cooperative Research Centre for Living with Autism (Autism CRC). The aim of this initiative is to establish a large-scale repository of detailed phenotypic and biological information to facilitate future ASD discovery research.

Methods: Participants are children with a confirmed diagnosis of ASD ('probands'), aged between 2-17 years, at four national data collection sites in Australia. Biological parents and siblings are also invited to participate, as well as typically developing children ('controls') recruited from the general community. No exclusion criteria regarding language level, cognitive ability, or comorbid medical, psychiatric or genetic condition are applied to children diagnosed with ASD. All children complete cognitive or developmental assessments, with probands additionally completing an ASD diagnostic assessment. Parents/caregivers of probands are asked to complete questionnaires about medical history and current symptoms, along with an interview about early development. Physical measurements as well as blood, stool, urine, and hair samples are collected from all children; physical measurements and blood samples are collected from both parents, where possible. Samples are sent to a central processing site and placed in long-term storage at a specialised biobanking facility.

Results: With recruitment still ongoing, 691 probands (144 females) have been recruited to date, with an average age of 7.59 (SD = 3.95) years at assessment. In addition, 566 mothers (M = 39.37 years, SD = 6.67), 384 fathers (M = 42.27 years, SD = 7.53), and 124 siblings (M = 7.87 years, SD = 4.26) have been recruited, forming 415 (60.58%) complete 'trios' (a proband with biological mother and father) and 88 (12.74%) complete 'quads' (a proband with a sibling and both biological parents). 211 (30.54%) probands were from 99 multiplex families; that is, families comprising multiple children diagnosed with ASD (between 2 to 5 children). The current cohort also includes 11 concordant and 3 discordant twin pairs.

Conclusions: The establishment of this Australian biobank has resulted in a valuable resource of detailed clinical and biological information that will help accelerate the pace of ASD discovery research. Recruitment numbers to date support the feasibility of large-scale biological sample collection in children diagnosed with ASD with comprehensive phenotyping across a wide range of ages, adaptive functioning, and cognitive levels. The initial characteristics observed in this sample appear to be broadly in line with international surveillance efforts and suggest a representative sample of children across the four largest metropolitan areas in Australia. Recruitment is currently ongoing, with data access requests available in the near future.

92 **165.092** The Autism Speaks Mssng Whole Genome Sequencing Resource

S. Walker[1], *R. K. Yuen*[1], *D. Merico*[2], *M. Bookman*[3], *J. Howe*[1], *B. Thiruvahindrapuram*[1], *R. V. Patel*[1], *J. Whitney*[1], *N. Deflaux*[3], *J. Bingham*[3], *Z. Wang*[1], *G. Pellecchia*[1], *J. A. Buchanan*[1], *C. Marshall*[1], *N. Hoang*[1], *S. L. Pereira*[1], *T. Paton*[1], *W. Van Etten*[4], *M. Szego*[5], *L. J. Strug*[1], *B. Fernandez*[6], *L. Zwaigenbaum*[7], *B. M. Knoppers*[8], *E. Anagnostou*[9], *P. Szatmari*[1], *W. Roberts*[10], *R. H. Ring*[11], *D. Glazer*[3], *T. W. Frazier*[12] *and S. W. Scherer*[1], *(1)The Hospital for Sick Children, Toronto, ON, Canada, (2)Deep Genomics, Toronto, ON, Canada, (3)Google, Mountain View, CA, (4)BioTeam inc, Middleton, MA, (5)University of Toronto, Toronto, ON, Canada, (6)Memorial University of Newfoundland and Eastern Health, St. John's, NF, Canada, (7)University of Alberta, Edmonton, AB, Canada, (8)McGill University, Montreal, QC, Canada, (9)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (10)isand, Toronto, ON, Canada, (11)Drexel University College of Medicine, Philadelphia, PA, (12)Autism Speaks, Princeton, NJ*

Background:

Autism Spectrum Disorder (ASD) is a highly heterogeneous disorder, both in clinical presentation and genetic architecture. There are many, perhaps hundreds, of loci associated with ASD with multiple forms of genetic variation contributing risk variants.

Objectives:

We are performing whole genome sequencing (WGS) of families with ASD to build a resource, named MSSNG, to enable the sub-categorization of phenotypes and underlying genetic factors involved.

Methods:

We have created a cloud database containing WGS data and clinical information which is accessible through an internet portal with controlled access. We have recently released new data to bring the total number of genomes to 7,235, including subjects who are part of the POND-network and Baby Siblings Research Consortium. Data are available for single nucleotide variants (SNVs), small insertion/deletions (indels) and copy number variants.

Results:

From the first 5,205 genomes, we detected on average 73.8 *de novo* SNVs and 12.6 *de novo* indels per ASD subject and identified 18 new candidate ASD-risk genes, such as *MED13* and *PHF3*. In total, by including *de novo* SNVs and indels and large copy number variants (CNVs), a molecular diagnosis could be determined for 11.2% of ASD cases (Nature Neurosciences, 2017). Analysis of the CNV data from these subjects found an average of 22.7 rare (<1% frequency) CNVs >1kb in size per individual sequenced on Illumina platforms, and 7.87 rare CNVs >2kb per individual sequenced by Complete Genomics. Of these, an average of 9.89 and 4.78, respectively, impacted protein-coding regions of genes. We are now analysing structural variant calls using multiple different tools; CREST, LUMPY, Manta and DELLY. The MSSNG phenotype database is also being expanded, and dozens of families are being added with multigenerational pedigrees, multiple affected siblings, and participants from clinical trials. Moreover, epigenetic analysis of DNA samples with data from methylation microarrays is adding additional functional data to the genomic information, and all of this is made available to the research community through a simple MSSNG user interface (portal).

Conclusions:

The Autism Speaks MSSNG project combines high quality WGS data with phenotype information to facilitate researchers of all backgrounds in studies of the genetic architecture of ASD.

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165.093 The Clinical Relevance of Intragenic NRXN1 Deletions

N. Cosemans[1,2]*, L. Vandenhove*[1,2]*, S. Shen*[3]*, J. Fitzgerald*[4]*, L. Gallagher*[4] *and H. Peeters*[1,2]*, (1)Center for Human Genetics, University Hospital Leuven, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research (LAuRes), Leuven, Belgium, (3)Regenerative Medicine Institute, School of Medicine, BioMedical Sciences Building, National University of Ireland (NUI), Galway, Ireland, (4)Trinity College Dublin, Dublin, Ireland*

Background: Neurexins (NRXNs) are involved in synapse formation, differentiation and function, which makes them important in brain development and function. Rare intragenic deletions affecting *NRXN1* have been associated with autism spectrum disorder, but also with other neuropsychiatric disorders, such as developmental delay, language disorders, epilepsy, schizophrenia and aspecific dysmorphic features. In fact, *NRXN1* deletions lack phenotypic specificity and are often inherited from a clinically unaffected parent. Therefore, it is challenging to determine to what extend a *NRXN1* deletion can explain the phenotype in a particular patient.

Objectives: The current study aims to gain insight in the genotype-phenotype correlation of intragenic *NRXN1* deletions.

Methods: First, an extensive literature study was performed that contains 629 heterozygous *NRXN1* deletions. The study cohort was assembled through data extraction from 73 literature reports and consists of 341 probands and 140 relatives from clinical cohorts or case reports and 148 individuals from control cohorts. All individuals are characterized by clinical data, position and size of the variant and family relationships. These data were used to study the prevalence, penetrance, inheritance, segregation and phenotypic specificity of *NRXN1* deletions. Second, we studied 44 additional cases with heterozygous *NRXN1* deletions identified at our center in Leuven to illustrate our findings by means of case based reasoning. Moreover, the exact breakpoints of these deletions were identified through targeted sequencing.

Results: Based on published unscreened control cohorts, the population prevalence of intragenic *NRXN1* deletions was estimated to be ~1/300 (0.312%; 99%CI [0.253%-0.370%]). However, 90% of these deletions were intronic, pointing out that the exonic deletions are very rare with a prevalence of ~1/3,000 (0.031%; 99%CI [0.013%-0.050%]). The observations from the extensive literature study allowed to distinguish three distinct parts in the *NRXN1* gene. First, exon 6-24 deletions, that were only present in two out of over 100,000 controls, often segregated with intellectual disability (ID) in families or were *de novo* in sporadic cases with ID. Genotype-phenotype data in the Leuven patient cohort illustrated this observation. Taken together, this lends support for an association of exon 6-24 deletions with mainly ID with high penetrance. Second, several intragenic deletions within intron 5 were founder deletions that did not show clear evidence for an association with neurodevelopmental or psychiatric disorders in the current study. These results were obtained by exact breakpoint determination in the Leuven cohort. Third, deletions affecting exon 1-5 are susceptibility variants that may have a very variable expression (from mild to severe phenotypes) and a variable penetrance. Penetrance is estimated to be rather low, however, it is difficult to estimate since these copy number variants are also present in screened and unscreened controls and may be overrepresented in the patient population because of reporting bias.

Conclusions: The current study revealed some important correlations between the position of *NRXN1* deletions on the one hand and the population prevalence, the segregation, the penetrance and the associated phenotype on the other hand. From these observations, clinical guidelines can be derived to improve the interpretation of a *NRXN1* deletion for a particular patient and family.

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165.094 To Test or NOT to Test? Fragile X Premutation Analysis in Minors- Ethical and Medical Dilemmas and Considerations

L. V. Gabis[1] *and A. Raas-Rothschild*[2]*, (1)Pediatrics, Sheba Medical Center, Rehovot, ISRAEL, (2)Genetics, Sheba Medical center, Ramat Gan, Israel*

Background: Since 2013, Fragile X screening test has been included in Israeli general screening performed in healthy women above age eighteen. Since then new knowledge emerge on the point that women with premutation beyond the risk of childbearing an offspring with full mutation might face medical and emotional challenges during their life. It has become common knowledge that women with premutation face medical and emotional challenges during their life, beyond the risk of childbearing an offspring with full mutation. Fragile X-associated primary ovarian

insufficiency (FXPOI) is a primary cause of infertility and occasionally it may present at a young age, sometimes before the age of family planning. In addition, it seems that a phenotype of learning disabilities, neuropsychiatric issues, ADHD and endocrine dysfunction emerges as a continuum in patients with expansion mutation between the range of premutation and full mutation, both in male and female premutation carriers, as well as social communication awkwardness, possibly autism spectrum features and FXTAS in aging carriers.
Knowledge in regards to the Fragile X status of a child or a teenager might be actionable for the primary care physician and may influence parental attitudes. Minors in families at risk could be tested to benefice from more focused treatment of related impairments- such as learning disabilities, ADHD, ASD or other neuropsychiatric difficulties. On the other hand, physicians may have concerns that carrying a genetic disorder may have a negative impact in terms of emotional burden, social and insurance implications.

Objectives: Main aim was to assess Israeli medical personnel's attitudes in regards to testing Fragile X premutation status in minors. As a secondary aim we probed the knowledge in regards to premutation symptoms. A third aim was to promote knowledge and awareness.

Methods: We used an on- line 10 questions query (SurveyMonkey), including anonymous background information, knowledge and experience with Fragile X families and attitudes towards testing minors.

Results: To date 78 practitioners completed the study of which more than a half had more than twenty years in practice and 20% cared for 5-10 families with Fragile X and 18% for more than ten. 82% of practitioners answered that they would consider testing Fragile X in minors and 13% would test in girls only. In regards to the symptom list, more than 20% confused between symptoms related to permutation and full mutation, mainly in regards to fertility, intellectual impairment, autism and dysmorphic features.

Conclusions:

The permutation phenotype is not well recognized. However, most practitioners would test in minors, mainly if full mutation phenotype is present.

We suggest to individualize the decision in regards to testing carrier status in minors sibblings of affected children and to discuss the different options with the parents, while differentiating between general screening for non specific phenotype such as anxiety or ADHD, to permutation carriers with a family member with Fragile X Syndrome. Awareness of the risks and incidence of the various possible manifestations linked to the permutation status are mandatory for advising patients and their families.

95 **165.095** Translating the Complex ASD Genetic Architecture into Clinical Phenotype Using an Integrative System Biology Approach

M. Asif[1]*, H. Martiniano*[2]*, C. Rasga*[3]*, A. R. Marques*[4]*, J. Santos*[4]*, G. Oliveira*[5]*, F. M. Couto*[6] *and A. M. Vicente*[7]*, (1)Faculdade de Ciências da Universidade de Lisboa , Lisbon, Portugal, (2)Faculdade de Ciências, Universidade de Lisboa, Portugal, Lisbon, Portugal, (3)INSA, lisboa, Portugal, (4)INSA, Lisbon, Portugal, (5)Centro Hospitalar e Universitário de Coimbra - CHUC, Coimbra, Portugal, (6)Departamento de Informática, Faculdade de Ciências, Universidade de Lisboa, Portugal, Lisbon, Portugal, (7)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL*

Background: Autism Spectrum Disorder (ASD) is characterized by a wide spectrum of behavioral presentation, rendering ASD difficult to diagnose particularly in very young children. While many genetic factors are implicated in ASD, the architecture of genotype/phenotype correlations is still very unclear. Delayed diagnose leads to delay in applying behavioral therapies that may help to reduce symptoms, particularly when applied at young age.
Objectives: The aim of the study was to develop a novel machine learning-based integrative system biology approach to predict the clinical outcome from biological processes defined by rare Copy Number Variants (CNVs) in ASD children.

Methods: Agglomerative Hierarchical Clustering (AHC) was used to identify ASD phenotypic subgroups from the clinical reports from 2529 ASD patients recruited by the Autism Genome Project. Altered biological processes in the same ASD patients were inferred from rare CNVs targeting brain genes, by employing functional annotation analysis. To predict phenotypic clustering of patients from biological process disrupted by rare CNVs in brain genes, four different machine learning methods were trained and tested on the clustered patient and disrupted biological processes datasets, and performance of implemented methods were compared using “accuracy” measure.

Results: Analysis of clinical data using AHC identified two distinct phenotypic clusters that differed in overall adaptive behavior profiles, verbal status and cognitive abilities, defining more severe and less severe phenotypes. Clusters were highly stable for 1000-bootstrap iterations and clusters validation through the Silhouette method also indicated that both clusters were true and consistent. Cluster 1 represented the subgroup with the most severe clinical presentation, with all patients being non-verbal and presenting dysfunctional adaptive behavior profiles for all VABS subscales, as well as lower performance IQ. Cluster 2 individuals presented less severe ASD symptoms and milder deficits for all clinical variables. Enrichment analysis of rare CNVs targeting brain genes, followed by removal of redundant biological processes using Gene Ontology hierarchy, identified 18 statistically significant biological processes, generally consistent with reported literature for ASD. Support Vector Machine (SVM) outperformed the other three methods by achieving highest accuracy of 66.3% to differentiate between less and more severely affected individuals, thus allowing a reasonable prediction of clinical outcome from biological processes defined by genetic alterations.

Conclusions: To address the ASD heterogeneous phenotype which has hindered the identification of genotype/phenotype associations, ASD patients were clustered into two clusters with more and less severe phenotype that is consistent with a previously reported analysis. Functional annotation analysis showed that rare CNVs targeting brain genes from ASD subjects tend to aggregate in common biological processes that have been previously associated to ASD, such as nervous system development and protein polyubiquitination. The presented approach seeks to enhance our knowledge on ASD diagnosis and prognosis by elucidating the complex genotype/phenotype associations in patients, allowing earlier and more personalized intervention, and contributing to understanding the genetic basis of ASD clinical heterogeneity.

Poster Session
166 - Interventions - Pharmacologic
5:30 PM - 7:00 PM - Hall Grote Zaal

96 **166.096** A Meta-Analysis of the Efficacy of Immediate Release Methylphenidate to Reduce Hyperactivity in Children with Autistic Spectrum Disorder

A. Bratt[1], *B. Masanyero-Bennie*[2] *and S. P. Kelley*[3], *(1)Medway School of Pharmacy, Kent, United Kingdom of Great Britain and Northern Ireland, (2)Medway School of Pharmacy, University of kent & greenwich, Chatham, United Kingdom, (3)Medway School of Pharmacy, University of Kent & Greenwich, Chatham, United Kingdom*

Background: Psychostimulant medications, such as methylphenidate (MPH) have become mainstay treatments for Attention Deficit Hyperactivity Disorder (ADHD) symptoms, such as hyperactivity, impulsivity and inattention in children. Such symptoms frequently also co-exist in children with Autistic Spectrum Disorders (ASD), thereby complicating a differential diagnosis[1]. The presence of ADHD-like symptoms in children with ASD can have a significant detrimental impact on learning and social interaction, and can limit the outcome of behavioural interventions to address areas of core ASD difficulties. Therefore it is of clinical relevance and potential benefit to address the issue of effectiveness and tolerability / safety of stimulants such as methylphenidate in children with co-morbid diagnoses of ASD + ADHD.

Objectives: This study performed a meta-analysis of three randomised controlled trials (RCT's) homogeneously measuring the effect of immediate release methylphenidate (MPH) to reduce scores of hyperactivity in children with comorbid ADHD + ASD.

Methods: The following databases were searched to find studies / trials which used MPH in treating ADHD related symptoms in children & adolescents with ASD: PsychINFO, PubMed-MEDLINE, Cochrane Controlled Trials, and Web of Science. The search terms were variants of eg: Autism (Autistic Spectrum Disorders) / Methylphenidate/ Hyperactivity / Children. The primary homogeneous outcome measure extracted from each study was teacher / practitioner rated hyperactivity on the ABC scale[2].

Results: The findings showed that ir-MPH produces an overall moderate significant benefit to reduce hyperactivity in children with comorbid ADHD +ASD (Hedge's g value -0.581 & 95% confidence interval effect size -0.65). These results are best considered preliminary as they are based on 3 RCTs only, all with quite small sample sizes. Tolerability of methylphenidate appears to be a real issue, as a high number of adverse effects were experienced within the studies, which were severe enough to lead to frequent treatment discontinuation. Most frequent side effects reported were decreased appetite, difficulty initiating sleep, irritability and gastrointestinal discomfort.

Conclusions: Outcomes are discussed in relation to the risk / benefit question of medication use in this vulnerable population. Sleep disturbance, selective feeding and emotional lability are commonly observed inherently in the ASD phenotype, and these may all be exacerbated by methylphenidate use in a subset of children receiving medication. There is therefore a need to understand the clinical and biological variables which may predict which children are most likely to respond to treatment with stimulant medication and hence avoid exposure in those children who may experience an intolerable side effect profile.

1: Zablotsky B, Bramlett MD, Blumberg SJ (2017) The co-occurrence of autism spectrum disorder in children with ADHD. J. Atten. Disord. (Epub ahead of print)

2: Conners (1969) A teacher rating scale for use in drug studies with children. Am. J. Psychiatry 126:884-888.

97 **166.097** A Randomized, Double-Blind, Placebo Controlled Trial of 4 Weeks Intervention with Lactobacillus Plantarum PS128 in Autism Spectrum Disorder Boys in Taiwan

Y. W. Liu[1,2], *H. Y. Huang*[3], *W. S. Peng*[4], *Y. Y. Wu*[5] *and Y. C. Tsai*[2,6], *(1)Institute of Biochemistry and Molecular Biology, National Yang-Ming University, Taipei, Taiwan (Province of China), (2)Microbiome Research Center, National Yang-Ming University, Taipei, Taiwan, (3)Department of Psychology, National Taiwan University, Taipei, Taiwan, Taipei, Taiwan, (4)Bened Biomedical Co. Ltd., Taipei, Taiwan, Taipei, Taiwan, (5)YuNing Psychiatry Clinic, Taipei, Taiwan, (6)Institute of Biochemistry and Molecular Biology, National Yang-Ming University, Taipei, Taiwan*

Background: Targeting gut microbiota was reported to modulate behavioral abnormalities in animal models of neurodevelopmental disorders, like autism. *Lactobacillus plantarum* PS128 (PS128) was a psychobiotic which modulated the dopamine and serotonin levels in depression animal models.

Objectives: To investigate the effects of PS128 on boys with autism spectrum disorders.

Methods: Eighty male subjects diagnosed with autism spectrum disorder and confirmed with Autism Diagnostic Interview-Revised (ADI-R) were included in a 4-week, randomized, double-blind, placebo-controlled trial with PS128 or placebo (microcrystalline cellulose) intervention. The subjects took PS128 (3×10^{10} CFU) or microcrystalline cellulose (300 mg) orally twice daily. Several questionnaires were measured at baseline and day28 including Autism Behavior Checklist-Taiwan Version, (ABCT), Social Responsiveness Scale (SRS), SNAP-IV and child behavior checklist (CBCL). The principle of investigator measured Clinical Global Impressions (CGI)-severity scale was measured on day1 and Clinical Global Impressions (CGI)-improvement scale on day28. The primary outcome measure was ABCT. Fecal sample of subjects were collected on baseline and day28. Fecal levels of inflammatory molecules were analyzed by ELISA. Gut microbiota was analyzed by Next Generation Sequencing techniques. This study was registered on the Australian New Zealand Clinical Trials Registry (ANZCTR; Trial ID: ACTRN12616001002471).

Results: Four subjects of placebo group and 2 subject of PS128 group were dropped-out (drop-out rates is 7.5%) in this study. There is no adverse effect occurred in this study. There were no significant differences between in terms of subjects' age, education and their caregiver's education. It was also no significant difference with baseline performance between two groups with ADI-R, ABCT, SRS, SNAP-IV and CBCL scores. By the end of 4 weeks, the scores of Body and object use in ABCT and Rule-Breaking Behavior in CBCL were decreased significantly in PS128 group ($p < 0.05$). However, the placebo group was failed to improve significantly on any efficacy measure. Fecal levels of inflammatory molecules, myeloperoxidase and calprotectin, and gut permeability marker, zonulin, were similar in both groups on day1 and day28. NGS analysis results showed significant increasement of *Lactobacillus* was observed in PS128 group.

Conclusions: PS128 (3×10^{10} CFU) twice daily for 4 weeks significantly improved the scores of Body and object use in ABCT and Rule-Breaking Behavior in CBCL. Alteration of gut microbiota may contribute at least partially to the improvement.

98 **166.098** Cannabidiol Based Medical Cannabis in Children with Autism- a Retrospective Feasibility Study

A. Aran[1], *H. Cassuto*[2] *and A. Lubotzky*[1,3], *(1)Shaare Zedek Medical Center, Jerusalem, Israel, (2)Clallit and Leumit HMO, Jerusalem, Israel, (3)Department of Developmental Biology and Cancer Research, Hebrew University, Jerusalem, Israel*

Background: Anecdotal evidence of successful cannabis treatment in children with autism spectrum disorder (ASD) are accumulating but formal studies are lacking.
Objectives: This retrospective study assessed safety, tolerability and efficacy of cannabidiol (CBD) based medical cannabis, as an adjuvant therapy, for refractory behavioral problems in children with ASD.

Methods: 60 children with ASD (age = 11.8± 3.5, range 5.0-17.5; 77% low cognitive functioning; 83% boys) were treated with oral CBD and tetrahydrocannabinol (THC) at a ratio of 20:1. The dose was up-titrated to effect (maximal CBD dose -10mg/kg/d). Tolerability and efficacy were assessed using a modified Liverpool Adverse Events Profile, the Caregiver Global Impression of Change (CGIC) scale, the Home Situations Questionnaire–Autism Spectrum Disorder (HSQ-ASD) and the Autism Parenting Stress Index (APSI).

Results: Following the cannabis treatment, behavioral outbreaks were much improved or very much improved (on the CGIC scale) in 61% of patients. The anxiety and communication problems were much or very much improved in 39% and 47% respectively. Disruptive behaviors, were improved by 29% from 4.74±1.82 as recorded at baseline on the HSQ-ASD to 3.36±1.56 following the treatment. Parents reported less stress as reflected in the APSI scores, changing by 33% from 2.04±0.77 to 1.37±0.59. The effect on all outcome measures was more apparent in boys with non-syndromic ASD. Adverse events included sleep disturbances (14%) irritability (9%) and loss of appetite (9%).

Conclusions: This preliminary study support the feasibility of CBD based medical cannabis as a promising treatment option for refractory behavioral problems in children with ASD. Following this preliminary study, we launched a randomized double blind placebo controlled trial.

99 **166.099** Effect of a Combination of Carnitine, Coenzyme Q10 and Alpha-Lipoic Acid (MitoCocktail) on Mitochondrial Function and Neurobehavioral Performance in Children with Autism Spectrum Disorder

A. Legido[1]*, M. J. Goldenthal*[1]*, B. Garvin*[2]*, S. Damle*[1]*, K. Corrigan*[1]*, J. Connell*[2]*, D. Thao*[1]*, I. Valencia*[1]*, J. Melvin*[1]*, D. Khurana*[1]*, M. Grant*[1] *and C. J. Newschaffer*[2]*, (1)Drexel University, Philadelphia, PA, (2)AJ Drexel Autism Institute, Philadelphia, PA*

Background: Emerging research has suggested that mitochondrial (mt) dysfunction, causing secondary bioenergetic deficit and increase in oxidative stress, may play a role in the etiology of some patients with autism spectrum disorder (ASD) *(Legido A et al. Semin Pediatr Neurol 2013;20:163).*
Objectives: The hypothesis of this FDA-IRB approved open-label pilot trial was that patients with ASD and indications of mt dysfunction would improve clinically and/or biochemically following treatment with a combination of carnitine, coenzyme Q10 and alpha-lipoic acid *(MitoCocktail).*

Methods: To be eligible, participants had to fulfill DSM V diagnostic criteria for ASD and have abnormal buccal swab mt RCC (respiratory chain complexes) I and IV test results. RCC I and IV were measured through immunocapture and spectrophotometric procedures with values normalized to citrate synthase activity. A total of 11 patients (10M, 1F), aged 5-12 years completed the protocol. They received *MitoCocktail* daily for a 3-month period. Behavioral outcome data was collected from the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), the Autism Spectrum Rating Scale (ASRS) and the Aberrant Behavior Checklist (ABC), administered at baseline (Time 1), three months into treatment (Time 2), and three months after treatment was discontinued (Time 3). Three separate scores (subscales and total) from the ADOS-2, three from the ASRS (subscales and total), and five (subscales) from the ABC were contrasted at Time 1 vs. Time 2. Those showing significant change were then examined for return toward baseline at Time 2 vs. Time 3. RCC I and IV levels were also compared across these time points. Paired t-tests were used to evaluate differences.

Results: Mean buccal complex I/IV activity ratio was significantly ($p<0.02$) reduced during *MitoCocktail* treatment compared to baseline. All subjects showed at least one specific sign of metabolic improvement, which waned 3 months post-treatment in 7 of the 11 participants. Of the 11 total or subscale scores considered, all showed change in means from Time 1 to Time 2. Statistically significant changes were observed for the Unusual Behavior subscale from the ASRS ($p<0.006$), the Lethargy subscale from the ABC ($p <0.01$), and the Inappropriate Speech subscale from the ABC ($p<0.02$). From Time 2 to Time 3, scores worsened on each of these three subscales with statistically significant changes on Lethargy ($p<0.01$) and Inappropriate Speech subscales ($p<0.007$).

Conclusions: The findings of this small pilot study provide preliminary support for the hypothesis that the use of *MitoCocktail* has a therapeutic benefit, improving maladaptive behavior and speech that correlate with changes in mt function. Larger placebo-controlled trials are needed to demonstrate efficacy.

100 **166.100** Effect of Vitamin A Supplementation on Gut Microbiota in Children with Autism Spectrum Disorders - a Pilot Study

J. Liu[1,2]*, X. Liu*[1]*, Q. X. Xiong*[3]*, T. Yang*[2]*, T. Cui*[2]*, L. N. Hou*[1]*, X. Lai*[2]*, S. Liu*[2]*, M. Guo*[2]*, H. X. Liang*[2]*, Q. Cheng*[1]*, J. Chen*[2] *and T. Li*[2,4]*, (1)Department of Child Health Care, Children's Hospital of Chongqing Medical University, Chongqing, China, (2)Children's Nutrition Research Center, Children's Hospital of Chongqing Medical University, Chongqing, China, (3)Pediatric Department of Clinical Medicine, Dazhou Vocational and Technical College, Chongqing, China, (4)Department of Child Health Care, Children's hospital of Chongqing medical university, Chongqing, China*

Background: Dysbiosis of gut microbiota are commonly reported in autism spectrum disorder (ASD) and may contribute to behavioral impairment. Vitamin A (VA) plays a role in regulation of gut microbiota.
Objectives: This study was performed to investigate the role of VA in the changes of gut microbiota and changes of autism functions in children with ASD.

Methods: Sixty four, aged 1 to 8 years old children with ASD completed a 6-month follow-up study with VA intervention. High-performance liquid chromatography was used to assess plasma retinol levels. The Autism Behaviour Checklist (ABC), Childhood Autism Rating Scale (CARS) and Social Responsiveness Scale (SRS) were used to assess autism symptoms. CD38 and acid-related orphan receptor alpha (RORA) mRNA levels were used to assess autism-related biochemical indicators' changes. Evaluations of plasma retinol, ABC, CARS, SRS, CD38 and RORA mRNA levels were performed before and after 6 months of intervention in the 64 children. Illumina MiSeq for 16S rRNA genes was used to compare the differences in gut microbiota before and after 6 months of treatment in the subset 20 of the 64 children.

Results: After 6 months of intervention, plasma retinol, CD38 and RORA mRNA levels significantly increased (all $P < 0.05$); the scores of ABC, CARS and SRS scales showed no significant differences (all $P > 0.05$) in the 64 children. Meanwhile, the proportion of *Bacteroidetes*/*Bacteroidales* significantly increased and the proportion of *Bifidobacterium* significantly decreased in the subgroup of 20 (all false discovery rate (FDR) $q < 0.05$).

Conclusions: *Bacteroidetes*/*Bacteroidales* were the key taxa related to VA. Moreover, VA played a role in the changes in autism biomarkers. It remains unclear whether the VA concentration is associated with autism symptoms.

101 **166.101** Management of Children and Youth with Neurodevelopmental Disorders (NDDs) in Community Settings Prior to Referral to a Tertiary Psychopharmacology Clinic

I. Kara *and M. Penner, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background:

The use of second-generation antipsychotic (SGA) medications to alleviate symptoms of irritability and aggression in children with autism spectrum disorder (ASD) has increased considerably in the past decade. Although efficacious, SGAs can be associated with significant cardiometabolic and neurologic risks. Given the increased susceptibility of the paediatric population to these adverse effects (AEs), the Canadian Alliance for Monitoring Effectiveness and Safety of Antipsychotics in Children (CAMESA) developed a set of guidelines in 2011 to provide physicians with clinical and laboratory testing recommendations for SGA monitoring. In this study, we undertake the first evaluation of CAMESA Guideline uptake amongst physicians to ensure that children with neurodevelopment disorders (NDDs) taking SGAs are receiving the current standard of care.

Objectives:

Primary: To determine how the introduction of the CAMESA Guidelines has impacted the frequency of clinical and laboratory investigations to monitor for AEs in children/youth with NDDs treated with SGAs.

Secondary:

1. Describe the sample of children/youth referred to a tertiary psychopharmacology clinic;
2. Determine rates of SGA prescription in the community and duration of treatment.

Methods:

A retrospective chart review was undertaken to compare rates of clinical monitoring of children/youth with NDDs treated with SGAs and referred to the Holland Bloorview psychopharmacology clinic before (2008-2011) and after (2013-2016) publication of the CAMESA Guidelines. Children on SGAs were divided into three categories based on reports of clinical monitoring: (1) Any investigations complete, (2) No investigations complete, and (3) Not specified. A Fischer's exact test was used to detect a statistically significant change in monitoring rates between the two time periods. Thoroughness of monitoring by CAMESA standards was also assessed. Descriptive statistics were used to address secondary objectives.

Results:

A total of 285 charts were reviewed (n=135 pre-CAMESA, n=150 post-CAMESA). The average age of children referred to the clinic was 10.4 years (range 2-18), with ASD as the most prevalent diagnosis amongst the population. The most common reasons for referral were aggression and hyperactivity/impulsivity. Forty-one percent of referred children were started on an SGA before arriving at the clinic, and median treatment duration was 17 months at the time of the first clinic visit. There is a nonsignificant difference (p=0.62) in the proportion of children on SGAs (n=48 pre-CAMESA, n=70 post-CAMESA) monitored for AEs before and after publication of the guidelines. Monitoring rates pre- and post-CAMESA were 35% and 44%, respectively. Of the children monitored, only 33% in the pre-CAMESA period and 63% in the post-CAMESA period underwent comprehensive investigations. This again represents a nonsignificant difference (p=0.11) in thoroughness of monitoring between the two time periods.

Conclusions:

We aim to provide novel insight into SGA monitoring practices and emphasize the importance of health risk minimization when prescribing these medications. Given that SGA monitoring rates did not significantly improve after CAMESA guideline publication, and that less than half of children on SGAs underwent monitoring, we have identified a gap in standard of care provision. There is a need to undertake future studies to identify barriers to guideline uptake and implement appropriate interventions to address them.

102 **166.102** Medical Cannabinoids for Patients with Autistic Spectrum Disorder: Parents Perspective

O. E. Stolar[1]*, D. Barchel*[2]*, T. De-Haan*[2]*, T. Ziv-Baran*[3]*, N. Saban*[4]*, G. Koren*[5,6] *and M. Berkovitch*[2]*, (1)Autism Center, Assaf Harofeh Medical Center, zerifin, Israel, (2)Clinical Pharmacology and Toxicology Unit, Assaf Harofeh Medical Center, zerifin, Israel, (3)Department of Epidemiology and Preventive Medicine, School of Public Health, Tel-Aviv University, Tel-Aviv, Israel, (4)Tikun Olam LTD, Tel aviv, Israel, (5)Maccabi Institute for Research and Innovation, Tel Aviv, Israel, (6)Research Institute, Maccabi Healthcare Services, Tel Aviv, Israel*

Background:

Parents to patients with autistic spectrum disorder (ASD) are in an endless search for treatment modalities to alleviate symptoms such as aggression, self- injury, restlessness, sleep disturbances, hyperactivity and other co-occurring conditions. In this study we report, for the first time, the experience of parents who administer oral oil-based cannabinoid extract to their child with ASD.

Objectives:

The aim of this study was to analyze parent's perspective on the usefulness of oral oil-based cannabinoid extract on their child with ASD.

Methods:

Patients with diagnosis of ASD were administered oral drops of oil-based cannabinoid extract, after getting license from the Israeli Ministry of Health. The cannabinoid oil solution was prepared by "Tikkun Olam" company, at a concentration of 30% and 1/20 ratio of cannabidiol (CBD) and Δ9-tetrahydrocannabinol (THC). During the first meeting, parents were instructed by a nurse practitioner how to administer the preparation. Thereafter, a weekly follow-up telephone interview was performed, where issues on efficacy and safety of the preparation were discussed. These reports were analyzed using statistical methods.

Results:

The parents of 53 patients with ASD and a mean age of 11.6 (4-22) years participated in this study. Mean duration of treatment was 66 (30-588) days. Mean daily CBD and THC dose were 102 (1.5 – 315) and 8.4 (0.5-49.5) [mean (range)]mg, respectively. Hyperactivity symptoms, reported among

38 patients, were improved in 26 patients (68.4%), not changed in 11 cases (28.9%) and worsened in 1 patient. Self-injury and rage attacks, reported among 34 patients, was improved in 23 cases (67.7%), not improved in 8 cases (15.1%) and worsened in 3 cases (8.8%), after the administration of the cannabis. Sleep disturbances, described in 21 patients, were improved in 15 patients (71.4%), not changed in 5 cases (23.8%), and worsened in 1 case. Anxiety and mood changes, reported in 17 patients, were improved in 8 cases (47.1%), not changed in 5 patients (29.4%), and worsened in 4 patients (23.5%). When parents were asked on overall change of ASD symptoms, 43.1% described a significant improvement, 31.4% mentioned any improvement, 21.6% described no change of symptoms, and worsening of symptoms was reported in 2 cases (3.9%). 5 families discontinued treatment. The most common reported adverse effects were somnolence and nausea, which resolved spontaneously.

Conclusions:

This study showed that cannabidiol is probably effective in improving ASD co-occurring symptoms, with few and transient adverse effects, however, the long-term effect and safety of these preparations should be evaluated in further large-scale, controlled studies.

103 **166.103** Mental Health Issues in Children and Youth with Autism Spectrum Disorder: Medication Use, Side Effects, and Monitoring

C. A. McMorris[1], *J. K. Lake*[2], *B. L. Ncube*[2], *R. Balogh*[3] *and T. Williamson*[4], *(1)Werklund School of Education, University of Calgary, Calgary, AB, Canada, (2)Psychology, York University, Toronto, ON, Canada, (3)Faculty of Health, University of Ontario Institute of Technology, Oshawa, ON, Canada, (4)Community Health Sciences, University of Calgary, Calgary, AB, Canada*

Background: Mental health issues are common in children and youth with autism spectrum disorder (ASD), and can cause significant interference in daily functioning. Approximately 70% of children and adolescents with ASD experience mental health symptoms, and 40% to 50% of these individuals meet diagnostic criteria for 2 or more mental health conditions. Psychopharmacological interventions are often used to manage or treat these mental health issues in children and youth with ASD, with as many as 39% taking a psychotropic medication (e.g., antipsychotic, antidepressant, etc.). There is also a small number of children and youth with ASD, that are taking more than three medications at the same time (polypharmacy). Despite the high prevalence of medication use and polypharmacy in this population, little is known about the potential side effects of a) using certain medications to treat mental health issues in this population; and b) using multiple medications concurrently. Similarly, it is unknown the degree to which these medications are monitored or managed by primary care physicians, essential information to minimize and prevent side effects and negative outcomes.

Objectives: The goal of the present study is to examine the: 1) prevalence of mental health issues in children and adolescents with ASD; 2) rates of medication use to manage these issues (class of medication prescribed, rates of polypharmacy, and associated side effects), and 3) service utilization patterns among children and youth with ASD and medical monitoring completed by their primary care physicians.

Methods: The cross-sectional study will involve secondary data analysis from the Canadian Primary Care Sentinel Surveillance Network (CPCSSN) database. CPCSSN is a multi-disease electronic medical record surveillance system that includes information from electronic medical resources of participating primary care providers across Canada. To be included in the study cohort, individuals must: 1) have had an encounter with a CPCSSN sentinel between January 1st, 2012 and December 31, 2014; 2) had two or more physician visits with an ICD-9 diagnostic code of ASD; and 3) be 18 years of age or younger.

Using descriptive statistics, we will identify the prevalence of mental health issues in this cohort. Next, we will determine the number of individuals with ASD prescribed medication to manage/treat co-occurring mental or physical health issues, as well as the class of drugs prescribed, rates of polypharmacy, and side effects of medication use. To further understand medical monitoring of medications, we will examine the service utilization patterns of those individuals with ASD prescribed medications.

Results: Data is already collected and analysis will begin in December 2017.

Conclusions: Mental health issues are highly prevalent in children and youth with ASD, and psychopharmacology is frequently utilized to manage and treat these issues. Although psychopharmacological intervention is quite common in this population, it is unknown the degree to which medication use is monitored by their primary health care provider. Implications for the prevention of adverse effects in the context of evidence-based clinical practice for children and youth with ASD and comorbid mental health issues will also be discussed.

104 **166.104** Multisite Randomised Controlled Trial of Fluoxetine Versus Placebo for the Treatment of Restricted Repetitive and Stereotyped Behaviours in Children and Adolescents with Autism

C. Marraffa[1,2], *D. S. Reddihough*[1,2,3], *M. O'Sullivan*[2], *F. Orsini*[2], *K. Lee*[2,3], *A. Mouti*[4], *P. Hazell*[5], *M. Kohn*[5,6], *D. R. Dossetor*[5,7], *N. Silove*[5,8], *J. Granich*[9], *A. J. Whitehouse*[10], *J. Wray*[11] *and P. J. Santosh*[12], *(1)Royal Children's Hospital, Parkville, Australia, (2)Murdoch Childrens Research Institute, Melbourne, Australia, (3)Paediatrics, University of Melbourne, Melbourne, Australia, (4)Sydney Children's Hospital Network, Sydney, AUSTRALIA, (5)University of Sydney, Sydney, Australia, (6)Sydney Children's Hospital Network, Westmead/Westmead Hospital/Centre for Research into Adolescent's Health (CRASH), Sydney, Australia, (7)Department of Psychological Medicine, Children's Hospital at Westmead, Sydney Children's Hospital Network, Westmead, Australia, (8)Sydney Children's Hospital Network, Sydney, Australia, (9)Telethon Kids Institute, Telethon Kids Institute, Subiaco, Australia, (10)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (11)State Child Development Service, Western Australia Department of Health, Perth, Western Australia, Australia, (12)Child Psychiatry, Institute of Psychiatry, Psychology & Neurosciences, King's College London, London, United Kingdom*

Background: Selective Serotonin Reuptake Inhibitors (SSRIs) have been used widely in clinical practice for children and adolescents with an autism spectrum disorder. These drugs are often prescribed off- license in children with limited evidence regarding effectiveness and safety. Two Cochrane reviews of the use of SSRIs in autism have been published, the last one in 2013. Fluoxetine has only been studied in clinical trials with small numbers of children. As this is a commonly prescribed SSRI in Australia, this trial was important to undertake. The only SSRI to be studied with sufficient power to answer the question about safety and efficacy is citalopram.

Objectives: Maladaptive repetitive activities, stereotypies and inflexibility have an impact on children's participation and function in their daily life. An adequately powered randomized double blind placebo controlled trial to establish whether there is a reduction in these troublesome behaviours was commenced in 2010. Low dose fluoxetine was compared to placebo.

Other aims of the study included frequency and type of adverse events and exploration of whether there is a relationship between the individual’s serotonin transporter genotype and response to treatment.

Methods: Patients aged 7 years 6 months to 17 years with a diagnosis of autism spectrum disorder were recruited in three states of Australia. We included children on stimulant medication for co-morbid attention deficit hyperactivity disorder. Exclusion criteria included being on any other psychotropic medications within 6 weeks prior to study entry, alternative therapies such as St John's Wort or co-morbid significant medical conditions such as cardiac, liver or kidney disease or uncontrolled epilepsy.

Detailed medical history and physical examination, an ADI-R and a number of rating scales were administered. Eligible participants were randomized to either placebo or active fluoxetine groups with medication being titrated upwards over a four-week period. Responses to medication were monitored on a weekly/fortnightly basis using the Clinical Global Impressions Scale (CGI). The primary outcome measure was the Children's Yale-Brown Obsessive Compulsive Scale- Modified for Pervasive Developmental Disorders (CYBOCS-PDD) at 16 weeks. Secondary outcome measures included the Aberrant Behaviour Scale (ABC), Spence Children's Anxiety Scale Parent version (SCAS-P) and the Repetitive Behaviours Scale (RBS-R) also at 16 weeks. Participants were also invited to undergo genetic testing for SLC6A4 allele variants via a cheek swab.

The primary outcome (total score on the CYBOCS-PDD at 16 weeks) will be compared for the active and placebo groups using unadjusted linear regression. Secondary outcomes will also be compared using unadjusted linear regression with proportions compared using unadjusted logistic regression.

Results: 146 patients were recruited to the study over a 7 year period. Our statistical analysis is currently being completed and will be available soon.

Conclusions: This trial has sufficient power to finally answer the question about whether the use of fluoxetine is safe and effective for troublesome symptoms in children and adolescents with autism spectrum disorder.

105 **166.105** One-Year Retention Effects of Multiple-Dose Oxytocin Treatment on Repetitive and Restricted Behaviors, Social Responsiveness and Attachment: A Randomized, Placebo-Controlled Trial

S. Bernaerts[1], *C. Dillen*[2], *J. Steyaert*[3] *and K. Alaerts*[1], *(1)Rehabilitation Sciences, University of Leuven, KU Leuven, Leuven, Belgium, (2)Department of Rehabilitation Sciences, KU Leuven, Leuven, Belgium, (3)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium*

Background:

Autism spectrum disorders (ASDs) are characterized by difficulties in social communication and repetitive and restricted behaviors. To date, no pharmacological treatment exists targeting the core symptoms of ASD, yet the past years, the pharmacological use of the neuropeptide oxytocin (OT), has gained increasing interest from the research community to explore its potential for elevating the core social deficits in ASD.

With our double-blind randomized placebo-controlled trial with thirty-nine young adult men with ASD (21 OT/18 Placebo (PL)) we previously showed that a four-week intranasal OT treatment (24 IU/day) improved repetitive behaviors, feelings of attachment and social responsiveness until one month post-treatment (poster presented at IMFAR 2017 ID#23322).

Objectives:

We conducted secondary analyses of this randomized trial to explore whether treatment-related behavioral improvements observed one month post-treatment were maintained at 12-month follow-up.

Methods:

We included thirty-one participants that completed the four-week treatment (OT or PL) and a follow-up session 12 months post-treatment (17 OT/14 PL). Behavioral outcome measures that showed improvements one month post-treatment were assessed again at 12-month follow-up, including assessments of treatment-related changes in repetitive behavior (Repetitive Behavior Scale–Revised(RBS-R)); feelings of attachment (State Adult Attachment Scale(SAAM)); and social functioning (self-report and informant-based Social Responsiveness Scale(SRS)). For each treatment group, the maintenance of behavioral improvements (from baseline) was assessed and difference-in-difference analyses were performed to assess whether the observed improvements were significantly larger in the OT, compared to the PL group.

Results:

At 12-month follow-up, improvements in self-reported repetitive behaviors were shown to be maintained in the OT group (t(16)=-1.78,p=0.05), not in the PL group (t(12)=0.31,p=0.76)(Fig.1a). The effect was most pronounced for the subscale assessing 'compulsive behavior' (t(16)=-3.27,p=0.005). Also in terms of state attachment, participants who received OT still reported to feel less avoidant towards others until 12 months post-treatment (t(16)=-1.91,p=0.04), whereas no significant improvement was observed in the PL group (t(13)=0.18,p=0.86)(Fig.1b). Albeit significant in the OT group, direct comparison of these effects to the PL group showed that the observed improvements were only tentatively more pronounced in the OT, compared to the PL group (RBS: t(28)=-1.58, p=0.06, Cohen's d=0.58; SAAM: t(29)=-1.59, p=0.06, Cohen's d=0.83) (Fig.1) (note that for the compulsive behavior scale, the effect was specific to the OT treatment (t(28)=-2.26, p=0.02, Cohen's d=0.83)).

In terms of social responsiveness, participants of the OT group still showed a tentative improvement in social responsiveness at 12-month follow-up (OT: informant-report: t(11)=-1.50,p=0.08; self-report: t(15)=-1.47, p=0.08)) (PL: informant-based: t(10)=0.59,p=0.30; self-report: t(13)=0.33,p=0.17). However, none of these tentative improvements were specific to the OT treatment (informant-based: t(21)=-0.44,p=0.33; self-report: t(28)=-0.33, p=0.37)(Fig.1c-d).

Conclusions:

Based on a subsample of participants that underwent a 4-week OT treatment and completed a 12-month follow-up session, we show that the observed behavioral improvements in repetitive behavior and attachment avoidance tended to persist until 12 months post-treatment. The observed beneficial effect of OT on social functioning was no longer significant at 12-month follow-up. Our findings provide first indications that continual OT treatment (four weeks) can induce long-lasting behavioral changes in individuals with ASD that last until 12 months after the actual treatment.

106 **166.106** Oxytocin Administration during Delivery and the Autism Spectrum Disorder

T. Brahim[1], *N. Gaddour*[2], *S. Missaoui*[3] *and L. Gaha*[3], *(1)PSYCHIATRY, UNIVERSITY OF MONASTIR, MONASTIR, Tunisia, (2)University Hospital F. Bourguiba, Monastir, Tunisia, (3)University of Monastir, Monastir, Tunisia*

Background:
The hypothesis of mediation by the oxytocin administrated to mother during labor to autistic behaviors had been elaborated from the effect observed on animals, and from the knowledge in the molecular level. However, the studies are scares and inconclusive.

Objectives:

to explore the relationship between administrating Oxytocin during labor to mother and the developing of Autism spectrum disorder by the offspring.

Methods: it is a cross sectional study. We included the first 150 child with diagnosed with ASD starting from Marsh 2015 April 2016, in the outpatient unit of child and adolescent psychiatry in Monastir. The 150 child with typical development were randomly chosen from kinder garden in the same region. We excluded from both group children with sensory abnormalities due to physical condition. The ASD diagnosis was done based on the DSM-5 criteria, the CARS and the clinical evolution of the child during the period of the study. The exposition to oxytocin during labor was explored by a direct yes/no question to the mothers. Analytic analysis were done using Chi-Square test and ANOVA.

Results:

the mean age of the ASD group was 2.66 years ± 0.55 years with a sex ratio of 3.2. Thirty-nine mother from the ASD group (27.1%) had received oxytocin during labor while only nine from the control group (6%) was exposed. The Chi-square test found a significant statistical relationship: $p<0.001$. After controlling of obstetrical complication, the relationship still significant $p=0.041$ [95% I.C (0.009-0.208)].

Conclusions: it seems that there is a possible relation between the use of oxytocin during labor in mother and the developing of ASD by the child. Further research should be undertaken.

107 **166.107** Vitamin A Improves the Symptoms of Autism Spectrum Disorders and Decreases 5-Hydroxytryptamine (5-HT): A Pilot Study

M. Guo[1], *J. Zhu*[1], *T. Yang*[1], *X. Lai*[1], *X. Liu*[1], *J. Liu*[1], *J. Chen*[2] *and T. Li*[3], *(1)Children's Hospital of Chongqing Medical University, Chongqing, China, (2)Children's Nutrition Research, Children's Hospital of Chongqing Medical University, Chongqing, China, (3)Department of Child Health Care, Children's hospital of Chongqing medical university, Chongqing, China*

Background: Autism spectrum disorders (ASD) are complicated neurodevelopmental disorders. Many studies have demonstrated that children with autism have multiple nutritional deficiencies and increased serum 5-hydroxytryptamine (5-HT) levels. In our previous study, 77.9% of autistic children were found to have vitamin A deficiency, and the concentration of vitamin A was negatively associated with the CARS score.
Objectives: In the present study, we sought to test whether vitamin A supplementation could improve autistic symptoms and decrease serum 5-HT levels.

Methods: The DSM-V criteria and CARS score were used for symptom description and symptom assessment of the patients, respectively, before and after vitamin A supplementation (VAS). Serum retinol and 5-HT levels, mRNA levels of RAR α, β, and γ and TPH1 expression were detected in autistic children before and after VAS and in normal children.

Results: Serum retinol levels in children with ASD were significantly lower than in control children. Serum 5-HT levels in children with ASD were higher than in control children, which was correlated with symptom severity of children with autism. After VA supplementation, the children with ASD exhibited significant improvements in autism symptoms. Serum retinol concentrations of children with ASD were significantly increased, and serum 5-HT levels were decreased. Moreover, statistically significant change were observed in mRNA expression levels of RAR α, RAR γ and TPH1 after VAS compared to baseline.

Conclusions: This study suggested that VA supplementation may improve symptoms and reduce 5-HT levels in children with ASD, indicating that VA supplementation is a reasonable therapy at least for a subset of children with autism.

Poster Session
167 - Molecular and Cellular Biology
5:30 PM - 7:00 PM - Hall Grote Zaal

108 **167.108** An Autism-Associated Signaling Network Differentiates Glutamate Receptor Inputs at Cortical Glutamatergic Synapses

S. E. Smith[1], *E. Brown*[2] *and J. Lautz*[2], *(1)University of Washington, Seattle, WA, (2)Seattle Children's Research Institute, Seattle, WA*

Background: The genomic revolution has revealed hundreds of genetic risk alleles for autism. Clustering these genes into functional groups using a variety of methods- gene ontology terms, mRNA co-expression networks, protein-protein interaction databases- has revealed that many risk genes are expressed at the neural synapse. Other genes participate in coupling synaptic activity to downstream homeostatic responses. Together, these genetic data suggest that ASD-linked genes constitute a molecular pathway that translates synaptic input into homeostatic responses.
Objectives: To test the hypothesis that ASD-linked genes are involved in the translation of extracellular inputs into cellular responses.

Methods: We used Quantitative Multiplex co-Immunoprecipitation (QMI), a flow-cytometry-based method that allows the simultaneous monitoring of hundreds of dynamic protein-protein interactions. We developed an experimental system to monitor the interactions among a network of synaptic proteins that have been genetically linked to autism, including NMDA receptors, mGluRs, Shanks, SynGAP, PSD95, and others. We stimulate cultured neurons with various excitatory chemicals (glutamate, high potassium, NMDA, DHPG, ect), and monitor the acute changes in our selected protein interaction network.

Results: We find acute, dynamic rearrangement of the targeted protein interaction network in response to activity-inducing stimuli. The majority of changes were dissociative: previously described reductions in co-associated Homer-mGluR5 were detected, as well as many previously undescribed changes largely centered on the scaffolding molecule Homer. Using weighted correlation analysis, we identified two correlated modules of co-regulated interactions. Using agonist and antagonist stimulation, we found that one of the modules responded to NMDA stimulation, while the other responded to mGluR stimulation. Glutamate stimulation resulted in simultaneous activation of both modules.

Conclusions: ASD-linked genes form a network of co-associated proteins at the synapse that responds to synaptic activity by changing its pattern of interactions. Information about the nature of the synaptic input seems to be encoded in the protein interaction network, with a set of interactions responding to mGluR stimulation and another set responding to NMDA. We hypothesize that many different autism risk alleles could convergently disrupt network-scale translation of synaptic input into homeostatic cellular responses, which has implications for LTP vs. LTD coordination, E/I imbalance and sensory hyperactivity phenotypes.

109 **167.109** A Novel Cost-Effective Approach to Derivation of Induced Pluripotent Stem Cells from Epstein-Barr Virus Immortalized β-Lymphoblastoid Cell Lines

S. J. Walker[1], *D. Mack*[2] *and A. Wagoner*[1], *(1)Wake Forest University Health Sciences, Winston Salem, NC, (2)University of Washington, Seattle, WA*

Background: Autism spectrum disorders (ASD) may be viewed as a collection of heterogeneous disorders that are currently diagnosed based upon DSMV criteria. The vast phenotypic differences that can exist from individual to individual suggest that the underlying etiologies are complex and likely involve multiple genetic and environmental inputs. Given that the availability of tissue, especially brain tissue, from ASD patients is extremely limited, the development of alternative tools to investigate molecular and neurobiological mechanisms is critically important. One key resource for ASD research is immortalized lymphoblastoid cell line (LCLs) banks generated from proband and family member blood samples. Induced pluripotent stem cells (iPSC), derived from these LCLs, can be to generate patient-specific neurons for use in downstream mechanistic studies.

Objectives: The objective of this study was to use LCLs to generate iPSCs for the downstream study of neurobiological aspects of ASD. The availability of a streamlined, standardized, reproducible, cost-effective, and efficient approach will render the use of well-characterized LCLs for ASD research a gold standard.

Methods: We obtained LCLs from two males (proband and sibling) from the Autism Genetics Resource Exchange (AGRE) and two males (proband and parent) from the NIMH Repository and Genomics Resource (Phelan-McDermid Syndrome [PMDS] patients). IPSCs were generated from all 4 EBV-LCLs by transfection with Epi5 Episomal iPSC reprogramming plasmids. For the first 7 days after transfection, cells were cultured on Matrigel-coated plates in N2B27 based medium. After 7 days, the reprogramming cells were cultured in Essential-8 medium until ready for passaging. PCR, RT-PCR, immunocytochemistry, and a novel assay, the Taqman® human pluripotent stem cell Scorecard™ Panel were used to fully validate endogenous pluripotency of all iPSC clones generated.

Results: IPSCs, generated via transfection with Epi5 Episomal iPSC reprogramming plasmids, were apparent as early as Day 8 post-transfection and ready for propagation as early as Day 18. IPSCs derived from LCLs obtained from the AGRE were propagated to passage 23 first, followed by the PMDS lines, which are currently at passage 10. Two clonal iSPC lines per original LCL were evaluated for normal karyotype, expression of pluripotency markers, and loss of OriP/EBNA-1 expression vectors. We have confirmed these iPSC clones are plasmid-free and EBV-free. Three of four clones had the expected expression of cell-autonomous pluripotency genes and normal karyotype. All clonal lines were allowed to spontaneously differentiate into embryoid bodies and were assayed for pluripotency markers and germline-specific transcripts using the Taqman® human pluripotent stem cell Scorecard™ Panel. Results indicated that all four iPSC lines are suitable for neuronal differentiation protocols.

Conclusions: This protocol describes a reproducible method to efficiently generate iPSCs with standardized and cost-effective reagents. IPSCs produced following this improved protocol can be used to generate and evaluate novel *in vitro* models to study a plethora of previously inaccessible neuronal cell types that underlie pathological mechanisms in ASD.

110 **167.110** Innate Versus Adaptive Immune Response Pathways in Peripheral Blood from ASD Children with Ileocolonic Inflammation

S. J. Walker[1] *and A. Krigsman*[2], *(1)Wake Forest University Health Sciences, Winston Salem, NC, (2)Pediatric Gastroenterology Resources of New York and Texas, Austin, TX*

Background: Gastrointestinal symptoms are a common co-occurring medical issue in ASD children. GI mucosal inflammatory infiltrates of both the small and large intestine have been noted in the setting of GI-symptomatic ASD and represent a potential etiology for many of the observed GI symptoms. Anecdotal and published reports of behavioral and cognitive improvement upon treatment of ASD-associated GI inflammatory disease supports the plausibility of a GI association for at least some of ASD behavioral and cognitive symptoms. We have previously described unique GI mucosal biomarkers specific for ASD-associated ileocolitis. It is not yet known whether these unique biomarkers are also present in the blood of these children. Identification of a validated blood-based biomarker of ASD-associated ileocolitis would allow for earlier identification of co-morbid GI disease and earlier GI intervention in affected patients. Moreover, it would provide insight into the relevant genes and biologic pathways in ASD-ileocolitis.

Objectives: The goal of these studies is to evaluate blood-based gene expression In GI-symptomatic ASD children with demonstrated histologic ileocolitis to identify the genes and biological pathways most affected.

Methods: The study cohort was comprised of whole blood from 22 ASD children undergoing clinically-indicated ileocolonoscopy for chronic GI symptoms, and 24 non-ASD (typically developing, TD) children undergoing ileocolonoscopy for a variety of GI symptoms. All ASD children had histologic inflammation of the ileum, colon, or both. The TD “controls” used for this study were selected based on absence of histologic inflammation anywhere in the GI tract and absence of a neurodevelopmental disorder. Differential gene expression in peripheral blood from ASD children (with ileocolitis) compared to TD children (without ileocolitis) was examined to identify differentially expressed transcripts that may serve as a proxy for GI inflammation.

Results: We reported in an earlier study (Walker *et al.*, PlosOne, 2013) that inflamed ileocolonic biopsy tissue from GI-symptomatic ASD children has a gene expression profile that overlaps with known inflammatory bowel disease. These earlier findings were apparent in inflamed ileocolonic mucosal tissue in this second cohort as well. In addition, we found that there is significant differential gene expression in peripheral blood of children with ASD and ileocolitis compared to TD children without GI inflammation. Two key immune-related pathways that were up-regulated in the blood of ASD cases are B cell receptor signaling and the Wnt signaling pathway, both important components of the *adaptive* immune response. In contrast, some of the key biological pathways that are coordinately down-regulated in the blood of the ASD (with inflammation) group are NOD-like receptor signaling, hematopoietic cell lineage, and Toll-like receptor signaling. Each of these pathways is important for pathogen recognition and for generating the host *innate* immune response.

Conclusions: Gene expression in peripheral blood from ASD children with ileocolitis reveals a down-regulation of the host defense mechanism (innate immune response) together with an up-regulation of pathways that constitute the adaptive immune response, a pattern seen in other inflammatory bowel diseases. Studies are ongoing to validate these findings in additional samples.

111 **167.111** Abnormal Crosstalk between Reelin-Dab1 and mTORC1 Signaling Pathways in Nonsyndromic Autism Spectrum Disorder

S. M. Sánchez-Sánchez[1], J. Magdalon[1], K. Griesi-Oliveira[1], V. Abreu[1], M. R. Passos-Bueno[2] and ***A. L. Sertie***[1]*, (1)Centro de Pesquisa Experimental, Hospital Israelita Albert Einstein, Sao Paulo, Brazil, (2)Centro de Pesquisas Sobre o Genoma Humano e Células-Tronco, Instituto de Biociências, Universidade de São Paulo, Sao Paulo, Brazil*

Background: Reelin-Dab1 and mTORC1 signaling pathways controls neuronal migration, layer formation, neurite outgrowth and plasticity of synapses in both the developing and the adult mammalian brain. Abnormal interplay between mTORC1- and Reelin/Dab1-signaling pathways has been implicated in the pathogenesis of syndromic Autism Spectrum Disorder (ASD). Recently, by using whole-exome sequencing in a subgroup of nonsyndromic ASD patients - in whom we found mTORC1 signaling hyperfunction, we identified rare and potentially damaging compound heterozygous variants in the gene encoding Reelin (*RELN*) in one patient (called as F2688). Although evidence from previous studies suggests that heterozygous loss-of-function variants in *RELN* can contribute to ASD, the molecular and cellular effects of *RELN* mutations identified in ASD patients are still poorly explored.

Objectives: To verify whether the variants we identified in *RELN* are functional and whether any crosstalk between Reelin-Dab1 and mTORC1 signaling pathways exists and potentiates neuropathological abnormalities.

Methods: We have generated iPSC-derived neural progenitor cells (NPCs) from patient F2688, from 5 idiopathic ASD patients (without *RELN* gene mutations) and from 5 control individuals. The gene expression levels of *RELN* were analyzed by RT-qPCR. The levels of Reelin protein in both whole NPC lysates and supernatants were analyzed by ELISA. Reelin and mTORC1 signal transduction was analyzed by RT-qPCR and western blot. Analysis of cell migration was performed using the Incucyte scratch wound cell invasion assay. F2688-derived NPCs were treated with rapamycin in order to verify whether an abnormal crosstalk exists between mTORC1 and Reelin-Dab1 pathways.

Results: We found that F2688-derived NPCs show impaired secretion of Reelin, impaired Reelin-Dab1 signaling (reduced levels of pDab1, pFyn and pSrc; and increased levels of total Dab1), hyperfunctional mTORC1 signaling (increased levels of *RPS6K1*, *RPS6*, pmTORC1 and pRPS6) and abnormal migration. Also, treatment of F2688-derived NPCs with rapamycin restored impaired Reelin-Dab1 signaling and migration.

Conclusions: Our results suggest that the variants we identified in the *RELN* gene are functionally relevant and suggest, for the first time, a dysfunctional interplay between Reelin-Dab1 and mTORC1 signaling pathways in nonsyndromic ASD.

112 **167.112** Complement System Dysregulation: A Contributing Factor for Autism Spectrum Disorder?

J. Magdalon[1], J. S. de Souza[1], K. Griesi-Oliveira[1], A. L. Teles e Silva[1], M. R. Passos-Bueno[2] and ***A. L. Sertie***[1]*, (1)Centro de Pesquisa Experimental, Hospital Israelita Albert Einstein, Sao Paulo, Brazil, (2)Centro de Pesquisas Sobre o Genoma Humano e Células-Tronco, Instituto de Biociências, Universidade de São Paulo, Sao Paulo, Brazil*

Background: Accumulating evidence points toward an important role of the complement system, a critical arm of the innate immune response, in normal brain development and connectivity. Complement cascade components expressed by neuronal and glial cells, such as C1q and C3, have been implicated in developmental pruning of rodent central nervous system synapses. Also, complement C3 fragments and their receptors were shown to positively regulate neurogenesis and neuronal migration in mice models. There is some evidence to suggest that improper complement activation can contribute to Autism Spectrum Disorder (ASD). Association between C4B null alleles and ASD was reported. Increased levels of C1q, complement factor H related protein, C3 and C3 fragments, as well as enhanced activity of complement factor I were found in the plasma of ASD patients. However, the involvement of the complement system in human neurodevelopment and in ASD is still poorly explored and understood.

Objectives: To compare the gene expression patterns of the main components of classical, lectin and alternative complement pathways in neural progenitor cells (NPCs), neurons and astrocytes derived from ASD patients and controls.

Methods: We have generated iPSC-derived NPCs, neurons and astrocytes from 7 patients with idiopathic ASD and from 4 control individuals. The expression levels of lineage specific markers were analyzed by immunofluorescence and RT-qPCR (TaqMan assays). The gene expression levels of complement cascade components (*C1QA*, *C1R*, *C1S*, *SERPING1*, *C3*, *C3AR1*, *C5*, *C5AR1*, *CD59*, *C7*, *C9*, *MBL2*, *MASP1*, *MASP2*, *CFB*, *CFD*, *CFH*) were analyzed by RT-qPCR (TaqMan assays). The mRNA expression levels of the target genes were normalized to the expression of the housekeeping genes *GAPDH*, *HMBS* and *HPRT1***.**

Results: We observed that: i) iPSCs were successfully differentiated into NPCs, neurons and astrocytes; ii) the gene expression levels of most complement components were higher in neurons than in NPCs and astrocytes; iii) ASD-derived NPCs showed significantly increased levels of *C1R* and *C7*, and significantly decreased levels of *MASP2* compared to control NPCs; iv) ASD-derived neurons showed significantly increased levels of *C3AR1* compared to control neurons; v) ASD-derived astrocytes showed significantly decreased levels of *C4* compared to control astrocytes.

Conclusions: Our results suggest that iPSC-derived neuronal and astroglial cells express a complete set of major complement components and therefore, constitute an interesting model to investigate the roles of the complement system in human neurogenesis and in ASD. Also, although further characterization and mechanistic investigation are required, our results point to abnormal complement regulation in ASD.

113 **167.113** Analysis of the Glutathione Cycle: A Comparison between Children with Autism, Healthy Controls, and Unaffected Siblings

S. C. Boland[1]*, E. K. Lecarie[1], M. B. Klein[2] and R. J. Jou[3], (1)Yale Child Study Center, New Haven, CT, (2)BioElectron Technology Corporation, Mountain View, CA, (3)Yale University, New Haven, CT*

Background:

Previous studies have demonstrated biochemical evidence of oxidative stress in children with autism spectrum disorder (ASD), including a subset with co-morbid mitochondrial dysfunction. Increased oxidative stress results in depletion of the endogenous cellular sulfur-hydride antioxidant system, including reduced glutathione and cysteine. Depletion of these sulfur-hydride metabolites leads to free radical-mediated cell injury and death, as well as other impairments in cellular function. Comparing the levels of key sulfur-hydride metabolites in children with and without ASD may improve understanding of underlying biochemistry and identification of candidate biomarkers and therapeutic targets.

Objectives: To compare plasma levels of key antioxidant metabolites in children with ASD to their unaffected siblings (UAS) and unrelated typically developing (TD) children.

Methods: This study consisted of 31 children between the ages of 4 and 12 years: 14 ASD (mean age = 7.79 ±2.91 years; 10 boys and 4 girls), 12 TD non-siblings (mean age = 8.08 ±2.35 years; 7 boys and 5 girls) and 5 UAS of proband participants (mean age = 7.40 ±2.88 years; 2 boys and 3 girls). Blood samples collected by venipuncture were separated into plasma and subsequently analyzed using a mass spectrometer and microflow, reversed-phase chromatography. Biomarker quantitation was performed using Multiple Reaction Monitoring (NRM) mode acquisition and with the aid of stable isotopically-labeled standards. The analytes evaluated include reduced cysteine (CysB), reduced glutathione (GSH), thiosulfate (TSH), cysteine persulfide (CyssB), glutathione persulfide (GSSB), ornithine, 5-oxoproline (PGA), and methionine. A total of the main sulfur species included CysB, GSH, TSH, CyssB, and GSSB. The following clinical data were collected: Social Responsiveness Scale (SRS), Vineland Adaptive Behavior Scales (VABS), and Differential Ability Scales (DAS). ASD diagnoses were confirmed using Autism Diagnostic Interview (ADI), Autism Diagnostic Observation Schedule (ADOS), and Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision. Correlation analyses between analyte levels and clinical measurements were also performed.

Results: A one-way ANOVA revealed significant differences between ASD and TD groups for CysB, CyssB, GSSB, ornithine and pooled sulfur analytes while differences in GSH approached significance. Significant differences between TD and UAS groups were found in PGA and ornithine. No differences were found between ASD and UAS groups. Across all subscales of the SRS, DAS (full-scale IQ), and all subdomains of the VABS, the ASD group significantly differed from both TD and UAS groups. No significant differences were found between the TD and UAS groups. There was a significant correlation between SRS and CysB, CyssB, GSSB, and pooled analytes.

Conclusions: This preliminary study demonstrates a differential biosignature across key components of the endogenous sulfur antioxidant system in children with ASD relative to TD children, suggesting that oxidative stress-associated sulfur depletion may play a role in the pathophysiology of autism. This is also supported by the significant negative correlations between SRS scores and analyte concentrations. However, the lack of significant differences between ASD and UAS groups in analyte levels suggests metabolite differences are also influenced by genetic factors and not solely driven by ASD symptomatology.

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167.114 Autism Human Neural Precursor Cells (NPCs) Display Common As Well As Personalized Developmental and Molecular Phenotypes

S. Prem[1]*, M. Williams*[1]*, R. J. Connacher*[2]*, B. Dev*[3]*, C. Peng*[3]*, M. Mehta*[4]*, P. G. Matteson*[4]*, J. H. Millonig*[4] *and E. DiCicco-Bloom*[1]*, (1)Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, (2)Rutgers University- New Jersey Medical School, Piscataway, NJ, (3)Rutgers University, New Brunswick, NJ, (4)Center for Advanced Biotechnology and Medicine, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ*

Background:

Autism spectrum disorders (ASD) are neurodevelopmental disorders characterized by impaired social interaction and communication and the presence of repetitive behaviors. Human neuropathological and MRI studies of ASD reveal changes in brain size, neuronal-connectivity, and brain-architecture, which suggest dysregulation of multiple developmental processes. However, inability to directly study human neurons, limitations of animal-models, and disorder heterogeneity have thwarted discovery of underlying mechanisms. Now, induced- pluripotent-stem-cell (iPSC) technology has allowed the generation of neural precursor cells (NPCs) from individuals with neuropsychiatric disorders thereby allowing study of human development and disease. Using iPSCs we have generated NPCs from 8 boys with severe idiopathic autism (I-ASD) and their unaffected-brothers (Sib) as controls.

Objectives:

Our goals are to study developmental processes such as neurite-outgrowth and cell-migration in our ASD patient-derived NPCs. Our studies employ developmentally-relevant extracellular-factors (EFs) such as PACAP, 5-HT, and NGF to uncover both common and personalized developmental abnormalities. We also aim to identify signaling-pathway defects that contribute to the developmental abnormalities and could serve as targets for personalized medicine.

Methods:

NPCs were derived from 3 iPSC clones per individual. Two separate NPC derivations were conducted per clone. At least 2 experiments were conducted per NPC derivation per clone (minimum 12 expts/individual/assay).

<u>Neurite Assay:</u> 48 hrs after plating, the percentage of cells with neurites≥2 cell diameters were counted blind in 1 cm rows

<u>Neurosphere Migration:</u> Neurospheres generated from NPCs were plated for 48h on Matrigel. Migration = total neurosphere area-inner mass area.

Results:

Our studies indicate common reductions in neurite-outgrowth and cell-migration in two I-ASD individuals. Additionally, while Sib-NPCs exhibited 2-fold increases in neurite-outgrowth in response to PACAP, NGF, and 5-HT, both I-ASD NPCs failed to increase neurites in response to these EFs. Preliminary studies in I-ASD-NPCs from a 3rd patient also showed similar defects in EF response. Likewise, Sib neurospheres exhibited increased migration with PACAP yet I-ASD neurospheres were unresponsive. I-ASD NPCs in Family-1, which did unresponsive to PACAP, exhibited 4x-lower PACAP induced P-CREB levels compared to Sib-NPCs. Conversely, increasing I-ASD P-CREB levels using db-cAMP restored neurite-outgrowth and migration to levels of PACAP-treated Sib-NPCs. Surprisingly, Family-2 ASD-NPCs exhibited different signaling abnormalities. We next compared these I-ASD profiles to a genetically-defined subtype of ASD (three 16p11.2-deletion patients). Remarkably, both neurite-outgrowth and migration were also reduced, however, all three 16p11.2-del NPCs responded normally to EFs.

Conclusions:

Using iPSC technology, our studies identified common defects in neurite-outgrowth and migration in two distinct subtypes of ASD (I-ASD; 16p11.2-Del-ASD), suggesting the disorder may have a common underlying mechanism. Interestingly, while NPCs from I-ASD patients failed to respond to EFs, 16p11.2-del-ASD NPCs had typical EF responses, suggesting there are autism subtype-based differences. Within the I-ASD subtype, both NPCs showed defects in developmental phenotypes yet, only one depended on PKA pathway dysfunction, suggesting that common abnormalities may reflect personalized causative mechanisms. Thus, our studies illustrate the benefit of studying ASDs using iPSC techniques to obtain a personalized understanding of both common and unique neurodevelopmental abnormalities in affected individuals. Ultimately, this information could help develop personalized treatments for ASD.

115 **167.115** Characterizing PTGER4 As a Target Gene of Autism Protein E6AP

C. Amadei[1], *J. El Hokayem*[2], *Z. Nawaz*[3] *and M. Alessandri*[4], *(1)University of Miami Miller School of Medicine, Miami, FL, (2)John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL, (3)Biochemistry and Molecular Biology, University of Miami Miller School of Medicine, Miami, FL, (4)University of Miami, Coral Gables, FL*

Background: ASD has been found to be associated with duplication or triplication of the UBE3A gene, which encodes for E6-associated protein (E6AP, an E3 ubiquitin ligase and transcriptional coactivator). Mice with three copies of UBE3A exhibit core ASD features and humans with Dup15q share many symptoms with ASD. However, the few E6AP ubiquitination substrates found do not explain ASD pathology. Our lab has identified and characterized E6AP as a coactivator of steroid hormone receptor signaling. Estrogens (E2) affect learning, memory and many other brain processes via estrogen receptors, which are transcription factors.

Objectives: This study tests the hypothesis that deregulation of E6AP-mediated steroid hormone receptor transcriptional signaling in the brain leads to the development of ASD. The project aims are to identify steroid hormone-dependent E6AP target genes in neurons and to study the role of these target genes in the pathogenesis of ASD. Identification of new molecular pathways that are transcriptionally regulated by E6AP will broaden our understanding of ASD.

Methods: Potential E6AP target genes were identified by microarray of MCF-7 breast cancer cells. Cells from the mouse neuroblastoma Neuro2a cell line were cultured. Cells were transfected with E6AP or had E6AP knocked down by siRNA and then were treated with physiologically relevant doses of estrogen, the estrogen receptor antagonist tamoxifen, or vehicle. Assays included western blot, co-immunoprecipitation, qRT-PCR, and microscopy.

Results: 1) E6-AP and ER colocalize in mouse HPC neurons. 2) E6-AP and ERα translocate to the nucleus of Neuro2a (N2a) cells upon E2 treatment. 3) E6-AP and ERα complex in N2a. 4) The learning and memory gene for prostaglandin E receptor 4, PTGER4, is an E6AP-dependent target gene that is downregulated in the presence of E6AP or estrogen.

Conclusions: We have identified a memory and learning gene that is regulated by E6AP and E2-dependent: PTGER4. This is evidence that PTGER4 may be altered in ASD, leading to learning and memory symptoms. PTGER4 allows phosphorylation of glycogen synthase kinase 3 (GSK3). GSK3 has a large role in apoptosis and has been implicated in neuropsychiatric disorders such as Alzheimer's disease and bipolar disorder. Given that GSK3 is amyloidogenic and ASD patients exhibit increased beta amyloid deposition, increased E6AP leading to decreased PTGER4 may lead to decreased inhibitory phosphorylation of GSK3. In a case study, the GSK3 inhibitor ketamine actually improved an adult ASD patient's symptoms, supporting this theory. Further experiments will be necessary to confirm these promising findings.

116 **167.116** Comparative Expression Analysis of Autism-Associated Cadherin Superfamily Members

J. A. Frei, G. J. Blatt and ***Y. C. Lin****, Hussman Institute for Autism, Baltimore, MD*

Background:

The cadherin superfamily is a group of cell adhesion molecules containing more than one hundred proteins, including classical cadherins type I and II, protocadherins, and atypical cadherins. N-cadherin functions throughout development of nervous system including neurite outgrowth, axon guidance, synaptogenesis, spine morphogenesis and plasticity. Although there is only little known about the function of other cadherins they have been strongly implicated in autism. A genome wide association study identified the classical cadherin type II CDH8 and CDH11, the protocadherin PCDH9 and the atypical cadherin FAT1 as candidate risk genes. This suggests that cadherin signaling pathways could be disrupted and may display increased vulnerability in autism.

Objectives:

As a first step toward understanding the central role of cadherins in the etiology of autism, we focused on CDH8, CDH11, PCDH9 and FAT1 and investigated their expression patterns in specific brain areas, cell types and their subcellular localization during development. This comparative expression analysis could provide novel insights into common and distinct functions of these cadherins in neural circuit formation. We further determined the expression of these cadherins in human postmortem brain tissues of control and autism individuals to evaluate whether cadherin levels are commonly altered in autism.

Methods:

Western blot analyses was performed to evaluate the protein expression of CDH8, CDH11, PCDH9 and FAT1 in the developing mouse brain of embryonic day 14, postnatal day 0, P7, P14 and P21 and adult as well as in different brain areas. To analyze the cellular localization, enrichment of cadherins in synaptic plasma membrane and postsynaptic densities was analyzed. Additionally, primary neurons from different brain regions were cultured for 14 days *in vitro* and co-stained for cadherins and neuronal marker MAP2 or synaptic markers PSD95, Synapsin1 and GAT1.

Results:

Temporal expression analysis in the developing mouse brain revealed increased expression of CDH8, CDH11, PCDH9 and FAT1 at P7 and P14 with an additional peak of FAT1 expression at E14. Analysis of specific brain areas showed that CDH8, CDH11 and PCDH9 were prominently expressed in the cortex, hippocampus and thalamus/striatum whereas FAT1 expression was restricted to the cerebellum. Additionally, CDH8, CDH11 and FAT1 localized to MAP2-positive dendrites and were enriched in synaptic plasma membrane and post-synaptic density. Moreover, CDH8 and CDH11 were associated with excitatory and inhibitory synaptic markers. In addition, CDH8 expression was elevated in CDH11-kockout brains, indicating at least partially redundant functions of those type II classical cadherins. Preliminary results of CDH8, CDH11 and PCDH9 expression in postmortem cingulate cortices of control and autism individuals suggest an altered expression profile of cadherins in autism brains.

Conclusions:

Our results revealed similar overall expression profiles among CDH8, CDH11 and PCDH9, with a distinct expression pattern for FAT1. The temporal expression and the subcellular localization of cadherins were consistent with the proposed functions in synaptogenesis. Taken together, the present study highlights that cadherins of different subfamilies are expressed in a developmental time window and in brain areas implicated as vulnerable in autism, thus strengthening the hypothesis of a central role of cadherins in this neurodevelopmental condition.

117 **167.117** Differential Methylation of Metabolic Mitochondrial Pathways in a South African Autism Cohort

S. Stathopoulos[1], *A. Nell*[1], *R. Gaujoux*[2] *and C. O'Ryan*[1], *(1)Molecular and Cell Biology, University of Cape Town, Cape Town, South Africa,* *(2)Cytoreason, Tel Aviv, Israel*

Background:

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterised by great phenotypic heterogeneity and overlapping co-morbidities. The genetic architecture of ASD is complex, with 100's of risk genes cumulatively contributing to the aetiology of ASD. Increasingly, recent findings support a role for epigenetic mechanisms in ASD, with DNA methylation being associated with the disorder.

Objectives:

We investigate whole-genome methylation patterns in a cohort of South African children. Differentially methylated genes are analysed to identify biologically relevant pathways. We correlate differential methylation from the epigenome-wide methylation assay with quantitative methylation and qPCR assays of candidate differentially methylated genes in both the discovery and replication cohorts.

Methods:

South African boys with ASD and boys with typical developmental profile (6 - 11 years old) were recruited. All participants were assessed using the Autism Diagnostic Observation Schedule-2, ADOS-2. DNA and RNA were extracted from study participants using buccal cells. We performed a whole-genome DNA methylation screen using Illumina 450K Human Methylation Array. Differentially methylated loci associated with ASD were assessed using a pathway-analysis approach. We validate our top differentially methylated gene from the whole epigenome assay, the stomatin-like protein 2 (STOML2) gene, using a quantitative pyrosequencing assay for DNA methylation, as well as a qPCR approach to quantify mRNA.

Results:

We identified over 900 differentially methylated genes (p-value ≤ 0.05) associated with ASD. Pathway analysis revealed canonical Metabolic, Mitochondrial and Autophagy pathways as being significantly enriched in our cohort. We correlate differential methylation patterns of STOML2 from the epigenome-wide assay, with a quantitate methylation measure, DNA pyrosequencing, as well RNA expression levels. The quantitative data supports a role for differential methylation in perturbating mitochondrial pathways in ASD individuals.

Conclusions:

This study is the first to investigate whole-epigenome profiles of DNA methylation in a South African cohort of children with ASD. We find that methylation patterns differ significantly between ASD and typically developing children at a large number of genes which converge on mitochondrial dysfuntion. We validate differential methylation and transcription levels of our top gene, STOML2, which is central to mitochondrial stress and the accumulation of reactive oxygen species. Our results suport a central role for mitochondrail function in ASD aetiology. As there are a number of pre-existing therapeutic options already in use for mitochondrial dysfunction, our results have important implications for re-examining exsiting therapeutic treatment of ASD symptomology.

118 **167.118** Elevation of a Putative Bacterial Metabolite in a Pediatric ASD Population

B. Needham[1], S. Mazmanian[1], M. Conrad[2], ***S. Rao***[3] *and S. Campbell[2], (1)Division of Biology & Biological Engineering, California Institute of Technology, Pasadena, CA, (2)Axial Biotherapeutics, Inc., Boston, MA, (3)Axial Biotherapeutics, Boston, MA*

Background:

It was previously shown that changes in the gut microbiome (dysbiosis) and increased intestinal permeability (IP) are present in the "maternal immune activation" (MIA) mouse model of autism spectrum disorder (ASD), a model that recapitulates key features of the autism phenotype, including increased anxiety, stereotypic behaviors, and decreased vocalizations and social behaviors. In addition, elevated levels of the putative bacterial metabolite 4-ethylphenylsulfate (4-EPS) were found by untargeted serum metabolomics in this model vs. controls, and this elevation was thought to be driven by dysbiosis and/or increased IP. Oral treatment with *Bacteroides fragilis***,** a human commensal gut bacterial species, resulted in restoration of gut microbial profiles, decreased IP, and markedly reduced serum concentrations of 4-EPS. Several tryptophan metabolites were also altered in the MIA model, and their levels were normalized by *B. fragilis* treatment. Remarkably, this treatment was also observed to increase vocalization, reduce anxiety-like features and correct stereotyped behaviors. Finally, causality between 4-EPS and anxiety-like behaviors was established by parenterally administering 4-EPS to naïve mice and demonstrating that such treatment resulted in the development of an anxiety phenotype similar to that observed in the MIA model.

Objectives:

The objectives of the current study was to extend the preclinical results by determining whether elevations in serum 4-EPS can also be found in children diagnosed with ASD.

Methods:

- A targeted analysis of 4-EPS and several other putative biomarkers was performed on a cohort of 50 subjects and controls via ultra-performance liquid chromatography-tandem mass spectrometry.
- A non-targeted analysis encompassing ~1,000 analytes was performed on 129 children aged 3-12yo diagnosed with ASD and 101 age matched controls (cohorts from the "Childhood Autism Risks from Genetics and the Environment" study ongoing at the Univ. of California Davis)

Results:

In the targeted analysis in 50 pediatric subjects, elevated serum 4-EPS concentrations were found in the ASD children vs. controls. This finding was replicated in the non-targeted serum metabolomics study involving 230 children, wherein the mean concentration of 4-EPS was found to be elevated by ~6-fold in the ASD vs. control children. Several tryptophan metabolites were also altered, including indolelactate, which was one of the metabolites most strongly associated with ASD in the non-targeted analysis.

Conclusions:

4-EPS concentrations, as well as several other microbial products, were found to be elevated in children with ASD vs. healthy controls in replicate analyses. The impact of this elevation on behavior and the impact of treatment with *B. fragilis* will be the subject of subsequent studies.

119 **167.119** Estimation and Comparison of Serum and Salivary Immunoglobulin G4 Levels in Children with Autism Spectrum Disorders:

A Case Control Study from South India

B. S. S. Kalal[1,2], *S. S. Bhat*[3], *V. KM*[4], *A. Kakunje*[5], *S. KS*[6], *R. PD*[2], *J. Chandra*[7], *V. S. Bhat*[8] *and N. I*[3], *(1)Department of Biochemistry, Yenepoya University, Mangaluru, India, (2)Yenepoya Research Centre, Yenepoya University, Mangaluru, India, (3)Department of Paedodontics, Yenepoya Dental College, Yenepoya University, Mangaluru, India, (4)Department of Oral Medicine & Radiology, Yenepoya Dental College, Yenepoya University, Mangaluru, India, (5)Department of Psychiatry, Yenepoya Medical College, Yenepoya University, Mangaluru, India, (6)Department of Pediatrics, Yenepoya Medical College, Yenepoya University, Mangaluru, India, (7)Department of Oral and maxillofacial Surgery, Yenepoya Dental College, Yenepoya University, Mangaluru, India, (8)Department of Prosthodontics, Yenepoya Dental College, Yenepoya University, Mangaluru, India*

Background: Autism spectrum disorders (ASD) are heterogeneous group of neurodevelopmental disorders with complex etiologies. Accumulating evidence suggests the role of deregulated immune components and mediators that may play role in the pathophysiology of autism. Some of the previous reports have suggested the abnormal immunoglobulin (Ig) levels in the circulation of individuals with ASD.
Objectives: To estimate and compare the serum and salivary immunoglobulin G4 (IgG4) levels in children with autism and typically developing control children (TD) from South India.

Methods: Case-control study. Children of special schools and those visiting hospitals in Mangaluru and neighbouring districts of Karnataka and Kerala were recruited. We collected blood and saliva from children with ASD (*n*=55), and age-matched typically developing (TD) controls (*n*=60). Childhood Autism Rating Scale (CARS) used to identify ASD children. Samples were assayed in duplicate using the commercial enzyme-linked immunosorbent assay (ELISA) kit (Human IgG4 Ready-Set-Go Kit, eBioscience, San Diego, CA, USA; #88-50590).

Results: The mean ages of autistic children were 10.7 year (SD± 4.2) and healthy children 11.2 year (SD± 2.7). The CARS assessment of children with ASD showed that 60% were under severe autism while 40% of the cases were mild to moderate autism. Routine laboratory tests showed no significant difference among two groups. Children with ASD had significantly higher levels of serum and salivary IgG4 (44.80 ±20.76 and 0.89 ±0.69 mg/dL) as compared to the TD (34.90 ± 20.19; *p*=0.021 and 0.56 ± 0.38 mg/dL; *p*= 0.024). Both serum and salivary IgG4 levels were positively correlated in ASD (R= 0.3729: *p*= 0.005), TD (R= 0.4644; *p*=0.0003).

Conclusions: Children with ASD have significantly higher levels of serum and salivary IgG4 compared TD controls, suggesting an underlying defect in immune function and can be used as diagnostic marker. The levels of serum and salivary IgG4 levels show significant correlation suggesting that saliva can be used for diagnostic platforms and as non-invasive assessment tools for health monitoring.

120 **167.120** Functional Alteration in Gating Behavior of IP3R Channel Mediating Calcium Signaling As Common Biomarker in Autism Spectrum Disorder

J. Gargus[1,2], *R. L. Nguyen*[3], *D. Ferguson*[3], *Y. Medvedeva*[4], *I. Parker*[5], *G. Schmunk*[3] *and S. Reiter-Akhavan*[3], *(1)University of California, Irvine, Irvine, CA, (2)The Center for Autism Research & Translation, Irvine, CA, (3)Physiology & Biophysics, University of California, Irvine, Irvine, CA, (4)Neurology, University of California, Irvine, Irvine, CA, (5)Neurobiology & Behavior, University of California, Irvine, Irvine, CA*

Background: Current clinical measures used in diagnosing Autism Spectrum Disorder (ASD) have been adapted to screen core characteristics that range widely in severity. However, even at its most refined, ASD remains a group of developmental disorders that is defined by behavioral qualities, not by its pathogenesis. Studies on the genetic architecture of ASD and related neurological disorders have brought light to the central role of calcium channelopathies and its effects on calcium signaling pathways rationally implicated in diverse aspects of ASD pathogenesis.
Objectives: We propose that depressed function in IP3R mediated calcium release channels in the ER may be a reliable diagnostic biological marker for monogenic and 'sporadic' forms of ASD.

Methods: Functional components of calcium signaling were dissected in ASD and a super-resolution STORM system was used to obtain molecular-resolution optical patch clamp analysis on monogenic ASD models. Fibroblasts derived from skin biopsies of healthy, unaffected inviduals, and patients with rare monogenic forms or 'sporadic' autism were cultured and monitored for agonist-evoked calcium signals using a high throughput FLIPR assay. Human induced pluripotent stem cells (hiPSCs) were generated from primary fibroblasts using the Thermo-Fisher Sendai virus protocol. hiPSCs were differentiated into neuronal progenitors, and measured with UV-activated caged iP3.

Results: Local IP3-mediated calcium signaling was decreased in fibroblasts derived from patients with monogenic forms of ASD when compared to those derived from healthy, control patients. Likewise, IP3-mediated calcium signaling was repeatedly decreased in fibroblasts derived from patients with monogenic or 'sporadic' forms of ASD when compared to healthy, control patients. iPSC- derived neuronal precursors from patient fibroblasts also share this signaling defect.

Conclusions: Our results strongly implicate deregulated calcium signaling in the pathogenesis of ASD and supports iP3-mediated calcium signaling as a diagnostic biological marker for ASD. Furthermore, a high-throughput FLIPR assay may be used as a highly reproducible diagnostic that is able to capture differences in IP3-mediated calcium signaling.

121 **167.121** Functional Recording of Neuronal Network Activity in Cortical Neurons Differentiated from Human Pluripotent Stem Revealed Mutation Dependent Patterns of Abnormalities in SHANK3 Haploinsufficiency Associated ASD Patients

L. Chatrousse[1], *C. Boissart*[2], *T. Bourgeron*[3,4], *M. Peschanski*[2], *R. Delorme*[5,6] *and A. Benchoua*[2], *(1)CECS/ISTEM/AFM, Corbeil-Essones, France, (2)CECS/I-Stem/AFM, Corbeil-Essones, France, (3)Human Genetics and Cognitive Functions, Institut Pasteur, Paris, France, (4)University Denis Diderot Paris 7, Paris, France, (5)AP-HP, Robert-Debré Hospital, Child and adolescent Psychiatry unit, Paris, France, (6)Pasteur Institute, Human Genetic and cognitive function, Paris, France*

Background: Human induced pluripotent stem cells (hiPSC), obtained by reprogramming of somatic cells of individuals with ASD, provide a promising route for *in vitro* modeling of the pathology by combining relevance, robustness and high availability of the biological resource, and offering a unique opportunity for powerful drug discovery approaches. One of these approaches relies upon using live cell imaging to study developing cortical networks differentiated from control or ASD iPSC in order to characterize functional abnormalities associated with the emergence of the symptoms. This will help understanding the impact of different genetic mutations on neuronal function and discover new, personalized pharmacological treatments.
Objectives: As a proof of principle we choose to model ASD associated with SHANK3 gene haploinsufficiency, also known as Phelan-McDermid syndrome, and compared the neuronal network activity of SHANK3-/+ neurons with controls in the context of different SHANK3 mutations.

Methods: We derived neuronal stem cells (NSC) from hiPSC of 4 controls and 5 ASD individuals bearing different heterozygotous mutations in SHANK3 gene. Each NSC line was differentiated into cortical neurons for up to 60 days. Neuronal phenotypes were analyzed using immunocytochemistry (beta-III Tubulin as a neuronal marker coupled with GABA and Glutamatergic markers) on days 14 and 28. Neuronal network activity was quantified using a fluorescent calcium probe Fluo4-AM from day 32 to 60. Calcium imagines were recorded during 3 min using the automated imaging system ImageXpress micro (Molecular Devices) and analyzed using FluoroSnap Software (Tapan Patel, University of Pennsylvania).

Results: This revealed that synchronized firing started in hiPSC derived neurons from day 50 where almost all the sampled cells participated in the synchronized firing. We observed synchronized firing defects in all SHANK3 +/- neuronal networks but we demonstrated that the type of defect differed with the type of mutation, suggesting that these defects are dependent of the type of isoforms spared by the mutation. Being totally amenable to automation, this read-out will be used to test the therapeutic potential of several pharmacologic compounds, more particularly, their ability to restore normal firing in SHANK3-/+ neuronal networks.

Conclusions: This approach may provide a pathway to an efficient stratification of ASD patients and a better personalization of their treatment.

122 **167.122** High Serum Vitamin B12 in Children, Adolescents and Adults with Neurodevelopmental Disorders.

S. Hope[1], *T. Nærland*[2], *L. Mørkrid*[3], *A. Høyland*[4], *T. Torske*[5], *E. A. Malt*[6], *T. G. Abrahamsen*[7], *M. Nerhus*[8], *K. Wedervang-Resell*[9], *J. Johannessen*[10], *V. Lonning*[9], *I. Agartz*[11], *N. Stenberg*[12] *and O. A. Andreassen*[13], *(1)Oslo University Hospital, Oslo, Norway, (2)National Center of Competence for Rare Disorders and Disabilities, Oslo University Hospital, Oslo, Norway, (3)Department of Clinical Medicine, University of Oslo, Oslo, Norway, (4)NTNU, Trondheim, NORWAY, (5)Vestre Viken, Drammen, Norway, (6)Division of medicine, Oslo University, Oslo, Norway, (7)Pediatry¨, Oslo University Hospital, Oslo, Norway, (8)K.G Jepsen Norment Norwegian Centre for Mental Disorders Research, Oslo University Hospital, Oslo, Norway, (9)CHild and adolescent mental health Research Unit, Oslo University Hospital, Oslo, Norway, (10)Autism Society Norway, Oslo, Norway, (11)Dep of Psychiatric Reseach, Diakonhjemmet Hospital, Oslo, Norway, (12)Child and adolescent mental health, Oslo University Hospital, Oslo, Norway, (13)NORMENT, KG Jebsen Centre for Psychosis Research, Institute of Clinical Medicine,, University og Oslo, Oslo, Norway*

Background: The disease mechanisms underlying Neurdodevelopmental Disorders (ND) imply both heriditable and environmental factors. Vitamin B12 is a factor which is essential for proper neurodevelopment, and serum levels are influenced by diet as well as by genetic variants. Lack of vitamin B12 during pregnancy and in childhood pertubs neurodevelopment and adequate vitamin B12 status is necessary for neurocognitive function in adults. The last years it has become clear that not only lack of vitamin B12 confers a health hazard, but that also too high serum levels have negative implications. Vitamin B12 is solemnly present in animal products and a high plasma level is a common finding in a western country as Norway were diets are rich in meat. Elevated serum levels of vitamin B12 associate with poor outcome and mortality of diseases, as cancer, liver and kidney failure. Importantly, it was recently reported that elevated serum levels in pregnant women increased the risk of autism in the child.

Objectives: We hypothesized that high vitamin B12 would be frequent in patients with ND and that their mean vitamin B12 levels would be equal as in healthy controls (HC). We also hypothesized that vitamin B12 levels would be equal as in schizophrenia, a clinical group that shares some genetic and sociodemographic characteristics with autistic patients, and were previous studies indicate adequate vitamin B12 status.

Methods: Patients with ND conferred to specialist services were asked to participate. Altogether 217 children, adolescents and adults with a diagnose of pervasive ND, specific NDs or intellectual disability were included. Their vitamin B12 serum levels were compared with 498 HC and 414 schizophrenia patients. In addition, 117.000 primary care patients from a catchment area were used as reference population. Levels in ND were also compared with a clinical control group consisting of 414 schizophrenia patients that had been conferred to specialist health services. We controlled the results for possible confounders. In Norway, available vitamin B12 supplements also contain folic acid, and thus we controlled for levels of folic acid as a proxy for supplement intake. We also controlled for indicators of general nutrition, liver disease, kidney function and inflammation.

Results:

19% of the patients with ND had elevated levels (above the current reference range of 650 mmol/l) of vitamin B12 and mean vitamin B12 levels (age and gender adjusted) were higher than among HC (p=0.004) and among schizophrenia patients (p=0.0003). We controlled the results for differences in age, gender, levels of folic acid, hemoglobin, creatinine, Alanine transaminase and leukocyte count. Serum vitamin B12 was still significantly higher in ND than in HC (p=0.015). Vitamin B12 was not associated with scores on the Social Responsiveness Scale, but was higher in patients who had experienced a loss of previous abilities (p<0.05).

Conclusions: Patients with ND have higher serum vitamin B12 than HC and schizophrenia patients. This result is supported by a previous finding of high levels in pregnancy increasing the risk of autism and warrants further research for possible underlying mechanisms.

123 **167.123** Identifying Autism Risk Genes Essential for Proliferation and Differentiation Using Genome-Wide CRISPR Screens

S. Shohat *and S. Shifman, The Hebrew University of Jerusalem, Jerusalem, Israel*

Background:

Recent advancements in sequencing technologies led to the discovery of many genes associated with autism spectrum disorders (ASD). Many of those genes are involved in chromatin regulation and synaptic functions. While a great deal of research has focused on the role of synaptic genes in ASD, less is known about how disruption of chromatin regulators can lead to ASD. Our hypothesis is that those chromatin genes are associated with ASD because they regulate proliferation and neuronal differentiation during development.

Objectives:

Our aim is to perform a genome-wide screen for genes essential for neuronal proliferation and differentiation and to test their connection with ASD.

Methods:

We have established a system which allows for a genome wide detection of genes essential for proliferation and neurogenesis. Using a CRISPR pooled library, we generated a population of mouse embryonic stem cells (mESCs) with a different guide RNA targeting almost every gene in the mouse genome (~20,000 genes). We proliferated the cells for two weeks and sequenced the guide RNAs to measure their frequency. The mESCs also contains GFP inserted into the Sox1 locus, and can be used to identify and isolate neural stem and progenitor cells.

Results:

We screened across the genome for genes affecting embryonic stem cells proliferation and survival. We found 1348 genes that were negatively selected (essential genes), and 32 genes that were positively selected. The essential genes are highly enriched for genes implicated in ASD, other neurodevelopmental disorders, and microcephaly. Moreover, the genes negatively selected in the screen are significantly enriched with genes intolerant to mutations in the human population. Among the essential genes are some high confidence ASD genes such as POGZ, CHD8 and SETD5.

Conclusions:

The study demonstrates the ability to trace the involvement of all genes in the genome in proliferation and differentiation and to subsequently decipher the functional role of ASD genes. We showed that some ASD genes affect proliferation of embryonic stem cell even before differentiation. Our ongoing screens during neuronal differentiation will shed further light on the function of chromatin regulators and their connections with abnormal brain growth observed in ASD.

124 **167.124** Neural Precursor Cells (NPCs) from 16p11.2 Deletion Patients Exhibit Enhanced Proliferation, and Alterations in FGF Mitogenic Signaling

R. J. Connacher[1]*, M. Williams*[2]*, S. Prem*[2]*, M. Mehta*[3]*, P. G. Matteson*[3]*, J. H. Millonig*[3] *and E. DiCicco-Bloom*[2]*, (1)Rutgers University- New Jersey Medical School, Piscataway, NJ, (2)Rutgers Robert Wood Johnson Medical School, Piscataway, NJ, (3)Center for Advanced Biotechnology and Medicine, Rutgers Robert Wood Johnson Medical School, Piscataway, NJ*

Background:
Autism spectrum disorder (ASD) genetic etiology is complex and heterogeneous. Within ASD, ~1% contain a copy number variation (CNV) within the 16p11.2 chromosomal region, exhibiting varying phenotypes. This CNV affects one copy of 27 genes, including MAPK3 encoding for ERK-1. Extracellular factors signal through ERK to stimulate proliferation and growth while alterations in ERK-1 impact brain development, as observed in 16p11.2 deletion (16p) mice that exhibit ERK dysregulation. Humans with 16p often have macrocephaly, suggesting developmental growth phenotypes due to this deletion.
Objectives:
We investigated induced pluripotent stem cell (iPSC) derived neural precursor cells (NPCs) from 3 16p individuals (2:1; M:F) compared to 3 age matched controls. 16p individuals were diagnosed with ASD to various degree, as well as comorbid macrocephaly and cognitive impairment. We hypothesized there is a proliferation phenotype in 16p NPC and altered ERK signaling.

Methods:
iPSCs were induced into NPCs which expressed markers Sox2, Pax6, and Nestin, and differentiated into neurons and glial subtypes. All proliferation and signaling assays utilized NPCs from passages 3-8 of 1-3 clones per individual cultured in control media +/- fibroblast growth factor (FGF). Experiments were conducted in 24-well plates or 35mm dishes and harvested after 2 days unless otherwise specified. DNA synthesis was assayed by measuring tritiated thymidine 3[H] incorporation following a 2hr pulse. NPCs cell counts were performed at 2, 4 and 6 days using hemocytometer. Signaling proteins levels from two male 16p compared to 3 controls were visualized by western blot.

Results:
CNV 16p patient NPCs exhibited 2-fold greater DNA synthesis than controls at 2 days. Exposure to extracellular factor FGF, a well-known neurogenic regulator and stimulator of ERK, elicited increased DNA synthesis in both 16p and unaffected NPCs. Interestingly, the magnitude of the FGF-induced stimulation of DNA synthesis was blunted in 16p NPCs. While cell counts were not different between groups at 2 days, there were 2-fold increases in 16p NPC numbers by day 6, reflective of earlier increases in DNA synthesis. Preliminary analysis of total ERK-1 protein in 16p NPCs revealed a 30% reduction, while P-ERK protein normalized to total ERK revealed a non-significant increase compared to control. Interestingly, mitogenic signals downstream of ERK, including Cyclin D1 and P-S6, were increased by 30 and 80%, respectively in 16p NPCs, suggesting differential activation of ERK-1 pathway.

Conclusions:
Using iPSC technologies, we observe that 16p NPCs exhibit greater DNA synthesis and proliferation, as well as alterations in signaling compared to unaffected controls. 16p NPCs may also exhibit a blunted response to FGF, though further studies are warranted. The increased proliferation and activation of mitotic regulators, cyclins and P-S6, may provide a mechanism that contributes to the macrocephaly observed in these two male 16p patients. These studies suggest that analyses of ASD NPCs may provide insights into developmental dysregulation that contributes to these disorders, as well as define underlying mechanisms that may ultimately be targeted to address these complex disorders.

125 **167.125** Platelet Studies to Unravel Defective Pathways in Neurodevelopmental Disorders

M. Padmakumar[1]*, E. Turro*[2]*, C. Thys*[1]*, C. Van Geet*[1]*, J. Jaeken*[1] *and K. Freson*[1]*, (1)KU Leuven, Leuven, Belgium, (2)University of Cambridge, Cambridge, United Kingdom*

Background: Next generation sequencing has opened new horizons for hitherto unexplained rare diseases. But with the discovery of novel candidate genes, it is becoming increasingly difficult to pin-point the cellular pathways modified by these genes, especially for neurodevelopmental disorders that are very heterogenous and typically lack patient-derived cell models. Platelets are easily accessible cells and share molecular players that regulate granules, receptors, calcium-dependent activation and cell junctions with neurons. The serotonin pathway, frequently studied in Autism Spectrum Disorder (ASD) also plays an important role in platelet-based hemostasis, as serotonin is stored in the platelet dense granules and is released upon activation. We have used platelets to study ASD and other developmental disorders to gain insights in underlying pathophysiological mechanisms (Bijl et al, Molecular Autism, 2015 and Goubau et al, Dev Med Child Neurol, 2014).
Objectives: We here present ‘platelets as model cell to study neuropathology’ with the description of a patient with a severe neurodevelopmental disorder caused by recessive variants in *SLC18A2* that codes for the vesicular monoamine transporter 2 (VMAT2) protein. VMAT2 is expected to transport dopamine, serotonin and other monoamines from the cell cytosol into synaptic granules. Its exact biological role in granules is still largely unexplored.

Methods: Our patient was included in the National Institute for Health Research (NIHR) BioResource - Rare Disease study using whole genome sequencing (WGS) for diagnosis of unexplained inherited disorders. Platelet granules were evaluated using functional assays and electron microscopy (EM) and a sensitive ELISA was conducted to measure serotonin levels in platelet extracts

Results: Our patient from consanguineous parents presented with severe psychomotor developmental delay, hypotonia, mental retardation, uncontrolled movements, gastrointestinal problems, and died at the age of 5.5 years due to pulmonary complications. Metabolic testing, brain MRI, ECG and cerebrospinal fluid analysis were normal. Though the patient had no hemostatic dysfunction, platelet functional tests were performed. This showed reduced aggregation responses to epinephrine and ADP and a mildly abnormal ATP secretion after ADP stimulation indicative of a dense granule secretion defect. Platelet EM analysis further revealed reduced numbers of dense granules with abnormal content and the presence of immature membrane complexes. WGS identified a novel homozygous variant c.946C>G in *SLC18A2* that results in p.P316A in VMAT2. Both parents were heterozygous carriers. VMAT2 is highly expressed in platelets compared to other blood cell types but its role in dense granules was not studied. ELISA measurements of serotonin levels in platelet extracts showed almost undetectable levels for the patient while the parents have comparable levels to platelets from unrelated healthy controls. This, together with the EM observation indicates a defect in VMAT2 function in the patient, abolishing the serotonin transport into platelet dense granules

Conclusions: This is the first report of defective platelet dense granule morphology, function and content in a patient with a mutation in VMAT2. It shows that defective monoamine transport in neurons can be studied using mirrored defective serotonin transport in platelets and stresses the possibility of using platelet studies to gain insight into the pathophysiology of neurological disorders

126 **167.126** Urinary Metabolomic Profile in Autism Spectrum Disorder: A Comparison between Patients, Siblings and Healthy Controls.

M. Siracusano[1], *A. Noto*[2], *L. Barberini*[2], *A. Riccioni*[3], *L. Mazzone*[3], *A. Benvenuto*[3], *P. Curatolo*[3], *V. Fanos*[2] *and C. Fattuoni*[2], *(1)Biomedicine and Prevention, University of Rome Tor Vergata, Rome, Italy, (2)University of Cagliari, Italy, Cagliari, Italy, (3)Systems Medicine, Division of Child Psychiatry, University of Rome Tor Vergata, Rome, Italy*

Background: Despite the progress in understanding the neurobiology of Autism Spectrum Disorder (ASD), the causes remain still unknown. A complex relationship between genetic, epigenetic and environmental factors contributes to ASD etiopathogenesis and it is responsible of the clinical heterogeneity. Metabolomics explores the molecular complexity of ASD and the relationships among phenotypes related to external agents. As an emerging tool of network medicine, metabolomics provides a direct functional read-out of the phenotype by the detection, identification, and quantification of metabolites in biological fluids in order to recognize metabolic alteration between comparative samples. Recent evidences show a different urinary metabolomic profile between ASD children and their unaffected siblings. More in details high level of mammalian-microbial cometabolites, alteration in nicotinic-acid metabolism and mitochondrial dysfunction and a dysregulation of antioxidant status and amino acid metabolism have been observed in ASD individuals.

Objectives: to identify urinary metabolic pathways involved in the etiopathogenesis of ASD in 3 different samples: ASD children, siblings and control group (typical development). To describe a specific urinary metabolomic profile related to the clinical phenotype (intelligence quotient, functioning, core symptoms, disruptive behaviours, medical comorbidity such as sleep and gastrointestinal problems).

Methods: we enrolled 105 children, (age range 18 months–11 years): 38 ASD, 35 unaffected siblings, 32 typical developing children without familiarity for ASD. Morning urine samples were collected for all participants. Urinary metabolites were analysed and quantified by Gas chromatography–mass spectrometry (GC-MS). Standardized neuropsychological assessment was performed for ASD children and their affected siblings.

Results: Our preliminary results on 45 children (26 ASD and 20 unaffected siblings) show two distinct urinary metabolomics profiles in the ASD population compared to their unaffected siblings (OPLS-DA R_2 0.5, Q_2 0.02, with a valid permutation test=0.049). The loading plot analysis reveals the different clusterization among the two groups (Figure 1). The main metabolic findings in ASD children include high concentrations of mammalian-microbial metabolites (lyxose, xylose, glucose, arabitol, sorbitol, threitol, fucose, p-cresol) and an alteration of tryptophan pathway (kynurenic acid, xanturenic acid, quinic acid, ribonic acid) (Figure 2). The metabolites most notably changed were compared with information obtained by Human Metabolome Database.

Conclusions: High level of mammalian-microbial metabolites, suggesting gastrointestinal (GI) dysbiosis, can be related to the GI symptoms described in autistic children. In particular, the high urinary level of p-cresol, can be due to proliferation of gut bacteria, constipation and increased oral exploration of objects. Low concentrations of kynurenic acid are associated with dysregulation of the tryptophan pathway, increased oxidative stress, excitatory/inhibitory imbalance.Our preliminary findings suggest a potential role of gastrointestinal dysbiosis, perturbation of antioxidant status, in the etiopathogenesis of ASD comorbidity such as gastrointestinal disorders, epilepsy, sleep disorders.

Poster Session
168 - Sensory, Motor, and Repetitive Behaviors and Interests
5:30 PM - 7:00 PM - Hall Grote Zaal

127 **168.127** A Multi-Disciplinary Exposure Therapy Approach to Treating Auditory Sensory over-Responsiveness

T. Carson[1], *C. Gayle*[2], *L. Guerrero*[3] *and C. Mathews*[2], *(1)Occupational Therapy, University of Florida, Gainesville, FL, (2)Psychiatry, University of Florida, Gainesville, FL, (3)School Psychology, University of Florida, Gainesville, FL*

Background: Auditory hyper-reactivity is estimated to affect up to 66% of children with autism spectrum disorders (ASD) and has been linked to both child and family mental health factors such as higher levels of stress and anxiety. Although hyper-reactivity to auditory stimuli is a significant problem for these children and their families, there are currently no evidence based treatments available to treat this problem in ASD. Exposure and response prevention (E/RP) is highly effective form of treatment for reducing escape/avoidance behaviors associated with obsessive and compulsive disorders, anxiety and phobias. It has also been shown to be effective for reducing OCD behaviors in children with concurrent ASD suggesting that children with ASD may also respond well to this type of treatment approach being applied to sensory hyper-reactivity behaviors.

Objectives: The present study is a clinical pilot to determine the feasibility of implementing a modified E/RP approach for reducing auditory sensory over-responsive behaviors in children with ASD.

Methods: A modified E/RP protocol was provided at the University of Florida Center for Translational Science Clinical Research Center to patients (n = 5) with high functioning ASD ages 5-17 with strong aversions to specific sounds. In addition to autism diagnostic assessments, participants also completed cognitive testing and caregivers provided reports for adaptive behavior scales and sensory processing. Exposure therapy was provided to each participant for up to 12 weeks. Prior to beginning exposures, patients and caregivers were provided psychoeducation on how to identify levels of anxiety and arousal level as well as how to enact self-regulation strategies. Exposure hierarchies were designed to address specific auditory aversions. Parent and patient reports were collected weekly before, during and after treatment regarding the participants' behavioral responses and levels of anxiety experienced when exposed to these sounds. Participant performance on self-reported distress scales, caregiver reports and behavioral observations are compared within subjects across three phases: baseline (no treatment;4 weeks), treatment (12 weeks) and follow-up (home programs; 4 weeks).

Results: Preliminary results suggest good feasibility and that patients with high functioning ASD respond to a modified E/RP protocol as evidenced by decreased avoidance/escape behaviors and decreased self-reported levels of discomfort/anxiety to auditory stimuli that were initially reported to be intolerable.

Conclusions: A modified E/RP approach can be useful for reducing avoidance behaviors and anxiety associated with auditory hyper-reactivity in patients with high functioning ASD. This study supports the idea that auditory hyper-reactivity, in some patients, may be the result of a conditioned response and thus, an E/RP based approach may be effective for such patients. Further studies are warranted to further evaluate treatment efficacy, generalization/maintenance of treatment outcomes, patient-treatment matching as well as follow through with home programs. The results from these studies can serve to: (a) improve children's abilities to tolerate every day sounds and to engage in activities of daily living and (b) improve evidence-based approaches to sensory processing difficulties in ASD. This work represents the first step in evaluating the feasibility and efficacy of applying E/RP treatment to reduce auditory hyper-reactivity in children with ASD.

128 **168.128** Abnormal Frontoparietal Network Connectivity Is Correlated with Motor Skill Ability in Children with Autism

N. F. Wymbs[1,2]*, M. B. Nebel*[1,3] *and S. H. Mostofsky*[1,3]*, (1)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (2)Neurology, Johns Hopkins School of Medicine, Baltimore, MD, (3)Department of Neurology, Johns Hopkins University School of Medicine, Baltimore, MD*

Background: Children with autism spectrum disorder (ASD) frequently show abnormal motor signs early in development, and strong correspondence with social and communicative features of ASD render it a critical focus of study. Converging evidence has shown that children with ASD have marked impairment in the production of motor skills, termed dyspraxia. Neurobiological evidence of motor skill (praxis), taken from both healthy and impaired states, is by in large supported with the functional involvement of a dorsal frontoparietal (dFPN) cortical network. Although the dFPN abnormalities have been identified in ASD, there is little understanding of how dFPN connectivity affects praxis performance in children with ASD.

Objectives: Our aim was to test if dFPN connectivity is abnormal in children with ASD, and if dFPN connectivity is related to dyspraxia in children with ASD.

Methods: We acquired resting state functional magnetic resonance imaging (rsfMRI) scans from 162 children (81 ASD, 81 typically developing, TD) aged 8-12 years. Groups were balanced for age, socioeconomic status, handedness, and general ability index (GAI). Independent component analysis (ICA) was used to estimate functional connectivity. The dFPN was localized using spatial matching, with left-lateralized sources localized to premotor and parietal regions. Local maxima in the dFPN map were converted to ROIs, and implemented in a seed-based functional connectivity analysis with correction for sources of extraneous noise. We tested for brain-behavior relationships by including measures of gesture and imitation ability (Florida Apraxia Battery modified for children), motor coordination (movement assessment battery for children, MABC-2), social skills (social responsiveness scale, SRS), and ADOS as covariates of interest in the regression model (SPM12).

Results: ASD children were less accurate on gesture imitation than TD children ($p < 0.0001$). We observed a consistent increase in connectivity between right and left inferior parietal lobule (IPL) dFPN seeds and the default mode network (DMN) ($p < 0.05$, FWE). In ASD children, increased connectivity between left IPL and left somatosensory cortex and right precentral gyrus was correlated with gesture accuracy. Connectivity between left IPL and left dorsal premotor, somatosensory cortex, and right cerebellum was correlated with measures of gesture and manual dexterity performance (MABC-2). Further, connectivity between left IPL and premotor, parietal, insula, and cerebellum correlated with gesture and ADOS, while overlapping right prefrontal and premotor, and medial premotor regions correlated with SRS scores and gesture.

Conclusions: These results suggest that praxis deficit in ASD arises from reduced connectivity between the IPL and other within- and between-network regions. Reduction of left IPL connectivity may hinder imitation through reduced ability to carry out dexterous movement. The reduced asynchrony with DMN suggests that abnormal between-network connectivity may contribute to dyspraxia in children with ASD. Our findings further demonstrate the striking correspondence between brain connectivity related to motor skill, and overlapping connectivity related to ASD severity and social skills. These findings represent a step towards understanding the involvement of the dFPN in skilled behavior in ASD, with extension to abnormalities in core social and communicative behaviors.

129 **168.129** An Integrative Approach of Visual Functions in ASD

K. Kovarski[1]*, M. Latinus*[2]*, J. Malvy*[3]*, F. Bonnet-Brilhault*[4] *and M. Batty*[5]*, (1)UMR 930 INSERM, University of Tours, Tours, France, (2)UMR INSERM U930, Tours, France, (3)CHRU Tours, Tours, France, (4)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (5)Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de la Santé, Université de Toulouse - Jean Jaurès, Toulouse Cedex 9, France*

Background:

Visual perception is atypical in children with ASD at many stages from oculomotor functions to cerebral processing. ASD children present more ophthalmological disturbances, faster saccades and atypical early brain responses to social and non-social stimuli. A number of studies have recently suggested that sensory processing might play a crucial role in social disturbances. However, few studies have investigated the relationship between impairements in fixation, saccades and the underlying brain responses recorded by EEG.

Objectives:

The current analysis aims at investigating whether impairments in high-level perception are the consequence of low-level sensory dysfunctions and to quantify their respective influence.

Methods:

After ophthalmological examination, thirteen children with ASD with normal vision completed several tasks conceived to investigate visual perception at different stages. Children were aged from 42 to 130 months (mean age ± standard deviation: 78.4 ± 29.2 months). Because several children presented an intellectual delay, all tasks were passive, and no explicit instruction was given to the participants. The tasks included the recording of visual evoked potentials to pattern reversal stimulation and to emotional faces. Moreover, two eye tracking tasks were designed to investigate i) fixation and ii) saccade metrics. For the ERPs studies, latency of the N170 and amplitudes of N75 and P1 for pattern-reversal stimulation and P1 and N170 for faces were measured in each child. For the oculomotor tasks, we focused on number of fixations and fixation duration in the fixation task, and the time to reach the target and the precision of the saccades in the prosaccade task. These parameters were entered in a principal component analysis.

Results:

The principal component analysis revealed that two components explained about 52% of the variability between the thirteen children. The first component was summarised mainly by the number of fixations, and the amplitudes of early visual evoked potentials (N75, P1 and N170) regardless of them being evoked by a social or non-social stimulation. The second component had larger weights on N170 amplitude and latency as well as saccade precisions. None of the components correlated with clinical scores such as ADOS or CARS. Future analyses will look at whether weighting the atypicalities found at each processing step influence the next step of processing at the individual level, therefore providing an individualised approach to bridge between clinical and research findings.

Conclusions:

These data highlights a strong link between oculomotor functions and visual evoked potentials in ASD, regardless of the stimuli being social or not. Moreover, the latency and amplitude of the N170 seems to depend on the ability of the child to reach the point of interest with accuracy, and fixate on it. This analysis strategy allows to determine the weights of low-level atypicalities on social difficulties. It further demonstrates the importance of controlling for sensory impairments (from ophthalmologic pathologies to oculomotor behaviour) in research looking at higher functions in ASD.

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168.130 Are Restricted and Repetitive Behaviours Related to Executive Function Performance? a Correlational Meta-Analysis.

***R. K. Iversen**, Lancaster University, Lancaster, United Kingdom of Great Britain and Northern Ireland*

Background: A growing number of correlational studies have been undertaken to evaluate the proposed relationship between executive function (EF) skills and restricted and repetitive behaviours (RRBs) in young children (e.g. Tregay, 2009) and individuals with autistic spectrum disorder (ASD) (e.g. South et al., 2007). The EF theory is a strong contender for explaining RRBs across both populations, as it proposes that an inability to control behaviours does not facilitate the inhibition of RRBs. For example, this theory is capable of accounting for the age-related changes occurring in typical development around the age of four/five, when EF skills undergo a rapid development (e.g. Carlson, 2005) and RRBs decrease (e.g. Evans et al, 1997). Despite this, the evidence regarding the relationship between EF skills and RRB levels is mixed, as some studies have found associations with several EF components, such as set-shifting and inhibitory control (e.g. Lopez et al, 2005), whereas others have found that only set-shifting performance predicted RRBs (Van Eylen et al, 2014). The current meta-analysis will, therefore attempt to evaluate the relationship with a focus on set-shifting and inhibitory control measures, but also parental-reports. The parental-report measures will be included as a separate analysis, as although both types of tasks are commonly used to measure EF skills, Toplak et al (2013) found that they measured different levels of cognition, namely, cognitive abilities and goal pursuit achievement. There is now a need for a systematic attempt to evaluate the relationship across studies and between task batteries.

Objectives: This meta-analysis (following recommendations from Quintana, 2015) will allow us to examine the general EF hypothesis, but also identify whether the link between RRBs and EF skills is a general one, or if it is caused by one specific mechanism.

Methods: Following a comprehensive search in three databases, three random-effects analyses were run. The set-shifting analysis consisted of 20 studies (with 26 correlations) and a sample size of 869. The inhibitory control analysis comprised of 14 studies (with 17 correlations) and a sample size of 664. Finally, the parental-report analysis included 8 studies (with 12 correlations) and a sample size of 1362. Moderators such as age, diagnosis, EF task and type of RRB measure were investigated.

Results: The analyses found significant but moderate associations between RRBs and set-shifting performance (.27, 95% CI 0.17-0.41, $p< 0.0001$), inhibitory control performance (.20, 95% CI 0.02- 0.37, p 0.02) and scores on parental-report measures (.31, 95% CI 0.0736-0.5514, $p <0.001$). We found that for set-shifting tasks and parental-scores; the association remained stable with age, between diagnoses and across different types of EF and RRB measures. In contrast, the relationship between RRBs and inhibitory control performance was moderated by age and diagnosis.

Conclusions: This meta-analysis offers support for the EF hypothesis, and suggests that at least two cognitive mechanisms may underpin the high RRB levels in individuals with ASD, as well as in young children. The relationship between cognitive skills and behaviours may have clinical training implications so directions for future intervention research will be proposed.

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168.131 Audiovisual Integration Abilities in ASD Using Music-Based Stimuli

***L. Silverman**[1], A. R. Canfield[2], N. Gebhard[3] and M. Schutz[4], (1)University of Rochester Medical Center, Rochester, NY, (2)Psychological Sciences, University of Connecticut, Storrs, CT, (3)Massachusetts General Hospital, Cambridge, MA, (4)McMaster University, Hamilton, ON, Canada*

Background: Individuals with autism spectrum disorder (ASD) have difficulty with audiovisual integration, which may contribute to some of the core symptoms of the disorder. However, the full extent of their sensory integration abilities is not yet well characterized. Studies using complex, language-based tasks have found that individuals with ASD do not use lip movements or hand gestures efficiently to improve speech perception. Conversely, research with simple non-social stimuli, such as auditory-beeps and visual-flashes generally suggests intact integration abilities. These findings are hard to compare because most language-based stimuli involve biological motion, while non-social studies tend to use computer-generated stimuli without natural human movements and artificial synthesized sounds. It is unclear whether individuals with autism

can integrate natural human, audiovisual information in the absence
Objectives:

The current study addresses this gap by examining integration of human, audiovisual information in the absence of language demands. This was achieved by utilizing a musical illusion documented by Schutz and Lipscomb (2007).

Methods: Participants were 24 adolescents with high-functioning ASD and 24 typically developing (TD) controls, matched on age, gender, and IQ. They watched videos of an internationally acclaimed musician performing short and long notes on the marimba (a percussion instrument similar to a xylophone). Prior research suggests that features of a musician's performance gestures (height and trajectory of hand movements) affect listeners' perception of note duration (longer gestures result in perception of longer sounding notes). This illusion is well documented in typical adults. The current experiment included three conditions: audio-visual, audio-alone, and video-alone. Participants were told that they would complete a computer game and some parts of the game had gestures, others had sounds, and other parts had both. They were informed that in the audiovisual condition, sometimes auditory and visual stimuli were mismatched. Participants were asked to judge the duration of each independently. Integration was determined based on participants' estimation of note duration and the presence of an audiovisual illusion.

Results:

We assessed the visual influence of gesture on perception of note duration in the two groups using a 2 (visual gesture length) X 2 (group) X 6 (note duration) repeated measures ANOVA. Notably, there was a significant influence of visual gesture length on note duration $F_{(1, 46)}$=22.00, $p < .0001$ (partial h^2 =.0454), as well as a lack of interaction between gesture length and group $F_{(1, 46)}$= .0004, p=.984. This indicates that individuals with ASD integrated auditory and visual information, and experienced the illusion no differently than the controls. In unimodal conditions there was a significant effect of group in the audio-only $F_{(1, 46)}$=9.781, p = .0003 (partial h^2 =.0791), and the video-only $F_{(1, 46)}$=8.988, p = .0044 (partial h^2 =.0642), with the ASD group providing shorter relative judgments, but no group X visual gesture nor group X pitch interaction.

Conclusions: The magnitude of the audiovisual illusion in the ASD group was comparable to the illusion experienced by controls. This suggests intact integration abilities in ASD for natural, human audiovisual information in the absence of language demands.

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168.132 Audiovisual Speech Perception in Children with Autism Spectrum Disorders: An Eye Tracking Study

S. Feng[1], *Z. Ma*[2], *Y. Wu*[1], *T. Li*[3], *L. Chen*[1] *and L. Yi*[3], *(1)School of Psychological and Cognitive Sciences, Peking University, Beijing, China, (2)Emory University, Beijing, China, (3)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

Background: Children with autism spectrum disorders (ASD) show weaker audiovisual speech integration, such as a weaker McGurk effect (Bebko, Schroeder & Weiss, 2014) than typically developing (TD) children do. The reduced McGurk effect could be related to their atypical face processing pattern (Rice, Moriuchi, Jones & Klin, 2012) or their deficits in multisensory temporal processing (Stevenson et al., 2014).
Objectives: We examined whether the potential weaker McGurk effect of children with ASD was due to their reduced fixation time on the face or the mouth. We also investigated whether the children with ASD had a deficit in the audiovisual temporal processing for the audiovisual mismatched McGurk stimuli.

Methods: Forty-nine children with ASD and thirty-one TD children participated in the two experiments in this study. First, we investigated whether the ASD group showed similar McGurk effect as the TD group did. We designed two conditions: the one with the speakers' eyes open and the other one with the speakers' eyes closed. In both conditions, we presented the audiovisual matched stimuli and the audiovisual mismatched stimuli (McGurk stimuli). The participants reported what the speaker said. Meanwhile, we recorded participants' eye movements. Second, we explored the width of the two groups' temporal binding window (ASD vs TD) using the McGurk stimuli. Participants completed an audiovisual simultaneity judgement task with SOAs of 0, ±40, ±120, ±240, ±360, ±480, and ±680 ms (negative values indicate auditory stimulus appeared first).

Results: In Experiment 1, we found a Group-Condition interaction for the McGurk effect: the ASD group showed significantly less McGurk effect than the TD group did in the open-eye condition only; the two groups performed similarly in the closed-eye condition. The TD group showed weaker McGurk effect in the closed-eye than the open-eye conditions, while ASD group did not differ between these two conditions (Figure 1). The area of interest analysis for the eye movement of the McGurk trials revealed that the ASD group looked shorter at the mouth and the face than the TD group for the audiovisual mismatched stimuli in both conditions (Figure 2). Additional trial by trial generalized linear mixed modeling revealed that longer mouth-looking time or longer face-looking time in the ASD group predicted stronger McGurk effect. In Experiment 2, each participant's percentages of simultaneous responses were fit by psychometric functions. The audiovisual temporal binding windows for the ASD group were significantly wider than those of the TD group. However, we failed to discover any correlation between the width of the audiovisual temporal binding windows and the strength of the McGurk effect.

Conclusions: The present study provided direct evidence for the relation between the children with ASD's audiovisual speech perception and their atypical face processing. These findings will further our understanding of the underlying mechanisms for the abnormal audiovisual speech perception in ASD.

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168.133 Autistic Individuals Are Slow in Updating Their Internal Representations and Predictions

M. Ahissar[1], *I. Lieder*[2] *and G. Vishne*[2], *(1)Hebrew Universiy, Jerusalem, Israel, (2)Hebrew University, Jerusalem, Israel*

Background:
In the last 15 years our lab studied dyslexia, asking what neural and cognitive mechanisms underlie their poorer performance in a broad range of simple serial discrimination tasks. We found that dyslexics' performance reflects impaired inference of stimuli statistics rather than a noisier sensory system. To assess dyslexics' sensitivity to context we studied a phenomenon termed "contraction bias" – the pulling of perception towards the "prior" – the mean of similar, previously encountered, stimuli. This pulling occurs shortly after stimulus presentation, and can be understood within a Bayesian framework of optimizing perception based on previous knowledge, given noisy sampling or memory. Dyslexics' contraction bias is smaller than controls', reflecting inefficient use of environmental statistics. Using behavioral, ERP and computational methods developed in our lab, we found that this inefficiency stems from faster decay of their implicit memory of previous stimuli.

Objectives:

We now asked whether the pattern of inference of high functioning autistic individuals, with no language difficulties, is similar to dyslexics'. Recent studies found reduced efficiency of statistical inference in Autism. However, Autistics' difficulties are quite different than those of dyslexics.

Methods:

We recruited a population of 58 adults, 28 autistic and 30 typically developing (TD) individuals, matched for age and reasoning skills, and replicated experiments of simple serial frequency discrimination, and paced finger tapping, which we previously administered to adult dyslexics.

Results:

Classical thresholds did not differ between the groups. However autistics' contraction bias was substantially smaller than that of TD participants. Analyzing the impact of previous trials on autistics' performance we found that they tend to under weigh recent trials. While both dyslexics and TD participants weigh recent trials more than earlier ones when implicitly calculating the mean of previous trials, autistic participants do not. However, their accumulation of stimuli statistics based on earlier trials is similar to that of TDs. This observations suggests that while they may accumulate adequate statistics in stable environments, they are less flexible in adjusting their representations, and hence predictions, to novel ones where statistics changes. To test this interpretation we administered a simple synchronize to metronome tapping task, where performance is determined only by very recent intervals. While dyslexics' performance was similar to TDs', autistics could not reliably synchronize to the external beats. Particularly challenging situations were those when metronome' beat changed and autistic participants were slower in adapting to new intervals, further supporting the slow-update interpretation.

Conclusions:

Autistics and dyslexics show inefficient statistical learning, but due to different underlying mechanisms. While dyslexics are fast adapters but show fast decay of their memory traces, autistics adapt slowly but show adequate retention. This difference is consistent with the broader behavioral profiles - dyslexics' fast adaptation but impoverished categorical representations, and autistics' slow adaptation but adequate categorical representations. A broad range of daily behavioral characteristics can also be explained as a consequence of these implicit learning patterns.

134 **168.134** Bilateral Patterns of Repetitive Movements in 6- to 12-Month-Old Infants As a Red Flag for Autism Spectrum Disorders

V. Costanzo[1]*, G. Purpura*[2]*, N. Chericoni*[1]*, F. Apicella*[1]*, M. L. Scattoni*[3] *and F. Muratori*[4]*, (1)IRCCS Fondazione Stella Maris, Calambrone (Pisa), Italy, (2)IRCCS Fondazione Stella Maris, Pisa, Italy, (3)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (4)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy*

Background: During the first year of life of an infant, repetitive movements represent a phase of typical motor development and they are considered a step towards voluntary purposeful movements. However, some types of repetitive movements and their higher frequency, from 12 months onwards, have been proved to distinguish infants with a Neurodevelopmental Disorders from infants with Typical Development (TD) . To distinguish between typical and atypical repetitive movements, the criteria that should be adopted are their frequency and the child's age : in fact, a higher rate of these movements beyond their physiological temporal window might reduce the infant's opportunity to develop more functional strategies of motor action. This is the case of Autism Spectrum Disorder (ASD), in which the persistence of repetitive and stereotyped movements during toddlerhood is considered, together with restricted interests and activities, one of the core symptoms.
Objectives: The purpose is to point out if a higher rate, duration and repertoire of repetitive movements could differentiate a) infants with ASD from infants with DD and TD aged between 6 and 12 months b) high-risk infants with ASD (HR-ASD), from high-risk infants without ASD (HR-nonASD), during the administration of the AOSI at 6 and 12 months of life.

Methods: We coded Repetitive Movements Episodes (RMEs), defined as a period of time characterized by a repetition of a movement for at least 2 times. We analyzed video-clips from retrospective homemade movies and from video-recordings of the AOSI administration, to compare the frequency and the duration of Repetitive Movement Episodes (RMEs) of a sample of 50 children equally distributed among the five groups (ASD, TD, DD, HR-ASD, HR-nonASD).

Results: Significantly higher total scores in RMEs with arms, hands, fingers and lower limbs were found to distinguish ASD infants from TD infants, with a satisfactory diagnostic efficiency (AUC>=80%). No significant difference was found between the distributions of unilateral RMEs between ASD and DD/TD. A similar difference was found between high-risk infants with ASD and without ASD. Results will be discussed in terms of the type of repetitive movements and of their implication for early diagnosis.

Conclusions: the results indicate that during the first year of life of life, an increased frequency of a particular repertoire of repetitive movements appears to be specific to ASD and could therefore be considered an early sign of the disorder.

135 **168.135** Brainstem Alterations in Young Children with Autism Spectrum Disorders: Comparison Among Automated Algorithms

P. Bosco[1]*, A. Giuliano*[1]*, J. Delafield-Butt*[2]*, F. Muratori*[3]*,* ***S. Calderoni***[3] *and A. Retico*[4]*, (1)National Institute for Nuclear Physics (INFN), Pisa, Italy, (2)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom, (3)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy, (4)Pisa Division, National Institute for Nuclear Physics, Pisa, Italy*

Background:
Sensorimotor abnormalities have been consistently reported in ASD individuals as an early impairment that may precede the development of defining characteristics. Motor abilities depend on multiple interacting pathways including cortico-cortical, cortical-subcortical, and cortico-cerebellar connections that reach spinal motor neurons through the brainstem.

Structural MRI studies of ASD individuals have demonstrated the potential role of the brainstem in the pathophysiology of ASD. However, the findings in volume alterations in subjects with ASD with respect to matched controls are controversial both in adults and children cohorts with some early studies that did not detect any significant differences between the ASD and control samples. For this reason, it is important to investigate the contribution to variability of brainstem volume measurements performed with different automated methods.

Objectives: The inter-method reliability of automated algorithms for brainstem segmentation was investigated, focusing on the potential involvement of this structure in ASD. Indeed, inconsistencies highlighted in previous studies on brainstem in ASD, may in part be a result of poor agreement in the extraction of structural features with different methods.

Methods: Structural MRI was used to measure the volume and the shape of the brainstem in young children with ASD and matched controls. A sample of 38 male children and 38 female children with ASD and their age and intellective-quotient matched controls were considered. Volume and shape analysis were carried out through some largely-used neuroimaging analysis tools for brain structure segmentation (FSL-FIRST, FreeSurfer -FS-, Advanced Normalization Tools -ANTs-), and for shape analysis (SPHARM-MAT). The inter-method agreement was quantified in terms of Pearson correlations between pairs of volumes obtained by different methods, whereas the degree of overlap between segmented masks was quantified in terms of the Dice index. In addition, a statistical examination of brainstem volume was performed using the analysis of variance (ANOVA) test. A comparison between ASD and control subjects was performed both in the male and female groups separately and in the entire dataset using gender as covariate and considering subjects with or without by intellectual disability separately.

Results: Both in terms of the Pearson correlation and of the Dice index, FSL-FIRST showed poor agreement with the other segmentation methods, which, by contrasts, consistently showed Pearson correlations greater than 0.93 and average Dice indexes greater than 0.76 in comparison among each other. The shape analysis confirmed the discrepancies among different segmentation methods, with particular reference to the FSL-FIRST under- and over-segmentation problems in specific brainstem regions. The BS volume resulted significantly higher in ASD when compared to controls both in the entire sample and in male subgroup for ANTs, FS 5.3, and FS 6.0 computations. No statistically significant volume differences were obtained for females in BS total volume.

Conclusions: This study suggests that research on brainstem alterations should cross-validate findings across multiple methods. Nevertheless, we reliably detected an enlargement of brainstem volume in the whole sample and in the male cohort, which is particularly driven by the subgroup of subjects with intellectual disability.

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168.136 Classifying Gender in Autism Spectrum Disorder Based on Restricted and Repetitive Behaviors and Interests

L. Antezana[1], *R. S. Factor*[1], *E. E. Condy*[2], *M. V. Strege*[2], *A. Scarpa*[3] *and J. A. Richey*[2], *(1)Virginia Polytechnic Institute and State University, Blacksburg, VA, (2)Virginia Tech, Blacksburg, VA, (3)Virginia Polytechnic Institute & State University, Blacksburg, VA*

Background: The female autism phenotype has been defined by differences in core autism spectrum disorder (ASD) symptomology related to reciprocal social communication and restricted and repetitive behaviors and interests (RRBI). Previous research on RRBI in ASD has found that affected boys have increased stereotyped and restricted behaviors compared to girls with ASD (Hiller, Young, & Weber, 2014; Mandy et al., 2012). Other domains of RRBI (i.e., self-injurious, compulsive, and insistence on sameness behaviors), which contribute to DSM-5 diagnosis, are less studied and have not been examined across gender. To date, no studies have examined gender differences using a comprehensive RRBI measure, which spans stereotyped, self-injurious, compulsive, insistence on sameness, and restricted behavior domains.

Objectives: To investigate whether symptoms of RRBI (i.e., stereotyped, self-injurious, ritualistic, compulsive, insistence on sameness, and restricted behavior), as measured by item-level data on the Repetitive Behavior Scale-Revised (RBS-R), can classify males versus females with ASD.

Methods: Participants included 615 youth with ASD (507 males; 82.4%), between 3 and 18 years of age (M=10.26, SD=4.20), who agreed to share data with the National Database for Autism Research (NDAR). A stepwise discriminant function analysis (DFA) was used to predict the degree RBS-R data could correctly classify gender in a large sample of individuals with ASD. Standardized canonical function coefficients (SCFC) from the DFA represent the contribution of each variable to the discrimination between groups, with greater SCFC indicating greater discrimination.

Results: DFA results suggest that RBS-R items significantly differentiate girls versus boys with ASD, Wilks' λ=0.89, χ^2=70.79, p<0.001. Of note, gender was classified based on a set of 8 items (see table 1). Interestingly, the items that differentiated boys from girls did not solely consist of higher stereotyped and restricted behavior in boys (as indicated by negative SCFC scores). Half of the items that differentiated gender were higher in females with ASD (as indicated by positive SCFC scores) and from the self-injurious, compulsive, and insistence on sameness domains. This set of RBS-R items had greater success in correctly classifying boys with ASD (67.90%) than in correctly classifying affected girls (61.00%).

Conclusions: This study extends findings of gender differences in RRBI for ASD, demonstrating that girls with ASD may demonstrate higher self-injurious, compulsive, and insistence on sameness behavior than affected boys. It is important for future research to disentangle whether these elevated rates of RRBI in girls with ASD are central to the female autism phenotype or an epiphenomenon of the high rates of co-occurring disorders (e.g., anxiety) noted in affected girls.

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168.137 Closure and Symmetry Perception in Autism

N. S. Subri[1], *C. Dickinson*[2] *and E. Gowen*[3], *(1)The University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (2)Division of Pharmacy and Optometry, The University of Manchester, Manchester, United Kingdom, (3)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom*

Background:

Closure describes a perceptual grouping cue, where a closed shape (e.g. a square) stands out more than an open shape (e.g. a single line), creating a 'pop-out' effect. Closure is believed to involve a global processing mechanism where feedforward information is integrated with feedback from visual areas responsible for shape processing. Previous work has shown that autistic adults have a reduced closure effect, suggesting reduced visual integration in this group (Jachim et al, 2015). However, it is unknown whether this is due to the short duration of stimulus presentation used in this study, as no group differences have been observed in studies measuring different aspects of visual integration that use longer durations (Kovács et al. 1999; Hadad et al. 2010). In addition, it is still unknown whether reduced closure may affect other aspects of perception in autism that also rely on global mechanisms such as symmetry perception. During symmetry perception, symmetrical shapes are processed faster than asymmetrical shapes. Given that both closure and symmetry perception involve global processing, we investigated how symmetry perception may be affected by reduced closure in autism.

Objectives:

Using two experiments, we investigated the effect of stimulus duration on closure (experiment 1) and how closure affects symmetry perception (experiment 2) in autistic and non-autistic adults.

Methods:

Two experiments were tested on autistics and matched non-autistic adults. Both experiments were based on a 2-IFC contour integration task, where participants had to detect a contour formed by Gabor elements, against a background of randomly oriented Gabors. In experiment 1, contour detection was compared between closed and open shapes at two durations: 150ms and 500ms. The closure effect was then calculated as the difference in performance between the two shapes, for each duration. In experiment 2, instead of detecting the contour, participants were asked to choose the most symmetric shape (symmetry detection task). Symmetry was varied by changing the angle of the sides of a square pattern, and performance was compared between closed and open shapes.

Results:

In experiment 1, we found a significant interaction of stimulusXgroup where the autistic group has less closure effect compared to the non-autistic group at both durations. This was similar across both durations with no three-way interaction with duration. For experiment 2, symmetry was significantly easier to detect with closed than the open shape for the non-autistic participants. However, symmetry detection was not significantly different between closed and open shapes in the autistic group.

Conclusions:

Experiment 1 showed that reduced closure in autistic group does not improve with longer durations, indicating a persistent alteration in the closure effect over time. In addition, Experiment 2 showed that closure seems to provide less benefit in symmetry detection in the autistic compared to non-autistic group, suggesting that the autistic group might be using different mechanisms to process both symmetry and closure. Overall, both findings depict atypical visual processing in autism, providing knowledge on how differences in visual perception may arise.

138 **168.138** Differences in Interoception and the Bodily Representation of Emotion in Autism and Typical Development

E. R. Palser[1], *E. Pellicano*[2], *A. Fotopoulou*[1] *and J. M. Kilner*[3], *(1)Clinical, Educational and Health Psychology, UCL, London, United Kingdom, (2)Macquarie University, Sydney, Australia, (3)Institute of Neurology, University College London, London, United Kingdom*

Background: Interoception is the detection of signals that relate to the physiological condition of the body, encompassing internal sensations such as those arising from the cardiac, respiratory and gastrointestinal systems, as well as external sensations such as temperature and pain (Ceuen et al., 2016; Craig, 2002; Sherrington, 1948). The perception of interoceptive signals has been considered of importance for understanding emotion since the seminal work of James and Lange (Lange & James, 1922), who suggested that emotion relies on the interpretation of physiological signals. It is now known that emotions are associated with discrete bodily maps of where they are experienced (Nummenmaaa et al., 2014), and these maps become more differentiated throughout child development (Hietanen et al., 2016). Difficulties in identifying and describing emotions are an integral part of autism (Griffin et al., 2015; Hill, Berthoz, & Frith, 2004).

Objectives: Here, we sought to investigate if there are differences in the bodily representation of emotion in children and adolescents with autism, compared to typical development and if so, do these differences relate to interoceptive processing.

Methods: Participants comprised 79 children and adolescents aged 6 to 19 years (mean=13.5, SD=3.0), of which 40 were reported to be typically developing, and 39 were reported to have an independent clinical diagnosis of ASD, verified by ADOS-2 administration. These groups were matched for chronological age and IQ. The Embody emotion coloring task (Nemmenmaa et al., 2014) was used to measure the bodily representation of seven emotions and interoceptive accuracy was gauged using the heartbeat tracking task (Schandry, 1981).

Results: We find significant differences in how emotions are embodied between typical development and autism ($t(77)=2.425$, $p=0.018$) and these group differences remain after controlling for age, gender and IQ. Further, interoceptive accuracy significantly explains more variance in the bodily representation of emotion, over and above group membership.

Conclusions: Autistic children and adolescents show significant differences in how they report the bodily sensations associated with emotions. These data suggest one possible cause of these differences is reduced interoceptive accuracy. Finally, the Embody emotion coloring task (Nemmenmaa et al., 2014) may offer a means of identifying difficulties in describing emotions that does not rely on the individual's ability to recognize that they have a difficulty, as is the case with traditional questionnaire measures.

139 **168.139** Disruption to Motor Intentions in Children with Autism: Evidence for Brainstem Timing Errors

J. Delafield-Butt[1], *K. Sobota*[2,3], *A. Anzulewicz*[4,5], *L. Millar*[2] *and P. Rowe*[6], *(1)Laboratory for Innovation in Autism, University of Strathclyde, Glasgow, United Kingdom, (2)Faculty of Engineering, University of Strathclyde, Glasgow, United Kingdom, (3)Harimata Sp.Z.o.o., Krakow, Poland, (4)Faculty of Humanities and Social Sciences, University of Strathclyde, Glasgow, United Kingdom, (5)Harimata Sp. z.o.o., Kraków, Poland, (6)Department of Biomedical Engineering, University of Strathclyde, Glasgow, United Kingdom*

Background:

Human movements are prospective. They must anticipate ahead of time their lawful consequences. In children with autism, evidence indicates a common disruption to movement may underpin its early pathogenesis (Trevarthen & Delafield-Butt, 2013). and may be a cardinal feature (Fournier et al., 2006). Yet, more work is required to better characterize this possible 'autism motor signature' and to probe its neurodevelopmental origins. In this study, we employed smart tablet computers with touch-sensitive screens and embedded inertial movement sensors to ecologically record the subsecond motor kinematics of movements made by children developing with and without autism.

Objectives:

(1) Characterise the subsecond motor kinematics of children with autism and those developing typically to identify autism-specific features. (2) Probe likely neurobiological origins of the motor disruption based on these variables.

Methods:

37 children 3-6 years old diagnosed with Childhood Autism and 45 age- gender-matched children developing typically were included. Children with sensory or motor impairment were excluded. iPad mini tablet computers employed two education games: *(1)* 'Sharing' where the main gameplay was to divide a piece of food and distribute it among four children; and *(2) Creativity* where gameplay was open, unstructured colouring of a toy or animal. Data were collected from the tablets' inertial sensors (tri-axial accelerometer, tri-axial gyroscope and magnetometer) and touch screen. Raw values and simple kinematic calculations produced 262 features. Previously we analysed these using machine learning

methods with a classification accuracy of 93% (Anzulewicz, Sobota & Delafield-Butt, 2016). Here, these features were extracted and analysed using standard statistical multivariate analyses to identify significant ones. Further, kinematic analyses of goal-directed gestures were analysed using standard biomechanical methods, and groups compared.

Results:

Features associated with impact force made at initial contact and forces put into the device during a gesture were significantly different between groups. Gesture kinematics were faster and larger across both games, with more distal use of space in children with autism. Children with autism made faster taps on the screen. Greater peak velocities with commensurate increases in acceleration and deceleration peaks and with significantly increased jerk amplitude were evident in goal-directed movements in the autism group.

Conclusions:

These data indicate under- and over-exertion of the motor impulse with velocity remaining high at a movement's conclusion. Acceleration-deceleration shifts with increased jerk amplitude appeared to oscillate at a fast, subsecond rate of ca. 13 Hz, corroborated by others (Cook et al., 2013). Greater impact forces confirm a greater velocity at movement termination, a finding in agreement with others' (Crippa et al., 2015). Disruption to sub-second control of intentional movements and timing their termination are two key features of the autism motor signature. A likely neuromotor origin of these is the brainstem inferior olivary pace-maker responsible for action timing. Disruption to basic action patterning will thwart motor intentions regularly, and may lead to distress, withdrawal, and the familiar simplification found in repetitive movement.

140 **168.140** Do Repetitive Behaviours and Restricted Interests Predict Later Cognitive Ability in Children with Autism Spectrum Disorder?

***V. Courchesne**[1], T. Savion-Lemieux[2], R. Bruno[2], T. Bennett[3], E. Duku[4], S. Georgiades[4], P. Mirenda[5], I. M. Smith[6], P. Szatmari[7], W. J. Ungar[8], T. Vaillancourt[9], J. Volden[10], C. Waddell[11], L. Zwaigenbaum[10], A. Thompson[4] and M. Elsabbagh[12], (1)McGill University, Montreal, QC, Canada, (2)Research Institute-McGill University Health Centre, Montreal, QC, Canada, (3)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA, (4)McMaster University, Hamilton, ON, Canada, (5)University of British Columbia, Vancouver, BC, Canada, (6)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (7)The Hospital for Sick Children, Toronto, ON, Canada, (8)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (9)University of Ottawa, Ottawa, ON, Canada, (10)University of Alberta, Edmonton, AB, Canada, (11)Simon Fraser University, Vancouver, BC, Canada, (12)McGill University, Montreal, PQ, Canada*

Background: Restricted and repetitive behaviors and interests(RRBIs) are one of the two domains of symptoms that constitute the diagnostic criteria of Autism Spectrum Disorder(ASD)(APA, 2013) and are therefore an important pillar for ASD diagnosis. The functional impact of RRBIs is source of debate in the literature. When studied as a single construct, RRBIs have shown to be negatively correlated to cognitive and adaptive functioning (e.g. Troyb et al. 2016). However, some argued that RRBI symptoms should be examined individually, rather than as a single homogenous construct, as they represent a vast array of heterogenous behaviours with possibly distinct underpinnings differentially affecting functioning across the lifespan (Lidstone et al. 2014). Support for this hypothesis comes from studies showing that when RRBIs are broken down into specific behaviours, some have been found to have an "adaptive" function and be associated to higher cognitive abilities(i.e. *stereotyped language,* Kim & Lord, 2010; *restricted interests*, Bishop et al., 2006; *rituals*, Militerni et al., 2002; *insistence on sameness*, Mooney et al., 2009). Nonetheless, there is still a paucity of research investigating individual RRBIs and their functional impact across development.
Objectives: Using data from a large longitudinal inception cohort of children with ASD, we explored whether the presence or absence of specific RRBIs, as reported by parents around the time of their child's diagnosis, could help predict non-verbal cognitive ability later in childhood.

Methods: Data were drawn from *Pathways in ASD*, a longitudinal study of 421 preschoolers diagnosed with ASD followed yearly across five Canadian provinces. Analyses included 206 children for whom the Autism Diagnostic Interview – Revised(ADI-R) was completed when they were 2-4 years (M=39.6 months; SD=8.6) and the Wechsler Intelligence Scales for Children – Fourth edition(WISC-IV) was completed when they were 8-9 years (M=104.7months; SD=2.5). Selected RRBI predictors of non-verbal cognitive ability (measured using the WISC-IV Perceptual Reasoning Index (PRI) standard score) included: stereotyped language (Q. 33), restricted interests (Q.68), rituals (Q.70), and insistence on sameness (Q.75), grouped as "absence" (score=0) or "presence" (scores of 1-3) of symptom as reported on the ADI-R. Student tests and linear regression models were performed to answer research question. Model validation was examined using adjusted R squared and homoscedasticity test of residuals variance.

Results: We found that the group of children for whom parents reported *rituals* (R^2=0.02 F=4.5, p=0.04) or *insistence on sameness* (R2=0.02 F=4.2, p=0.04) around the time of diagnosis had a tendency to have a slightly more elevated mean PRI standard score later in childhood as compared to the group of children for whom parents did not report these behaviors. No significant results emerged for the other two RRBIs (p>.05)

Conclusions: Our results support the notion that RRBIs should be considered as distinct behaviours that can differentially affect functioning across development. Further research is warranted using observational data and/or more dimensional measures capturing frequency of the behavior (rather than presence or absence) to better understand the differential impact of RRBIs on different spheres of functioning and across the lifespan to ultimately better inform RRBIs' targets in interventions.

141 **168.141** Emotional Contexts of Postural Control in Neurodevelopmental Disorders

***D. Green**, CHILD Research Institute, Jönköping University, Sweden*

Background:
Motor and social impairments are commonly reported to overlap in neurodevelopmental disorders. However, assessment of movement problems via standardised assessment requires an understanding of both implicit and explicit instruction e.g. 'stand on one foot as long as you can'. Standardised assessment is further complicated where anxiety may affect performance; evidenced by the literature with respect to balance and anxiety. There are few, if any studies, directly contrasting postural control between children with autism spectrum disorders (ASD) and those with developmental coordination disorder (DCD).

Objectives: This study will explore the potential relationship between emotional factors and balance in children with ASD and DCD and implications for assessment.

Methods: A scoping review profiling the motor impairments and emotional problems of children with ASD and DCD. Secondary data from an intervention study will contrast performance on tests of balance from the Movement Assessment Battery for Children (MABC) and compare associations between balance and emotional factors as measured by the Strengths and Difficulties Questionnaire (SDQ).

Results:

This paper will present data contrasting use of standardised measures of static and dynamic balance between children with ASD and those with DCD. Data on 48 children (median age 8 years; range 5 years-4 months to 10 years-8 months; 12 with ASD, 36 with DCD) were available. Findings reflect similarities in performance with a lack of distinction between these groups on standardised testing on both static and dynamic balance on the MABC (*p*>.05). Spearman correlations reflect an association between poor dynamic balance and emotional difficulties on the SDQ (*rho* =-.382, *p* = .016). No associations were found between emotional difficulties and other motor skills.

Conclusions:

The literature and preliminary findings support a potential relationship between emotional adjustment and motor skills, particularly balance. The results and interpretation will be considered with respect to administration of assessments, consequent interpretation of findings and implications for research and practice.

142 **168.142** Examining the Relationship between Sleep Patterns and Rrbs in Individuals with 16p11.2 Deletion with and without ASD

J. Straus[1]*, E. Hanson*[2] *and S. M. Attar*[3]*, (1)Developmental Medicine, Boston Children's Hospital, Boston, MA, (2)Boston Children's Hospital/Harvard Medical School, Boston, MA, (3)Boston Children's Hospital, Boston, MA*

Background:

Restrictive and Repetitive Behaviors (RRBs) can be extremely impairing for individuals and their families (Richler, Huerta, Bishop, & Lord, 2010). RRBs are necessary for a diagnosis of Autism Spectrum Disorder (ASD) and are also present in other disorders of development (Harrop et al., 2015). Previous research has shown gender differences in RRBs, with males reported to have greater numbers of these behaviors than females (Attar et al., submitted, 2017). In addition, past research has shown an increase in sleep difficulties in individuals with ASD (Cohen et al., 2014) as well as individuals with 16p11.2 deletion (Girirajan et al., 2010). Research has not yet been conducted to examine whether the presence of RRBs in individuals with 16p11.2 is related to sleep disturbance and, if so, if this is impacted by ASD and gender.

Objectives:

We hypothesized that sleep difficulties would be related to a higher presence of RRBs for children with 16p11.2 deletion with and without ASD.

Methods:

Data was used from the Simons Variation on Individuals Project on individuals with 16p11.2 deletion (N=117) with ASD (n=30) and without (n=87). Participants ranged from 1 year to 22 years old (*m*=8). Inclusion criteria included a completed Behavior and Sensory Interest Questionnaire (BSIQ, Hanson et al., 2016), which measures type and severity of 74 RRBs and the Pediatric Sleep Questionnaire (PSQ, Chervin, Hedger, Dillon & Pituch, 2000), which assesses disordered sleep patterns. Three items were used to measure sleep difficulty (SD) from the PSQ: difficulty falling asleep, waking up during the night, and difficulty falling asleep after waking up.

Results:

Of the 74 RRBs measured on BSIQ, five were found to be most prevalent in our sample and used in our preliminary analysis: delayed echolalia (35.67%), sensitivity to loud noises (58.92%), pushing face (35.14%), hitting caregivers or family members (70.27%), and difficulty with changes in school routine (41.62%).

RRBs were observed in 52 out of 59 (88.14%) of the male participants. Preliminary results suggest that there was a positive but not significant correlation between SD and presence of the five RRBs (*r* =.070, p = .357). When looking separately at individual RRBs and SD, two behaviors reached significance: pushing face (*r* =.353, p =.006) and hitting caregivers (*r* =.306, p =.018). Delayed echolalia, sensitivity to loud noises and difficulty with changes in school routine did not reach significance.

RRBs were observed in 46 out of 58 (79.31%) of the female participants. Preliminary results reveal that there was a positive but not significant correlation between SD and presence of the five RRBs (*r* =.094, p = .216). When looking separately at individual RRBs and SD, none reached significance.

Conclusions:

This preliminary data analysis supports the hypothesis that disordered sleep disturbances may be related to some common RRBs in male but not female individuals with 16p11.2 deletion with and without ASD. Further analysis will examine the relationship between sleep difficulties and severity as well as amount of a range of RRBs controlling for gender, IQ and diagnostic status.

143 **168.143** Exploring the Link between Sensory Reactivity, Anxiety and Related Mental Health Symptoms in Children with and without Autism

L. Roach[1] *and T. Tavassoli*[2]*, (1)University of Reading, Reading, United Kingdom, (2)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom*

Background:

Around 80% of individuals with autism spectrum disorder (ASD) report sensory reactivity symptoms. Sensory hyper-reactivity can be disturbing for daily life and has been suggested to be associated to anxiety. Specifically previous research has found there to be a link between sensory hyper-reactivity and anxiety in autistic children. Those with more severe sensory symptoms have also been found to have higher anxiety levels than those with less severe sensory symptoms. However, most studies have previously used questionnaire measures of sensory reactivity and focussed on anxiety only.

Objectives:

Thus this study set out to investigate the potential link between sensory reactivity, anxiety and related mental health symptoms using an observational tool.

Methods:

The study included 39 children with and without autism who were categorised according to their sensory reactivity; 16 children with sensory reactivity symptoms, and 23 without. We used a direct observation, the Sensory Processing Scale Assessment, to measure sensory reactivity, and the Behaviour Assessment System for Children (BASC) for measuring mental health symptoms, such as anxiety.

Results:

Children with sensory reactivity symptoms had significantly higher parent reported anxiety (p=.006), depression (p=.019), attention problems (p=.010), social skills (p=.019), withdrawal (p=.011) and adaptability (p=.020) compared to children without sensory reactivity symptoms. There were no significant differences in regards to aggression (p=.643), hyperactivity (p=.163), conduct problems (p=.246) and somatization (p=.456).

Conclusions:

Children with and without autism who have sensory reactive symptoms have significantly more mental health symptoms compared to children without sensory reactivity symptoms. This study used a direct observation to measure sensory reactivity, future research should include more direct measures of mental health symptoms as well. Identifying a link between sensory reactivity and mental health symptoms has implications for treatment approaches.

144 **168.144** Fine Motor Trajectories in Children with Fragile X Syndrome and Siblings of Children with Autism

E. A. Will *and J. E. Roberts, Psychology, University of South Carolina, Columbia, SC*

Background: Early motor delays and atypical motor movements are associated with autism related outcomes including increased autism symptomatology for children with fragile X syndrome (FXS; Roberts et al., 2016a) and expressive language delays in at-risk siblings of children with autism (ASIBs; LeBarton & Iverson, 2013). In addition, children with FXS and ASIBS demonstrate divergent fine motor skills from one another at 24 months old, indicating a differential motor profile in these groups at high risk for ASD (Roberts et al., 2016b). However, little is known regarding developmental trends in fine motor skills in children with FXS compared ASIBs and whether this is a potential area for early identification of autism in FXS.

Objectives: The purpose of the two studies presented was to 1) compare longitudinal developmental trajectories of fine motor skills in children with FXS contrasted to unaffected ASIBS, and 2) to compare these trajectories between children with FXS, children with FXS and comorbid autism (FXS+ASD), and ASIBs.

Methods: Study 1 compared longitudinal fine motor trajectories between a larger FXS group (N=128; mean chronological age (CA) at initial assessment=17.60 months) and the non-ASD ASIB group (N=34; *M* initial CA=11.48). Study 2 examined fine motor trajectories between the FXS (N=27; *M* initial CA=15.07), FXS+ASD (N=13; *M* initial CA=22.84), and the non-ASD ASIB (N=34) groups. Groups were assessed annually between 5 and 60 months old. Measures included the Mullen Scales of Early Learning (MSEL, 1995) for both studies, and for study 2, data from the Autism Diagnostic Observation Schedule-2 (ADOS-2, Lord et al., 2000) was drawn for clinical best estimates of comorbid ASD. The subset of FXS participants in study 2 (n=40) and all ASIBS were evaluated for a clinical best estimate of ASD. Approximately 33% (n=13) of the FXS group were diagnosed with comorbid ASD (FXS+ASD), and ASIBS were confirmed as not meeting criteria for ASD. Multilevel models were estimated to examine fine motor trajectories between groups.

Results:

Study 1: Results indicated that the FXS group had lower fine motor skills (b=1.49, p=.0026) at 9 months of age as well as a decelerating trend in fine motor skills over time compared to the ASIBs (b=.025; p<.001). The FXS and ASIB demonstrated increasingly divergent trends, with the greatest fine motor discrepancy at 60 months (b=14.43; p<.001).

Study 2: The fine motor skills of the FXS group were lower than the ASIBs (b=2.59, p=.0001) at 9 months of age, but were similar to the FXS +ASD group. The FXS and FXS+ASD groups became gradually more divergent from ASIBs over time. The FXS and FXS+ASD groups were marginally different at 24 months (*p=.059)*, and differed at each subsequent assessment, with the FXS+ASD group demonstrating lower rates fine motor skill acquisition over time.

Conclusions: Collectively, study findings indicate that fine motor skills are an area of marked delay for children with FXS, and in particular FXS+ASD, relative to ASIBs. These results also provide preliminary evidence that fine motor trajectories may serve as a potential early indicator of atypical development and autism risk in FXS.

145 **168.145** Gender Comparison of Repetitive Behavior Profiles Among Two Age Cohorts

M. G. Evans[1,2], ***A. B. Barber***[1], *S. Ryan*[3], *S. W. Eldred*[4] *and P. E. Reed*[1], *(1)Communicative Disorders, University of Alabama, Tuscaloosa, AL, (2)University of Alabama, Tuscaloosa, AL, (3)The University of Alabama, Tuscaloosa, AL, (4)Department of Psychology, University of Alabama, Tuscaloosa, AL*

Background:

ASD is identified more often in boys than girls, at a ratio of 4.5:1 (Christensen et al., 2016). Research suggests that a possible gender bias leads to under diagnosis of girls (Dworzynski et al., 2012), particularly for those with higher cognitive abilities (Frazier et al., 2014). More research is needed to better understand differences in core symptom presentation, including repetitive behavior profiles (Halladay et al., 2015). In general, boys tend to demonstrate more repetitive behaviors than girls (Szatmari et al., 2012) although the repertoire may be similar under age 5 (Harrop et al., 2015). Qualitative differences in repetitive behavior presentations have been suggested, which may be contingent on higher social proficiency, making repetitive behavior difficult to classify as diagnostically relevant in girls (Halladay et al., 2015; Hiller et al., 2015). Therefore, the female ASD phenotype should be reevaluated in order to improve diagnostic precision (Van Winjngaarden-Cremers et al., 2014).

Objectives:

The purpose of this study is to describe and compare repetitive behavior profiles and frequencies in two age cohorts of girls and boys with ASD measured by the Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 2000).

Methods:

Participants included 214 children with ASD (42 girls; 172 boys) ranging from 16 months to 10 years of age (mean = 46.1 months). Participants were recruited from a university based ASD Clinic research database. Each participant met the following criteria: (1) a clinical diagnosis of ASD (2) 10 years of age or younger at the time of their evaluation; and (3) no co-morbid medical diagnosis that could attribute to repetitive behavior. Repetitive behaviors demonstrated by children in two age cohorts (1-3 years; 4-10 years) were compared using the RBS-R, a 43-item parent report measure which assesses frequency and repertoire of repetitive behaviors across 6 categories.

Results:

Preliminary analyses indicated that prior to 3 years of age, girls demonstrated a significantly higher overall number of repetitive behaviors (t = -1.66; p = .03) and significantly more ritualistic behaviors (t = -.12; p = .004) and sameness behaviors (t = -1.9; p = .002). A different profile emerged in older children indicating that girls demonstrated more stereotyped behaviors than boys (t = -2.2; p = .001). The younger cohort of girls (n = 23) demonstrated more stereotyped behaviors (62.7% of the total number of stereotypical behaviors assessed were endorsed), followed by restricted interests (58%), sameness (41%), compulsive (46%), ritualistic (36%) and self-injurious behavior (27%). This profile remained fairly consistent among the older cohort of girls (n = 19) with one exception. Ritualistic behaviors were endorsed more often than compulsive behaviors in the older female cohort. Both cohorts of boys demonstrated restricted behaviors most often, followed by stereotypical behaviors. Repetitive behavior profiles will be discussed relative to developmental level and social skills.

Conclusions:

In opposition to previous findings, results indicated that girls demonstrate more repetitive behaviors than boys, which may be reflective of methodological differences (parent report vs. direct observation). These findings contribute the understanding of the female ASD phenotype. Diagnostic implications will be suggested.

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168.146 Generalised Time Processing Impairment in Autism Spectrum Disorders

C. M. Falter-Wagner[1], *S. Isaksson*[2], *S. Salomaeki*[2], *J. Tuominen*[2], *V. Arstila*[2] *and V. Noreika*[3], *(1)LMU Munich, Munich, Germany, (2)University of Turku, Turku, Finland, (3)University of Cambridge, Cambridge, United Kingdom*

Background: Individuals with ASD have been known to show a poor sense of time *“to a degree that is markedly discrepant with their level of intelligence”* (Wing, 1996: 89). Deviations in the processing of time do not currently form diagnostic criteria, but may affect every day behaviour and could feed into many diagnostic domains. In particular, efficient interaction and communication are reliant on accurate timing of durations and events. Hence, timing has received increasing attention in recent research (for a review see Allman & Falter, 2015). Yet, a lack of systematic studies testing different aspects of timing in the same sample of participants, prevents a conclusive assessment of whether there is a generalised time processing deficit in ASD and whether there is any relationship to diagnostic symptoms.

Objectives: The aim of this study was to test performance across time processing functions, scales and modalities in the same group of individuals.

Methods: 17 children diagnosed with ASD and 18 typically developing age- and IQ-matched controls carried out a set of motor and perceptual timing tasks: free tapping, simultaneity judgment, auditory duration discrimination, and verbal time estimation. In addition, parents of participants filled out a questionnaire assessing the sense and management of time.

Results: Children with ASD showed faster and more variable free tapping than controls. Auditory duration discrimination thresholds were higher in the ASD compared to the control group in a sub-second version of the task, while there were no group differences in a supra-second discrimination of intervals. Children with ASD showed more variable thresholds of simultaneity judgment, and they received lower parental scores for their sense and management of time. No group differences were observed in the verbal time estimation task in the minute-range. Importantly, we found an inter-correlation between timing functions in the ASD group only, pointing towards less differentiation and specification of timing functions in ASD. Finally, autistic symptom severity was associated with several timing measures.

Conclusions: The time processing deficit in ASD can be generalised to motor timing, perceptual timing, and temporal perspective, and it is associated with autistic symptom severity. An interrelation between timing functions suggests that, in contrast to control participants, individuals with ASD might apply a similar strategy irrespective of task demands and context.

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168.147 Identifying the Origins of Postural Control Deficits in Autism Spectrum Disorders: Sensory Acuity Vs. Sensory Integration

M. Doumas[1], *R. Knox*[2], *C. Craig*[3] *and C. O'Brien*[2], *(1)School of Psychology, Queen's University Belfast, Belfast, United Kingdom, (2)Queen's University Belfast, Belfast, United Kingdom, (3)Manchester Metropolitan University, Manchester, United Kingdom*

Background: Individuals with Autism Spectrum Disorders (ASD) experience the world differently compared with neurotypical individuals. ASD is characterised by deficits in social interaction and communication, but also in sensory processing and motor control. One of the key aspects of movement affected by ASD is postural control. Postural control deficits in ASD are well established, however, the underlying mechanisms of these deficits are not well understood. Recent studies suggest that the increased postural instability observed in individuals with ASD is most evident when one or more of the sensory channels (visual, vestibular and proprioceptive) involved in this task is compromised. Thus, this impairment is likely to be either due to impaired acuity of information from these channels, due to impaired sensory integration processes, or both.

Objectives: The main objective of this study was to assess the contribution of sensory acuity and sensory integration to the postural control deficits of individuals with ASD. We hypothesized that these deficits will be due to sensory integration rather than sensory acuity.

Methods: Fifteen high functioning (IQ>80) young adults with ASD (2 female, age range 18-35 years) and 15 age- and gender-matched neurotypical adults participated in our study. They first performed an ankle joint-position matching task measuring proprioceptive acuity. Then, they performed a postural control task, without vision, thus involving only proprioceptive and vestibular information. Participants were asked to stand on a fixed surface (baseline, 2 minutes), immediately followed by standing on a sway referenced surface (adaptation, 3 minutes) which induced inaccurate proprioceptive information about body sway, and then again on a fixed surface (reintegration, 3 minutes).

Results: Participants with ASD and neurotypical controls were not different in absolute and variable error in the joint position-matching task. In the balance task, no group differences in AP (Anterior-Posterior) and ML (Medio-Lateral) path length were shown during baseline. Subsequently, when sway referencing was introduced AP and ML path length increased in both groups as expected. However, over the course of the 3 minutes of adaptation to this environment, neurotypical participants were able to reduce sway especially in the AP direction over time through adaptation. In contrast, participants with ASD did not exhibit this ability to adapt to the sway referenced environment by reducing sway over time, reflecting an inability to reweight proprioceptive and vestibular information during postural control. Finally, when the fixed surface was restored both groups were able to return to their baseline levels of sway at the same rate.

Conclusions: These results confirm our hypothesis that the postural control deficit observed in individuals with ASD is primarily due to central, sensory integration deficits rather than peripheral, sensory noise. Future research is needed to identify ways to moderate this deficit in order to improve motor skill performance and quality of life in children and adults with ASD.

148 **168.148** Individuals with ASD Imitate By Way of Mirroring More Than Their Typical Peers

Z. M. Dravis[1], *J. Diaz*[2], *V. Obsekov*[2], *E. S. Kim*[1], *A. Tiedemann*[3], *M. Cola*[1], *S. Uh*[1], *E. F. Ferguson*[2], *L. Adeoye*[4], *L. Bateman*[2], *S. Plate*[1], *A. Zoltowski*[5], *A. Pomykacz*[6], *K. Bassanello*[1], *J. Pandey*[1], *S. H. Mostofsky*[3], *R. T. Schultz*[1] *and A. de Marchena*[7], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)The Center for Autism Research/CHOP, Philadelphia, PA, (3)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (4)The Center for Autism Research/CHOP, Phladelphia, PA, (5)Vanderbilt University, Nashville, TN, (6)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (7)University of the Sciences, Philadelphia, PA*

Background: When performing elicited imitation, one can either *mirror* (e.g., use the right hand when the model is using their left, as if looking in a mirror) or *transpose* (i.e., imitate using the same hand as the model; see **Figure**). Mirroring is generally thought to be easier than transposition, potentially because mirrored movements have more visual parallels to the model's movement, and potentially because transposition requires greater perspective taking. From a developmental perspective, typically developing children are more likely to spontaneously mirror, while adults are more likely to transpose. When prompted to mirror, typical children and adults' performance tends to improve, suggesting that mirroring benefits imitation accuracy, a finding that has not been consistently demonstrated in ASD. Studies of school-age children have demonstrated that in goal-directed imitation, those with and without ASD do not differ in their spontaneous tendency to mirror. It is unknown whether adolescents and adults with ASD make the same shift to favoring transposition during imitation shown by typically developing adults.
Objectives: To determine whether older children, adolescents, and adults with ASD transition to a primarily mirroring strategy during elicited imitation.

Methods: Verbally fluent, right-handed children, adolescents, and adults with ASD (*n*=29) and age- and IQ-matched typically developing controls (TDC; n=14, see **Table**) completed a brief praxis battery, administered by right-handed examiners. The battery consisted of 19 items for which participants completed specified actions either by imitating the examiner (*imitation* condition), or following a *non-imitation* prompt (i.e., following verbal instruction with or without a relevant prop). Participants were explicitly instructed that they could use whichever hand they wanted to complete the actions. Each item was later coded for whether the participant used their right or left hand. Because all participants and examiners were right-handed, use of the right hand during imitation can be taken to reflect transposition, whereas use of the left hand reflects a mirroring strategy.

Results: Participants across groups primarily or exclusively used their right hand during the non-imitation condition (see Table for details). During the imitation condition, the TDC group continued to overwhelmingly select their right hand, showing the expected preference for a transposition strategy. In contrast, participants with ASD often switched to using their left hand, suggesting a stronger inclination toward mirroring compared to those without ASD (independent-samples t-test, p=.004, d=1.57).

Conclusions: The present study shows that older children, adolescents, and adults with ASD spontaneously imitate by way of mirroring more than their typical peers (who almost entirely transpose), even when doing so requires them to use their non-dominant hand. This suggests that, even beyond early childhood, people with ASD may continue to rely on a developmentally earlier strategy for imitation. Mirroring may be beneficial because actions occur in a more familiar spatial field, thereby reducing working memory load. Future research can test these potential mechanisms, and can examine whether strategy selection (i.e., mirroring vs. transposition) relates to task performance. Understanding how older individuals with ASD spontaneously imitate may shed light on self-other mappings and automatic perspective taking in this population.

149 **168.149** Measuring Dyspraxia in Autism with a Brief Praxis Exam

V. Obsekov[1], *J. Diaz*[1], ***Z. M. Dravis***[2], *E. S. Kim*[2], *L. Adeoye*[3], *L. Bateman*[1], *A. Pomykacz*[4], *E. F. Ferguson*[1], *M. Cola*[2], *S. Uh*[2], *S. Plate*[2], *A. Zoltowski*[5], *K. Bassanello*[2], *A. Tiedemann*[6], *J. Pandey*[2], *S. H. Mostofsky*[6], *R. T. Schultz*[2] *and A. de Marchena*[7], *(1)The Center for Autism Research/CHOP, Philadelphia, PA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)The Center for Autism Research/CHOP, Phladelphia, PA, (4)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (5)Vanderbilt University, Nashville, TN, (6)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (7)University of the Sciences, Philadelphia, PA*

Background:
Individuals with ASD are now known to exhibit a wide array of motor differences. Over the past decade-plus, deficits in *praxis* have been robustly demonstrated and replicated in ASD. Praxis refers to the ability to perform learned skills movements, such as using tools or producing familiar symbolic gestures. A widely used measure of praxis, the Florida Apraxia Battery, typically takes 20-30 minutes to administer, and up to twice as long to score, limiting the feasibility of including it in multi-dimensional studies of ASD.

Objectives:

To test whether well-established deficits in praxis could be demonstrated using a brief (5-minute) measure.

Methods:

Verbally fluent children and adults with ASD (n=34) and age- and IQ-matched typically developing controls (TDCs; n=17) completed a 5-minute praxis battery. The battery consisted of 19 items from the Florida Apraxia Battery, across four sections: (1) Gestures to Verbal Command, (2) Gestures with Tool Use, (3) Gestures to Imitation, and (4) Gestures to Meaningless Imitation. The first three sections contained the same five transitive actions: stirring a cup of hot chocolate, hammering a nail, painting a wall, writing with a pencil, and scooping ice cream. The last section contained five “meaningless”/nonsense actions, similar to short dance moves. Administrations were video recorded and later coded by two independent raters, naïve to participant diagnosis, for the presence of errors, including: spatial, temporal, content, and body-part-for-tool errors (see Figure 2). Intraclass correlation coefficients for total errors ranged from .82-.98, demonstrating excellent interrater reliability.

Results:

Participants with ASD made far more errors on the task (M=11.53, SD=6.01) than did controls (M=6.41, SD= 2.09), $p<.001$, $d=1.32$, a reliable effect with a large effect size. Although participants with ASD performed worse on each individual subtest (Figure 1), there was no interaction between group and subtest ($p=.29$, $\eta^2=.08$), suggesting that both groups responded to the four subtests similarly. A significant interaction between group and error type ($p=.01$, $\eta^2=.23$) revealed that participants with ASD were more likely to make spatial and temporal errors specifically, compared to controls (Figure 2). Individual differences analyses revealed that better praxis performance was associated with higher IQ in the TDC group ($r=.521$, p=.032), and with older age ($r=.374$, p=.029) and lower ADOS scores ($r=-.318$, p=.072) in the ASD group.

Conclusions:

These preliminary results demonstrate that known weaknesses in praxis performance in ASD can be replicated using a significantly shortened version of a praxis exam. Using this abbreviated battery, individuals with ASD made more errors across all four sections of the battery relative to those in the typically developing group. Additionally, individuals with ASD were more susceptible to certain error types than others, specifically spatial and temporal errors. These findings are largely consistent with studies using the full battery (e.g., Mostofsky et. al, 2006), suggesting that a shortened battery may have sufficient sensitivity to observe group differences in praxis performance. The ability to measure praxis efficiently will increase the feasibility of including it as part of larger batteries aimed at testing the relationship between praxis and hypothesized downstream skills (e.g., social communication).

150 **168.150** Intact Sensorimotor Adaptation in Autistic Adults

J. R. Oulton[1], *J. Causer*[1], *S. J. Hayes*[2] *and S. J. Bennett*[2], *(1)Research Institute for Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom, (2)Research Institute Sport and Exercise Sciences, Liverpool John Moores University, Liverpool, United Kingdom*

Background: Atypical sensorimotor integration in autism leads to altered action models (Mostofsky & Ewen, 2011). There is growing evidence illustrating how atypical sensorimotor integration underlies differences in sensorimotor behaviour (Cook, Blakemore, & Press, 2013; Marko et al., 2015), however the majority of research has been carried out with autistic individuals that have mild severity, or require support. Whereas, autistic individuals who are moderate/severe, or require substantial support are understudied.

Objectives: Examine the effect of experience on sensorimotor adaptation in adults diagnosed with moderate/severe autism spectrum disorders.

Methods: Forty autistic individuals diagnosed with moderate/severe autism spectrum disorders formed an *experimental group* (n = 22) and a *control group* (n = 18). The *experimental group* participated in trampolining sessions and accumulated an average of 144 hours (SD =26) of sensorimotor experience. The *control group,* who were matched for age, gender, verbal IQ, social responsiveness, sensory profile, and motor proficiency, had participated in community-based activities that did not have a sensorimotor basis. A non-invasive preferential viewing protocol (PVP) measured gaze behaviour while observing one of four point-light models (8 seconds duration) displaying *experimental stimuli:* specialist trampolining movements (BAGA award level 2 *seat drops* and 3 *twists*) or the *control stimuli: straight jumps* on a trampoline, and *gait*. Participants viewed these on a computer monitor, while eye gaze was measured using a desk mounted Tobii X2 eye-tracker. A PVP trial required participants to view a vertical split screen, with the same action (e.g., seat drop) presented in an upright (congruent) and inverted (incongruent) orientation. Participants viewed each of the stimuli presented as a block of four trials, trial order within a block counterbalanced to avoid sequence effects. In total, there was 4 blocks and 4 trials. Preferential attention was quantified using first-fixation-location (e.g., congruent) and first-fixation-duration (Jones, Carr, & Klin, 2008; Ryan, Hannula, & Cohen, 2007).

Results: Significant group x congruency interactions were revealed for first-fixation-location ($p = 0.001$) and first-fixation-duration ($p = 0.037$) when viewing *twists*. The *experimental group* orientated attention to the incongruent point-light action, but then fixated longer on the congruent action (congruent: M = 193.85ms; incongruent: M = 147.63ms). The *control group* orientated attention to the congruent point-light action, but then fixated longer on the incongruent action (incongruent: M = 177.22ms; congruent: M = 169.00ms). No significant (*ps* > 0.05) effects were revealed when viewing seat drops, straight jumps, and gait.

Conclusions: Sensorimotor training leads to functional adaptation in the underlying perception-action system, with faster motor response times during the perception of learned stimuli (Catmur et al., 2009), and the development of experience-dependent perception-action processing (Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005; Casile & Giese, 2006). Consistent with these effects, here there were differences found in preferential attention (first-fixation-location) and evaluation (first-fixation-duration) of specialist learned action stimuli (i.e., *twists*) following trampolining sensorimotor experience compared to those that engaged in community-based activities. This indicates intact sensorimotor development and processing in autistic adults diagnosed with moderate/severe autism spectrum disorders.

151 **168.151** Individuals with ASD Meet Diagnostic Criteria for Co-Occurring Developmental Coordination Disorder

H. L. Miller[1], *P. M. Caçola*[2], *G. M. Sherrod*[3] *and N. L. Bugnariu*[1], *(1)University of North Texas Health Science Center, Fort Worth, TX, (2)Kinesiology, University of Texas at Arlington, Arlington, TX, (3)University of Alabama - Birmingham, Birmingham, AL*

Background: Autism Spectrum Disorder (ASD) and Developmental Coordination Disorder (DCD) are developmental disorders with distinct definitions and diagnostic criteria. DCD is characterized by poor motor proficiency despite age and opportunity for learning. ASD and DCD can now be diagnosed as co-occurring in the same individual (DSM-5; APA, 2013). Systematic assessment for DCD is uncommon in the ASD diagnostic process, despite shared sensorimotor symptoms, and so the rate of co-occurrence (ASD+DCD) remains unknown.

Objectives: We aimed to determine whether individuals with ASD meet DSM-5 diagnostic criteria for DCD, using a combination of parent-reports and standardized clinical tests. We compared motor profiles and impact of motor problems on daily living in ASD and DCD. We also compared social communication skills in both groups.

Methods: Thirty-seven individuals participated in this study, 27 diagnosed with ASD (Male = 21) and 10 diagnosed with DCD (Male = 9). We assessed all 4 criteria for a DCD diagnosis based on the DSM-5. All participants completed three assessments: The Movement Assessment Battery for Children – 2nd ed. (MABC-2) for motor profiles, the Developmental Coordination Disorder Questionnaire (DCD-Q) for impact of motor problems on daily living. Both assess criteria A and B of the DSM-5, respectively. We used the Social Communication Questionnaire (SCQ) to assess social communication skills. In addition, we asked about delays in early milestones (crawling and walking) for Criterion C, and ruled out all neurological impairments (Criterion D) in both groups.

Results: Independent t-tests indicated no significant differences ($p < 0.05$) between the groups on the MABC-2 total percentile, with all individuals fitting the cut-off score for DCD (ASD: 6.69±16.81; DCD: 1.62±2.68). However, individuals with ASD scored significantly higher than those with DCD on the DCD-Q, indicating a lower impact of their motor deficits on daily living for this population (ASD: 37.32±11.60; DCD: 28.9±5.38). As expected, individuals with ASD scored significantly higher than those diagnosed with DCD (ASD: 20.04±6.53; DCD: 6.60±5.23) on the SCQ. Results on the early motor milestones indicated that the majority of the individuals in both groups did not have delays, but most individuals with ASD were close to the cut-off for a delay in waking (walked close to 18 months).

Conclusions: We conclude that all individuals in our sample could potentially be diagnosed with DCD in addition to ASD. We recommend that the evaluation of potential DCD in individuals with ASD be performed systematically and thoroughly, so as to distinguish this co-occurring condition from sensorimotor symptoms associated with ASD. The implications of a DCD diagnosis on individuals with ASD. This will aid clinicians in making important choices about intervention, informed by the distinction between individuals with co-occurring ASD+DCD and individuals with ASD who display some motor differences but do not meet criteria for DCD.

152 **168.152** Motor Skills As Moderators of ASD Core Symptoms: Insights from the Artificial Networks Approach

F. Fulceri[1], *E. Grossi*[2], *A. Contaldo*[3], *A. Narzisi*[4], *S. Calderoni*[5], *F. Apicella*[4], *I. Parrini*[3], *R. Tancredi*[3] *and F. Muratori*[3,5], *(1)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (2)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (3)IRCCS Stella Maris Foundation, Calambrone (Pisa), Italy, (4)IRCCS Fondazione Stella Maris, Calambrone (Pisa), Italy, (5)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy*

Background:

In addition to the core symptoms, both fine and gross motor delays/disorders have been reported in children with Autism Spectrum Disorders (ASD). However, it is still unclear whether motor impairments are uniformly distributed across the entire ASD spectrum and whether they are related to DSM-5 specifiers (i.e. intelligence, language, comorbidity and associated conditions). In the light of the high heterogeneity in ASD it could be possible that “a single symptom approach analysis” do not provide comprehensive information. The strong inherent non-linearity of the relationships between clinical variables may account for the inability to grasp the core problem by the traditional analysis. Artificial neural networks (ANNs) are computational adaptive systems particularly adapting to solving non-linear problems. The goal of this data mining model is to discover hidden trends and associations among variables. Recently this approach has been successfully applied to the ASD field.

Objectives:

To investigate associations between motor skills and clinical/developmental features in preschoolers with ASD. We hypothesized that ANNs will be able to find hidden trends among the variables revealing the clinical profiles related to motor functioning in ASD.

Methods:

This study was carried out according to the standards for good ethical practice of the IRCCS Stella Maris Foundation and in accordance with the guidelines of the Declaration of Helsinki.

32 male with ASD (age range: 30-60 months; nonverbal IQ≥ 70) were recruited at the IRCCS Stella Maris Foundation, a tertiary care university hospital. Multidisciplinary comprehensive diagnostic evaluation was associated with a standardized assessment battery for motor skills, the Peabody Developmental Motor Scale- Second Edition (PDMS-2). The PDMS-2 consists of six motor subscales (Reflexes, Stationary, Locomotion, Object Manipulation, Grasping and Visual-Motor Integration) and three motor quotients (MQ) (Gross MQ, Fine MQ, Total MQ). According to PDMS-2, motor skills were classified into 7 categories: very superior, superior, above average, average, below average, poor and very poor.

Analyses were performed through the Auto Contractive Map system which is a fourth-generation unsupervised ANNs. Auto Contractive Map system ‘spatializes’ the correlation among variables (‘closeness’) providing a graph that identifies the relevant associations and organizes them into a coherent picture.

Results:

Preliminary linear correlation analysis revealed that motor impairment was associated with both cognitive skills and repetitive behaviors in children with ASD (Table 1). The ANNs analysis (Figure 1) showed that motor disorders were strongly related to low level of expressive language and high level of repetitive behaviors in preschoolers with ASD. In addition, the ANNs approach considered the entire spectrum of relationship among clinical variables, revealing hidden trends among motor, cognitive and social skills.

Conclusions:

The ANNs approach revealed motor skills as moderators of ASD core symptoms. This appears to be consistent with the growing literature suggesting that the systematic observation of motor development in ASD may improve the knowledge about clinical and neurobiological involvement as well as guide development of treatments.

153 **168.153** Multisensory Integration and Autistic Traits

S. A. Lauzon, *S. E. Schulz, Z. I. Cohen and R. A. Stevenson, Western University, London, ON, Canada*

Background: Sensory processing issues are one of the most common complaints in ASD. One area of sensory difficulties that has been the focus of intense research in recent years is multisensory integration, or the ability to bind auditory and visual information into a single, unified perception. One consistent finding has been that multisensory integration is an area of difficulty in ASD when the sensory information contains social or linguistic information (e.g., audiovisual speech), but results have been less clear with simple, non-sociolinguistic stimuli. This study aims to address this current area of ambiguity.

Objectives: Our objective for this study is to determine whether multisensory integration abilities are related to traits and symptomatology commonly associated with ASD, specifically during the processing of non-sociolinguistic sensory information.

Methods: Sixty-five undergraduate students completed a behavioural audiovisual detection task, and completed a battery of questionnaires assessing ASD-related traits and symptomatology. During the behavioural component of the study, participants were presented with auditory tones and visual sinusoidal gratings (Gabor patches) embedded in auditory and visual white noise, respectively. Stimuli were presented either separately (audio *or* visual), or simultaneously in combination (audiovisual). Eighty trials of each modality were presented, as well as 240 catch trials (1/2 of all trials), in which no tone or grating was presented. Participants were asked to press the space bar as soon as they perceived either a tone or a grating. Multisensory enhancement (ME) was measured by comparing accuracy rates during audiovisual trials to the accuracy rate predicted by the unisensory conditions assuming independent processing:

$pAV_{acc} = A_{acc} + V_{acc} - A_{acc} * V_{acc}$.

Participants then completed measures of autistic traits in general (Autism Quotient, Broad Autism Phenotype Questionnaire), social competency and communication (Social Responsiveness Scale, Multidimensional Scale of Social Competency), repetitive behaviours (Repetitive Behaviours Questionnaire), and sensory processing (Sensory Profile 2, Sensory Perception Quotient).

Results: Mean accuracies for auditory, visual, and audiovisual conditions are presented in Figure 1A. Measures of multisensory enhancement for individuals were found in the normal range, from -.12 (no enhancement) to .02 (enhancement). Importantly, correlations between ME and all measures of ASD-related traits and symptomatology were non-significant, and did not approach significance, with R-squared values ranging from 0.001-0.03. Scatterplots associated with each questionnaire can be seen in Figures 1B-H.

Conclusions: These results suggest that there is no relationship between ME of simple, non-sociolinguistic sensory information and autistic traits and symptomatology. While multisensory integration issues are well established with sociolinguistic stimuli, these data suggest that these issues may be restricted to social or linguistic information. These data align well with studies of multisensory integration in ASD using different paradigms. For example, processing of the temporal characteristics of multisensory stimuli are impacted in autism when social or linguistic information is present, but not simple, non-sociolinguistic information. Importantly, the lack of any relationship between ME and ASD traits spanned a range of symptoms, including repetitive behaviours, social communication, and sensory issues, suggesting multisensory integration may be associated with autism symptomatology only when sociolinguistic information is present.

154 **168.154** Oculomotor Functions in ASD

M. Latinus[1], *J. Malvy*[2], *M. Siwiaszczyk*[3], *K. Kovarski*[4], *F. Bonnet-Brilhault*[5] *and M. Batty*[6], *(1)UMR INSERM U930, Tours, France, (2)CHRU Tours, Tours, France, (3)Inserm U930 - Université François Rabelais de Tours, Tours, France, (4)UMR 930 INSERM, University of Tours, Tours, France, (5)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (6)Centre d'Etudes et de Recherches en Psychopathologie et Psychologie de la Santé, Université de Toulouse - Jean Jaurès, Toulouse Cedex 9, France*

Background: Atypical sensory information processing is today part of the diagnostic criteria of ASD. Several studies reported atypical visual exploration of both social and non-social stimulation in ASD with less precise and more heterogeneous saccade, which could be the manifestation of underlying difficulties in oculomotor control.

Objectives: We aimed at characterizing oculomotor functions in children with ASD.

Methods: We assessed a subset of oculomotor functions (saccade, fixation) in children with ASD and age-matched controls using paradigms of increasing complexity, while no instructions were provided. First, participants fixated a cartoon presented at the center of the screen. Second, participants were involved in a prosaccade gap paradigm. Finally, the children performed three visual search tasks: a feature search (e.g., color), and social/non-social visual-search task (e.g., a face among butterflies and vice-versa).

Results: Children with ASD showed shorter fixation duration and more microsaccades. In the prosaccade task, they were as accurate as control participants, yet faster to reach the target, an effect partially attributable to shorter saccadic response times. In the color search task, children with ASD performed less well than TD children, but were faster in reaching their closest position to the target. Finally, we compared visual search of complex stimuli (butterfly and faces), and found a significant interaction between group and stimulus type, showing that control children were more precise in searching for faces among butterflies, while ASD children performed similarly in the social and non-social visual search tasks. Once again, participants with ASD were generally faster in reaching the odd one out.

Conclusions: Children with ASD showed atypical, but not always impaired oculomotor behaviors. Atypical oculotomor behavior from enhanced motor functioning to impaired fixation abilities could hinder exploratory behavior of children with autism, leading to difficulties in complex situations, whether social or not.

155 **168.155** Odor Identification Skills in Adults with ASD Are Associated with Anatomical Abnormalities in the Tractography of Fronto-Occipital Fasciculi

V. Parma[1], *K. G. Stephenson*[2], *D. N. Top*[2], *J. S. Beck*[3], *N. C. Russell*[2], *A. W. Carr*[2], *L. Peacock*[3], *C. Ray*[2], *N. J. Goodrich-Hunsaker*[3] *and M. South*[4], *(1)William James Center for Research, ISPA - Instituto Universitário, Lisbon, Portugal, (2)Brigham Young University, Provo, UT, (3)Psychology, Brigham Young University, Provo, UT, (4)Psychology & Neuroscience, Brigham Young University, Provo, UT*

Background: Individuals diagnosed ASD exhibit abnormal chemosensory experiences from childhood into adulthood. Sensory function is likely linked to social communication function (Bennetto et al., 2007) and the manifestation of anxiety (South & Rodgers, 2017). However, there few studies of olfaction in adults with ASD and to date there are no published neuroimaging studies of olfactory processing in ASD.

Objectives: We investigated white matter tractography to determine point-wise quantifications of abnormal anatomical connections in olfactory areas in adults with ASD. We additionally examined correlations of tractography results alongside olfactory identification skills.

Methods: Thirty-four adults with ASD (13F) and 39 neurotypical controls (NT group, 19F) participated in the study. Tracts within inferior fronto-temporal areas, chosen *a priori*, were defined using automated fiber-tract quantification. High fractional anisotropy (FA) values indicate greater fiber density while mean diffusivity (MD) describes the rotationally-invariant magnitude of water diffusion within brain tissue. The odor identification task required participants to smell 16 odorous pens one at a time after having visualized four images representing the target odor and three distractors, then choosing the correct odor from the four possibilities.

Results: Bayesian models showed that individuals in the ASD group were nearly 3 times more likely to show reduced odor identification skills than NT controls. The tract profiles of infero fronto-occipital and longitudinal fasciculi show abnormalities in ASD especially in rostral sections of the tracts. Odor identification performance was significantly associated with FA values in frontal sections of tract profiles. Odor identification skills in ASD are binomially distributed, in line with other sensory-related experiences in ASD (Bogdashina, 2016).

Conclusions: Taken together, our findings describe for the first time the relationships between odor identification skills and their neural underpinnings in adults with ASD. Results suggest that olfactory perception and neuroimaging can provide non-invasive tools for ASD subgroup characterization. Further exploration of relationships between olfactory processing, social communication skills, and anxiety symptoms is warranted.

156 **168.156** Ophthalmologic Peculiarities in Children with Autism Spectrum Disorder

ABSTRACT WITHDRAWN

Background:
Impairments in the exploration and perception of social stimuli could at least partially result from undetected eye pathology in ASD. Although highly recommended, eye examination is not done systematically due to a lack of complaints. Moreover, this examination is difficult to realize in children with ASD.

Objectives:

The main purpose of this prospective study was to evaluate the prevalence of ophthalmological disorders in children presenting ASD and understand the influence of these disorders on autistic traits. Another important aim of the study was to developp a suitable clinical protocol to evaluate opthalmological pathologies in children with ASD, including children without langage or with mental retardation.

Methods:

An original procedure was born from the collaboration of ophthalmologic and child psychiatric departments to propose an ophthalmologic examination for each child included in a therapeutic follow-up protocol. Ophthalmologic assessment included a visual acuity test, a sensorimotor exam, a slit lamp examination and a cycloplegic refraction with an automated refractometer. Parents and children were familiarized to the examination thanks to an instruction book. A second examination was conducted when visual acuity could not be evaluated in the child psychiatry department, a place familiar to the child.

Results:

The strategy adopted to measure visual acuity allowed us to measure monocular visual acuity in 52% of the children with ASD after the first examination and was improved to 74% after the second examination. Ophthalmologic pathology was found in 32% of the participants, with 29% having significant refractive errors, 6.5% presenting strabismus and 3.2% demonstrating amblyopia. Children with ophthalmological disorders had significant lower verbal intelligence quotients and higher social impairment.

Conclusions:

The existence of undetected ophthalmologic pathology in ASD and its influence on autistic traits stressed the importance of early, systematic, and comprehensive examination by a pediatric ophthalmologist. It is of main importance to have a reliable diagnosis in order to prescribe spectacles to improve visual development, especially in children with neurodevelopmental issues. This examination procedure of children with ASD contributes to a comprehensive examination, including subjective and objective data, which is mandatory to obtain a reliable diagnosis. Besides, this would help to replicate these results in further prospective studies. Finally, taking into account ophthalmological parameters is a requisite before any research on visual functions in ASD.

157 **168.157** Parent Perspectives on DEEP Touch Pressure Sensory-Based Interventions for Chldren with ASD

***M. Pena**, Holland Bloorview Bloorview Kids Rehabilitation Hospital, Bloorview Research Institute, Canada, Toronto, ON, Canada*

Background: Deep touch pressure sensory-based interventions are recommended by occupational therapists to enable function and participation in children with autism spectrum disorder. There is a paucity of research however, on parents' perceptions of these interventions when administered within naturalistic settings
Objectives: To examine parents' perceptions of the value, uptake, and acceptability of deep touch pressure sensory-based interventions when used to target challenging behaviours in children with autism spectrum disorder.

Methods: Using a survey design, an online questionnaire was created. The questionnaire was sent to 399 families registered at the Province of Ontario Neurodevelopmental Disorders' database; 152 parents completed the study, yielding a response rate of 39%. Data were analyzed for frequency of responses and open-ended responses were reviewed and grouped by the researchers.

Results: The most frequently recommended interventions were trampoline (54.6%), massage (47.8%), and oral-motor tools (43.8%). Of the recommended interventions, the percentage of use was highest for massage (96.3%), followed by trampoline (89.2%), and joint compressions and brushing (89.2%). The majority of parents found the interventions helpful in addressing challenging behaviours and most viewed their use to be important (31.7%) or very important (43.1%). Main barriers included: interventions were not recommended to parents, parents found them difficult to use, and families did not have access to the recommended equipment. To increase the use of these interventions, parents wanted ongoing support from the occupational therapist and access to therapeutic equipment.

Conclusions: These interventions are valued and accepted by parents of children with autism spectrum disorder, but that there are barriers to their use. By gaining an understanding of, and addressing, these barriers occupational therapists may support improved uptake of these interventions.

158 **168.158** Perceptual Atypicalities in Autism Revealed By Pupillometry

***D. C. Burr**[1], P. Binda[2] and M. Turi[2], (1)Department of Neuroscience, Psychology, Pharmacology and Child Health, University of Florence, Florence, Italy, (2)Department of Translational Research on New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy*

Background:

It has long been known that perceptual processing is unusual in autism: they have superior performance on some tasks, such as the Embedded Figures Test and visual search tasks, and inferior performance on many complex tasks requiring a more holistic, global perception. Recently these differences have been well modelled within the *Bayesian* approach to perception, with the suggestion that autistic observers have reduced integration of sensory and predictive information. This study explores further the different styles of autistic perception with an objective measure that correlates well with autistic traits.

Objectives:

The aim of the study is to use an objective and non-invasive technique to characterize different perceptual styles correlated with autistic traits in the typical population.

Methods:

We measured modulation of pupil-size in 50 typical adult humans viewing a bistable-rotating cylinder, constructed so the brightness of the front surface changes with perceived direction of rotation. Subjects reported perceptual switches as they viewed the stimulus. We correlated the amount of pupil modulation in pupil size associated with the perceptual switch of the bistable stimulus with the autistic traits of participants, measured by the Autism-Spectrum Quotient AQ.

Results:

In some but not all participants, pupil diameter oscillated in phase with the ambiguous perception, more dilated when the black surface was in front. Importantly, the magnitude of oscillation predicts autistic traits of participants, assessed by the Autism-Spectrum Quotient AQ. Further experiments suggest that these results are driven by differences in perceptual styles: high AQ participants focus attention on the front surface of the rotating cylinder, while those with low AQ distribute attention to both surfaces in a more global, holistic style.

Conclusions:

This is the first evidence that pupillometry reliably tracks inter-individual differences in perceptual styles, quickly and objectively, without interfering with spontaneous perceptual strategies. The results confirm the relationship between high autistic traits and local perceptual-style, suggested by previous, less objective studies. This relationship will be discussed in terms of Bayesian models suggesting less use of predictive *priors* in autistic perception.

159 **168.159** Prospective Action Planning: Autistic Children Go Their Own Way

C. Becchio[1], *A. Cavallo*[2], *L. Romeo*[3], *C. Ansuini*[4], *J. Podda*[1], *E. Veneselli*[5], *F. Battaglia*[1] *and M. Pontil*[1], *(1)Italian Institute of Technology, Genova, Italy, (2)University of Turin, TORINO, Italy, (3)Università Politecnica delle Marche, Ancona, Italy, (4)C'MON Unit, Istituto Italiano di Tecnologia, Genoa, Italy, (5)Istituto G. Gaslini, Genova, Italy*

Background:

The simple act of picking up a water glass involves predictive control mechanism. People alter their manipulative behavior as a function of what they plan to do with the objects. Failure to develop this form of prospective motor control has been proposed to contribute to faults in higher mind functions of individuals with autism spectrum disorders (ASDs; Trevarthen and Delafield-Butt, 2013), however, no study to date has *quantified* the extent to movement parameters specify future action plans in ASD.

Objectives:

The present study combined kinematic analysis with machine learning techniques to determine whether and how movement parameters specify *self-action* and *other-action* plans in ASD and TD. The specification of action plans was analyzed at three levels: i) individual level, to investigate whether individuals with ASD show consistent motor patterns specifying self- and other-action plans; ii) within-group level: to determine whether specification of self- and other-action plans is similar across individuals with ASD; iii) between-group level: to determine whether specification of self- and other-action plans is similar across ASD and TD individuals.

Methods:

We used a sequential object manipulation task to test prospective motor control in children with ASD (n = 20) and IQ-matched typically developing (TD) children (n = 20). To quantify changes in behavior as a function of self-action plans, we first trained a support vector machine to classify grasping movements as a function of onward self-actions (place, pour, and pass). We next attempted to verify whether ASD and TD children altered their initial grasp in anticipation of co-actor’s forthcoming action by training the same classifier to distinguish grasps as a function of onward other-actions (pass-to place and pass-to pour).

Results:

Self-action plans. Specification of self-action plans detected at the individual level was similar across individuals with ASD. As shown by cross-classification, ASD and TD children activated similar motor plans in anticipation of forthcoming self-demands.

Other-action plans. Both ASD and TD children altered their grasp in anticipation of other-demands, showing consistent within-group patterns. However, a cross-group analysis in which a classifier was trained on one group and tested on the other, failed to achieve greater than chance performance, suggesting that specification of other-action plans varied across ASD and TD children.

Conclusions:

While motor parameters specify future action plans in both ASD and TD individuals, children with autism appear to have their own way to accommodate other-action plans. This may contribute to bilateral difficulties in reciprocal social interaction, reinforcing the view that the difficulties that autistic individuals experience in social cognition are rooted in atypical motor patterns.

160 **168.160** Quantification of Predictive Motor Impairments in Children with Autism Spectrum Disorder

S. W. Park[1,2], *A. Cardinaux*[2], *S. Ben-Ami*[3], *D. Guo*[1], *L. Denna*[2], *P. Sinha*[2] *and D. Sternad*[4], *(1)Northeastern University, Boston, MA, (2)Massachusetts Institute of Technology, Cambridge, MA, (3)Brain and cognitive science, Massachusetts Institute of Technology, Cambridge, MA, (4)Biology, Electrical & Computer Engineering, and Physics, Northeastern University, Boston, MA*

Background: Anecdotal reports and selected research results suggest that individuals with autism spectrum disorder (ASD) exhibit difficulties in motor coordination, particularly when interacting with dynamic objects, like catching a ball. A recent theoretical framework from our group suggests that the seemingly distinct manifestations of ASD in multiple domains may share a common core: an impaired ability to make predictions. Difficulties in language, social interactions, repetitive behaviors, and motor coordination may all result from the same underlying impairment, albeit at different time scales. This study examined motor predictive impairment through multiple tasks of catching and bouncing a ball, which involve predicting and intercepting a moving object.
Objectives: Motivated by the theory of predictive impairment in autism, our hypothesis is that individuals with ASD will show impaired motor coordination when interacting with moving objects, specifically when performing actions that involve prediction.

Methods: Four children with ASD (IQ-matched, divided into 2 age groups, 7-9 and 10-12 years) and 21 neurotypical (NT) children performed 5 ball interception tasks in a virtual environment that afforded controlled manipulation of the time window for prediction, while simplifying the coordination challenges for hand movement. Subjects either pressed a button to predict the time or location of a launched ball (low motor challenge), or they vertically moved a paddle to catch or bounce a ball to hit a target (higher motor challenge). Additionally, subjects performed naturalistic ball catching with two hands, where 3D kinematics of joint movements and muscle activity of arm, leg, and postural muscles were recorded to quantify endogenous predictive responses. A set of control tasks assessed more elementary motor abilities, such as postural sway, reaction time, and smoothness of hand movements.

Results: NT and ASD children successfully completed all tasks. However, ASD children performed with significantly higher errors in temporal and accuracy metrics. In virtual ball catching, when the challenge for predicting the ball's trajectory was increased by partial occlusion, ASD children's accuracy registered a disproportionately large decrease relative to NTs. Additionally, ASD children displayed lower accuracy when intercepting a ball to bounce it to a target. Importantly, in reaction times and smoothness, tested in control tests designed to closely relate to the experimental tasks, ASD children did not differ from NT children. Similarly, while NT children achieved significantly more safe ball catches during the naturalistic ball catching task, their performance in postural balance alone was not superior to ASD children. Preliminary EMG analysis suggests that when catching balls ASD children show less coordinated muscle activity than NT children in stabilizing trunk muscles.

Conclusions: Results from a sequence of prediction-based tasks reveal that despite considerable individual differences in skill, ASD children on average show impaired motor performance compared to NT children. These data are consistent with our hypothesis that the ability to predict may be an explanatory construct common across ASD individuals despite their phenotypic variation. Given its broader theoretical embedding, the results of this study have implications beyond motor skills towards a more encompassing understanding of autism.

161 **168.161** Quantitative Assessment of TIP-TOE Behavior in Autism Spectrum Disorder Subjects: A CROSS-Sectional Cohort Study

G. Valagussa[1,2]*, V. Balatti*[1]*, L. Trentin*[1,3]*, A. Signori*[3] *and E. Grossi*[1]*, (1)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (2)School of Medicine and Surgery, University of Milan-Bicocca, Milano, Italy, (3)Department of Health Sciences (DISSAL), Section of Biostatistics, University of Genoa, Genoa, Italy*

Background:
About one fourth of individuals with autism stand, and/or walk, and/or run on their tiptoes. Studies about quantitative assessment of Tip-toe behavior (TTB) are scarce relating to walking and running and absent relating to standing. In a previous cohort study, using a qualitative assessment we described three mutually exclusive clinical functional classes of TTB of increasing severity: TTB only during running (TTB1), TTB only during walking and running (TTB2) and TTB during standing, walking and running (TTB3).

Objectives:
The aims of this cross-sectional study are: 1) to quantify TTB during both a static and a dynamic test in our ASD sample; 2) to compare the intensity of TTB in the three TTB clinical functional classes and in the NO-TTB group.

Methods:
Our study sample included 45 ASD subjects (mean age: 13,15 years – 4,63 SD; 40 males) diagnosed according to DSM V criteria and under observation at our Institute. The confirmation and the severity of autism was established through ADOS-2. A therapist assessed the presence/absence of TTB during standing, walking and running using direct observation and interview of the main caregiver living with the child through a structured assessment. According to this assessment, 25 ASD subjects resulted not TTB, 3 resulted in TTB class 1, 10 in TTB class 2 and 7 in TTB class 3. The intensity of TTB expression during static and dynamic tests was quantified as percentage of time spent on the tip toes and as the percentage of toe steps, respectively. Both tests were conducted using standardized video recordings reviewed independently by two expert therapists.

Results:
The overall ADOS calibrated severity score (CSS) of all the subjects was 7.56 (1.71 SD). The overall ADOS CCS was 6,92 (1,55 SD) in NO-TTB, 8,15 (1,73 SD) in TTB1+2 and 8,71 (1,38 SD) in TTB3 ($p = 0.02$). The TTB time percentage values of the NO-TTB group during the static quantitative test was 0.25% (0.37 SD), while the time percentage values of the TTB1+2 was 1,82% (2,82 SD) vs 32,34% (31,82 SD) in TTB3 (table 1). We found a significant difference between each of the 3 groups ($p < 0,02$). In the NO-TTB group, during the dynamic quantitative test, the mean percentage of the TTB steps was 0.66% (1.48 SD), while it was 7,91% (5,71 SD) in TTB1+2 vs 60,93% (28,29 SD) in TTB3 (table 1). We found a significant difference between each of the 3 groups ($p= 0.000$)(fig 1). Moreover, we found a significant correlation ($r = 0.702$) between the quantity of TTB in the static and the dynamic test. Finally, we also found a significant correlation between the severity of TTB during both the static and the dynamic tests and the ADOS-2 CSS ($r = 0.305$ and $r = 0.406$ respectively).

Conclusions:
We quantified TTB using a new structured static and dynamic assessment test in our ASD sample. We found significant difference between NO-TTB and the 2 TTB subgroups. The TTB quantity in the static test is correlated with TTB quantity in the dynamic test.

162 **168.162** TIP-TOE Behavior in Autism Spectrum Disorder: A Prospective Cohort Study

G. Valagussa[1]*, V. Balatti*[1]*, L. Trentin*[2] *and E. Grossi*[1]*, (1)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (2)Autism Research Unit, Villa Santa Maria, Tavernerio, Italy*

Background:
According to the literature, about one fourth of individuals with ASD present with toe walking. In a previous study, we found that this behavior is present not only during walking but also while standing and running, and described three mutually exclusive clinical functional classes with a different degree of severity: TTB during running (TTB1), TTB during walking and running (TTB2) and TTB during standing, walking and running (TTB3). In another study we also found a positive relationship between the presence and severity of TTB and the Achilles's tendon shortening in ASD subjects. In this perspective, assessing and monitoring TTB in ASD subjects could become critical to identify ASD subjects at risk of developing muscle shortening. Moreover, to our knowledge in the literature systematic observations of the natural history of Tip-toe Behavior (TTB) in ASD children using standardized assessment are lacking.

Objectives: The aim of this prospective cohort study is to describe the natural history of TTB and NO-TTB ASD subjects at short-medium term.

Methods:

The prospective study included 72 consecutive subjects (62 males; mean age: 15,68 years – SD 3,85) present in our Institute. The inclusion criteria were: an ASD diagnosis according to the DSM V criteria, a diagnosis confirmation based on the ADOS–2. The exclusion criteria were: presence of co-morbid diagnoses that would have an impact on gait. The assessment of presence/absence of TTB during standing, walking and running was done through direct observation and a structured interview of the main caregiver living with the child. We repeated the same evaluation 12 to 44 During months (mean: 29,88 months – SD 8,86; median: 34,5 months) after the first observation.

Results:

During the first TTB assessment 49 subjects resulted Non-TTB (68,1%) and 23 resulted TTB. In TTB group, 4 subjects were TTB1, 9 subjects were TTB2 and 10 subjects were TTB3. At follow up 7 out of 23 TTB subjects (30%) changed the severity class, 5 decreasing and 2 increasing severity (table 1). No one shifted to NO-TTB group. In NO-TTB group 8 subjects (16%) shifted to TTB group (5 in TTB 1 class, 2 in TTB 2 class and 1 in TTB class 3. The ADOS calibrated severity score of the converters was not different from non-converters (7,5 – 1,4 SD versus 7,56 – 1,74 SD).

Conclusions:

TTB behavior can change over time in ASD subjects. In an average time of two years about one third of TTB subjects change their severity class and 16% of Non-TTB subjects become TTB. This finding underlies the importance of close monitoring of TTB with standardized protocols.

163 **168.163** Quantitative Measures of Motor Function in Children with Duplications of 15q11.3-13.1 (Dup15q Syndrome) and Typically Developing (TD) Children.

***R. R. Wilson**[1], A. H. Dickinson[2], C. Hyde[3], S. Rallapalli[1], K. Dahlerbruch[1], C. Rocha[1] and S. Jeste[2], (1)UCLA Medical Center, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Semel Institute, UCLA Medical Center, Los Angeles, CA*

Background: Motor skills are critical for the development of more complex social behaviors and overall cognitive development (Iverson, 2010; Karasik et al, 2012). Impairments in motor skills, specifically in gait, are prevalent in children with Autism Spectrum Disorders (ASD) and represent an important area for intervention to improve functional outcomes. Due to limitations in available standardized assessments, motor impairments in individuals with ASD are poorly quantified and understood. Impairments in gait are quantifiable and translatable measures of motor skills that provide insight into overall motor development and are directly related to social communication skills. In this study we utilize the Protokinetics Zeno Walkway to quantify kinematic variables of gait in children with Dup15q Syndrome, the most common copy number variant associated with ASD, and highly penetrant for motor delays (DiStefano et al, 2016). Preclinical models of Dup15q syndromes have specific gait impairments. We also compare gait variables to social communication skills using the Social Responsiveness Scale (SRS) (Constantino et al, 2012).
Objectives: To compare quantitative measures of gait, including stride width, cadence (steps/minute), and gait variability index (GVI), in children with Dup15q Syndrome and Typically Developing (TD) children and to evaluate the relationship between measures of gait and social communication.

Methods: Participants included 28 children with Dup15q Syndrome ages 3-15 years (Mean, 8 years). TD data included TD siblings and normative gait data. Children completed four trials of walking. Multiple kinematic variables of gait were extracted with specific focus on mean cadence, stride width, and GVI. Differences between group gait variables in Dup15q syndrome and TD were compared using Mann-Whitney U tests. Correlations were used to determine the relationship between cadence and step width to total T Scores on the preschool and school aged SRS.

Results: **See table 1 for detailed statistical analysis and results.** Significant differences were seen in stride width and GVI but not in cadence between groups. Expected markers of developmental maturity of motor function, such as reduction in cadence, step width, and GVI were not seen in children with Dup15q syndrome. Increased step width was positively correlated with increased preschool and school aged SRS scores (R= 0.38). When looking only at school aged SRS there was greater association with step width (R= 0.57). Cadence was negatively correlated with SRS scores (R= -0.002).

Conclusions: Gait patterns in Dup15q syndrome were strikingly similar to gait patterns reported in the Dup15q mouse model, specifically in increased stride width and decreased cadence which likely represent lack of stability, reduced strength, and overall motor dysfunction (Figure 1). Children with Dup15q syndrome show persistent abnormalities and delayed neuromotor maturation of gait. Children with greater motor dysfunction characterized by increased stride width and decreased cadence showed greater impairments in social communication. These findings not only establish feasibility of these motor measures, but they also emphasize their potential value as translational biomarkers in Dup15q syndrome**.** Use of this quantitative measure of motor function can aid in identifying biomarkers of clinical stratification, treatment targets, and meaningful outcome measures of clinical trials in ASD.

164 **168.164** Reduced Left Cradling Bias and Cerebral Lateralization in Children with ASD

***R. Davis**[1], B. Todd[2] and G. Forrester[3], (1)Birkbeck College, London University, London, United Kingdom, (2)City University, london, United Kingdom, (3)Birkbeck, University of London, London, United Kingdom*

Background: Previous studies have indicated a maternal preference to holding infants on the left side of their body. The physical positioning is thought to facilitate the processing of social-emotional stimuli by establishing a direct route to the right hemisphere. Reduced cortical lateralization has been associated with ASD and whilst disruption to left cerebral lateralization for fine motor dominance is associated with

weaker language acquisition in young children, the ramification of disruption of right cerebral lateralization associated with social-emotional processing has yet to be explored within the scope of cognitive development.
Objectives: To examine right cerebral lateralization of processing social stimuli through the left cradling bias in children with ASD and typically developing controls.

Methods: 60 4-6-year old children with ASD were compared with 80 control children in a cradling task consisting of three different holding conditions; participants cradled a lifelike human baby doll or a control object of an equivalent weight and dimension either with or without symbolic facial features. Handedness was also assessed across three motor tasks interspersed with each cradling trial.

Results: The control group demonstrated a significant left side preference when holding the human doll. Whilst a left side bias was not demonstrated when the group cradled the control object without social features, the addition of rudimentary facial features was sufficient to elicit a left holding bias. Conversely, no preference for left cradling was evident in the ASD group for any doll type and no significant difference was identified between the holding preference of social and non-social objects. Furthermore, stronger hand dominance was positively correlated with a left cradling bias overall.

Conclusions: We identified the absence of a left cradling bias as a possible indicator of atypical cerebral lateralization in children with ASD. Findings support the possibility that socialisation influences cerebral lateralization for processing social-emotional stimuli in typical development, whereas children with ASD did not distinguish between social and non-social stimuli.

165 **168.165** Relating Sensory Hypersensitivity and Autistic Traits in Typically-Developed Adults

S. E. Schulz *and R. A. Stevenson, Western University, London, ON, Canada*

Background:
Restricted interests and repetitive behaviours (RRBs) are a core diagnostic symptom of Autism Spectrum Disorder (ASD) and tremendously impact an individual's day-to-day life, yet the underlying factors of RRBs are not fully understood. Recent work suggests that sensory issues related to ASD, specifically sensory sensitivities, contribute to RRBs. While these studies have provided evidence for a relationship between RRBs and hypersensitivity in individuals with ASD, these studies have mostly utilized parent report measures which conflate sensory reactivity with sensory sensitivity.

Objectives:

1. Pilot a novel behavioural paradigm to empirically measure sensory sensitivity.
2. Determine the relationship between sensory sensitivity and autistic traits, specifically repetitive behaviours.
3. Compare relationships between RRBs and sensory sensitivity as measured through empirical, behavioural methods versus questionnaire data.

Methods:
Participants consisted of 110 university students who completed questionnaires reporting on sensory processing (Sensory Profile-2; SP-2), and RRBs (Repetitive Behaviours Questionnaire-2; RBQ-2). Behavioural measures of visual sensitivity involved a detection task from which sensory thresholds were determined. Participants were instructed to indicate when a Gabour patch was present in background noise. The Gabour patch was presented at 8 different contrasts ranging from 0.025 to 0.5 which were randomly presented ten times each. There were also 80 null trails for a total of 160 trials. A two-step analysis was employed. First, correlational analyses were conducted to identify relationships between sensitivities and RRBs using the various measurement methods. Second, hierarchical regressions were conducted to examine the unique contributions of sensory sensitivities while controlling for demographic variables.

Results:
Correlations confirmed a negative relationship between RRBs and visual thresholds (r^2=-0.275, p=0.008). There was also a strong positive relationship between RRBs and the Sensory Sensitivity Quadrant of the SP2 (r=0.340, p=0.001). Importantly, there was no relationship found between the two measures of sensory sensitivity (r=-0.049, p=0.645). In fact, a hierarchical regression revealed that both the behavioural measure of sensory sensitivities as well as the SP-2 "sensory sensitivity" measure significantly predicted RRBs (r=0.435, p<0.001), but each of them explained different portions of the variance in the RBQ (pr=-0.275, p=0.009; and pr=0.351, p=0.001, respectively).

Conclusions:
The relationship between the questionnaire data from the SP-2 and the RBQ confirm previous results that RRBs increase with increased sensitivity. There was also evidence for a relationship between empirically-measured visual thresholds and the RBQ. Lower visual thresholds imply higher levels of sensory sensitivity, suggesting, again, that as sensitivity increases, RRBs increase as well. However, surprisingly, there was no relationship between the two so-called measures of sensory sensitivity. Results from the hierarchical regression suggest that these two metrics measure distinct constructs and account for different aspects of RRBs. We hypothesize that the behavioural tasks measure sensory *sensitivity*, questionnaire data actually measure sensory *reactivity,* as parent reports are intrinsically dependant on parents observing the behavioural response that a child has to a sensory stimulus. These data also highlight the need to distinguish between sensory sensitivity and reactivity in the literature.

166 **168.166** Relationships between Sensory Atypicalities, Repetitive Behaviours, Anxiety and Intolerance of Uncertainty

M. Glod[1]*, D. M. Riby*[2]*, E. Honey*[3] *and J. Rodgers*[1]*, (1)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (2)Department of Psychology, Durham University, Durham, United Kingdom, (3)Northumberland, Tyne & Wear NHS Foundation Trust, Newcastle Upon Tyne, United Kingdom*

Background: Unusual sensory responses are common in autism spectrum disorder (ASD) and a subcategory of atypical sensory behaviours has been included in the restricted, repetitive patterns of behaviour, interests, or activities diagnostic criterion (APA, 2013). Not only has a high degree of co-occurrence between sensory atypicalities and repetitive behaviours been reported in a number of studies (for the review see Glod et al., 2015), but interestingly, repetitive behaviours and sensory atypicalities have been linked to anxiety (Green et al., 2011; Lidstone at al., 2014;

Wigham et al., 2015) and intolerance of uncertainty (Wigham et al., 2015) in ASD. The associations, however, are still not well understood and the degree of co-occurrence of these features is still not fully explored.

Objectives: The aim of this study was to examine the relationships between sensory atypicalities, repetitive behaviours, anxiety and intolerance of uncertainty in autistic children to better understand the complexity of the disorder and its pathogenesis.

Methods: Parents of 17 autistic children, aged between 4 and 9 years, were recruited. Parents were asked to complete the Sensory Profile to provide information about their children's sensory experiences, the Social Responsiveness Scale to assess a degree of social impairment, the Spence Children's Anxiety Scale/Preschool Anxiety Scale and assess anxiety symptoms, the Repetitive Behaviour Questionnaire to evaluate the severity or frequency of repetitive behaviours that the children were engaging in and the uncertainty subscale of the Anxiety Scale for Children-ASD to measure children's level of intolerance of uncertainty.

Results: Serial mediation analysis was performed using PROCESS (Hayes, 2012). The model was based on previous computational work (Wigham et al., 2015): direct paths from both sensory hyporesponsiveness and sensory hyperresponsiveness to both repetitive sensory/motor behaviours and insistence on sameness and an indirect path through intolerance of uncertainty and anxiety were tested. The significant total and direct effects were found: from sensory hyporesponsiveness to repetitive sensory/motor behaviours (β=-.12, *p*=.003 and β=-.14, *p*=.018 respectively) and insistence on sameness behaviours (β=-.17, *p*<001 and β=-.19, *p*=.007); and from sensory hyperresponsiveness to repetitive sensory/motor behaviours (β=-.13, *p*=.002 and β=-.11, *p*=.031) as well as to insistence on sameness (β=-.17, *p*=.001 and β=-.13, *p*=.040). Moreover, significant indirect effects through anxiety (β=-.09, LL=-.21, UL=-.00) and intolerance of uncertainty and anxiety (β=.19, LL=.02, UL=.46) from sensory hyporesponsiveness to insistence on sameness behaviours were found.

Conclusions: Significant direct relationships were found between sensory features and repetitive behaviours. Yet, all the paths between sensory processing abnormalities and repetitive behaviours were partially mediated by at least one of the mediation variables (intolerance of uncertainty or anxiety). Significant indirect relationship between sensory hyporesponsiveness and insistence on sameness behaviours was mediated via anxiety, and intolerance of uncertainty and anxiety. The important mediating role of anxiety and intolerance of uncertainty between sensory atypicalities and repetitive behaviours in ASD needs to be taken into account in sensory processing and repetitive behaviours treatment programmes for young children with ASD.

167 **168.167** Representational Gestures Provide a Direct Link between Motor Behavior and Social Communication Deficits in ASD

A. Bagdasarov[1], Z. M. Dravis[2], E. S. Kim[2], L. Adeoye[3], V. Obsekov[4], J. Diaz[4], B. B. Maddox[5], E. F. Ferguson[4], A. A. Pallathra[6], L. Bateman[4], A. Pomykacz[7], A. Tiedemann[8], E. S. Brodkin[9], J. Pandey[2], J. Parish-Morris[2], S. H. Mostofsky[8], R. T. Schultz[2] and ***A. de Marchena**[4,10]*, *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)The Center for Autism Research/CHOP, Phladelphia, PA, (4)The Center for Autism Research/CHOP, Philadelphia, PA, (5)University of Pennsylvania, Philadelphia, PA, (6)Department of Psychiatry, Catholic University of America, Washington, DC, (7)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (8)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD, (9)Department of Psychiatry, Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, (10)University of the Sciences, Philadelphia, PA*

Background:

Atypical motor behavior is widespread in ASD; individuals with ASD often display impairments in coordination, postural control, imitation, and praxis/pantomime performance. Praxis is the ability to perform learned skilled movements, and praxis weaknesses in ASD are associated with social-communication deficits (Dowell, Mahone, and Mostofsky, 2009). To date, research has only *indirectly* established a relationship between praxis performance and nonverbal communication, e.g., by correlating praxis and ADOS scores (Dziuk et al., 2007), leaving the question of mechanisms open. Here we propose a *direct* link between impoverished praxis skill and social-communication skills, via the performance of spontaneously produced co-speech hand gestures. Specifically, we predicted that participants with worse praxis scores would be less likely to use *representational* gestures ("descriptives" on the ADOS), in which speakers represent visuospatial information, such as shape or movement, with their hands.

Objectives:

To test the hypothesis that impoverished praxis skill is associated with decreased spontaneous production of representational gestures.

Methods:

Verbally fluent adults with ASD (n=12) and typically developing controls (TDC; n=21) were group-matched on age, gender, and full-scale IQ (see Table). Praxis was assessed using an abbreviated version of the Florida Apraxia Battery, consisting of 19 items, including gesture to command, gesture to imitation, and gesture with tool use, which were coded for a range of errors. To assess spontaneous production of co-speech gestures, participants completed a five-trial referential communication task, in which they described abstract three-dimensional figures to a trained confederate. The task was designed to allow for back-and-forth conversational interaction in a controlled setting. All hand gestures produced during the task were coded for: (1) frequency (gestures per minute), (2) type (representational, interactive, deictic, beat, or other; see Table), and (3) confidence (rater's confidence in the gesture's meaning).

Results:

Participants with ASD made marginally more errors on the praxis task compared to controls, with a robust effect size (*p*=.063, *d*=.893). On the referential communication task, participants with ASD and TDC gestured at a similar overall rate (*p*=.151; *d*=.529), but participants with ASD were less likely to use *representational* gestures specifically (*p*=.007, *d*=1.67), and coders were marginally less confident about what their gestures meant (*p*=.07, *d*=1.12). Looking at gestures broadly, praxis error rate and co-speech gesture rate were not correlated (*r*=-.029, *p*=.874). However, participants who produced more praxis errors were less likely to select *representational* gestures specifically (*r*=-.649, *p*=<.001), a finding that held in the ASD group alone (*r*=-.642, *p*=.045), but not in the TDC group (*r*=-.279, *p*=.247, see Figure). Participants who made more praxis errors also produced gestures with lower confidence ratings (*r*=-.477, *p*=.009).

Conclusions:

Adults with ASD who show greater deficits on a structured praxis exam are less likely to spontaneously produce representational gestures during conversation. Like praxis, representational gestures depend on access to underlying internal actions models, thus individuals with impoverished mental representations may evidence difficulty drawing on these representations both to perform skilled movements (i.e., praxis), and to perform communicative co-speech gestures. These findings demonstrate preliminary support for a *direct* link between motor skills impairments and communication skills in ASD.

168 **168.168** Sensory Abnormalities and Earlier P3a in Adults with Autism Spectrum Disorder

Y. L. Chien[1], *M. H. Hsieh*[1] *and S. S. F. Gau*[2], *(1)Department of Psychiatry, National Taiwan University Hospital, Taipei, Taiwan, (2)Department of Psychiatry, National Taiwan University Hospital & College of Medicine, Taipei, Taiwan*

Background:

Perceptual disturbance is among the essential features of autism spectrum disorder (ASD) with hyper- or hyporeactivity in the same individual across different sensory modalities. Despite some data in children with ASD, little is known about the sensory profile of adults with ASD. Most of current studies assess sensory symptoms by self-report or parent-report questionnaire, rather than an objective method. Although some studies used event-related potentials (ERP) to demonstrate the sensory abnormality in children with ASD, whether the ERP abnormalities persist into adulthood remains inconclusive.

Objectives:

This study investigated perceptual disturbances in young adults with ASD by self-report on sensory measure as well as ERPs, including P50, Mismatch Negativity (MMN), and P3a.

Methods:

Thirty-seven participants, aged 15 to 30, with a clinical diagnosis of either high-functioning autism or Asperger's disorder and 35 typically developing controls (TD), aged 15 to 27, were assessed with ERPs and completed the self-administered questionnaires of the Chinese versions of the Adolescent/Adult Sensory Profile, Social Responsiveness Scale, and Autism Questionnaire. Three kinds of ERPs, P50, MMN, and P3a component using frequency and duration paradigms, were compared between the ASD and TD groups. The clinical correlates of ERPs parameters were also examined.

Results:

Compared to TD, young adults with ASD showed greater sensory symptoms on subscales of low registration, sensory sensitivity, and sensory avoidance, but less sensation seeking. Regarding the parameters of ERPs, young adults with ASD displayed shorter dP3a peak latency but similar amplitude on P50, MMN and P3a. Notably, there were different correlation patterns between the ASD and TD groups on sensory profiles, autistic symptoms and ERP parameters. The patterns of clinical correlates for ERP responses differed between the ASD and TD groups. Both P3a paradigms showed correlations with several ASD-related symptoms, such as social awareness deficits and stereotyped behaviors, as well as sensory symptoms such as sensory avoiding.

Conclusions:

Our findings of sensory symptoms and P3a latency deviations in ASD and their associations with clinical symptoms provide evidence to support perceptual disturbance in young adults with ASD and the clinical correlates of ERP responses. Pre-attentive sensory gating and novelty detection seem not different from TD in adulthood. These findings need further validation.

169 **168.169** Sensory Attenuation in Autism Spectrum Conditions

J. J. Finnemann[1] *and P. C. Fletcher*[2], *(1)Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (2)Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background:

The last years have seen a growing interest in using approaches within the predictive processing framework (Dayan et al., 1995; Rao & Ballard, 1999) to investigate differences in the cognitive, perceptual and neural processes in autism spectrum conditions (Pellicano & Burr, 2012; Sinha et al., 2014; Lawson et al., 2014; Van de Cruys, 2014).

At the core of models of prediction lies the notion of the brain as an 'optimal inference machine' which tries to model the external world with the purpose of minimising prediction errors (= the difference between the expectation of the experience and the experience itself).

Self-generated actions are thought to be accompanied by an efference copy of the motor command and as such generally result in smaller prediction errors than externally generated sensory input. There is evidence that predicted sensory input (such as from self-generated actions) is attenuated in order to make unpredicted sensory information more salient (Bays & Wolpert, 2007).

Objectives:

We were interested in investigating sensory predictive processes during self-generated movements in autism spectrum conditions.

Methods:

A well-established 'force matching' task (Shergill et al., 2003) was performed by 26 control and 23 ASC participants. During the experiment a force (varying between 0.5N and 2.75N) was applied to the participants' index finger via a lever and participants were are asked to match the force by pressing directly on the lever with their other index finger ('finger condition') or by adjusting a slider which controlled the torque motor and lever ('slider condition').

As the 'finger condition' models the sensory attenuation occurring during self-generated movements, it is expected that participants will overcompensate and apply a larger force than the reference force whereas limited experience with the 'slider condition' should produce more accurate matching results.

Participants also filled in self-report measures of autistic (AQ, Baron-Cohen et al., 2001) and schizotypal traits (PDI, Peters, 1999).

Results:

Regression lines were calculated for both the 'finger' and 'slider' condition.

Both group experienced sensory attenuation ($p<0.000$) as measured by a difference in slope and intercept between the 'finger' vs. 'slider' condition but there was no difference between the groups in the magnitude of overestimation ($p=0.805$).

Higher scores on the PDI were linked to smaller intercepts in the 'finger condition' in the control subjects only ($p=0.012$) whereas there was a trend in the ASC group relating higher scores on the AQ to larger intercepts in the 'finger condition' ($p=0.067$).

Conclusions:

Our experiment does not support the suggestion of autism as a generalised 'disorder or prediction' (Sinha et al., 2014) as attenuation of predicted sensory input seems to be preserved.

However while we replicated earlier findings of reduced sensory prediction in individuals with higher schizotypal traits in the control group (Teufel et al., 2010) the same did not hold for the ASC participants. This could be either due to the fact that the PDI is not measuring the same latent trait in the ASC group or because variance in sensory prediction is not mediated by the same factors in individuals with autism.

170 **168.170** Sensory Processing of Individuals with Autism Spectrum Disorder and an Intellectual Disability: A Systematic Review.

M. Werkman[1], *S. A. Reijneveld*[2], *S. Begeer*[3], *I. A. van Berckelaer-Onnes*[4], *Y. Dijkxhoorn*[5] *and J. A. Landsman*[6], *(1)UMCG, Groningen, Netherlands, (2)Health Sciences, UMCG, Groningen, Netherlands, (3)VU University Amsterdam, Amsterdam, Netherlands, (4)Faculty of Social Sciences, Clinical Child and Adolescent Studies, Leiden University, Leiden, Netherlands, (5)Leiden University, Leiden, Netherlands, (6)University Medical Centre Groningen - Applied Health Research, Groningen, Netherlands*

Background:

Autism Spectrum Disorders (ASD) and Intellectual Disabilities (ID) both coincide with atypical sensory processing. The severity of one of these disorders could have an impact on the other disorder regarding a number of outcomes. Little is known about the impact the combination of both conditions has on sensory processing. To date, we do not know to what extent the sensory processing of individuals with both ASD and ID differ from individuals with ASD or ID alone and what the impact will be on daily functioning.

Objectives:

The aims of this systematic review are 1) to investigate how individuals with both ASD and ID differ from individuals with ASD or ID alone in their sensory processing, and 2) to examine whether and how sensory processing problems are related to outcomes linked to sensory processing problems for individuals with ASD and/or ID.

Methods:

We searched three different databases: PubMed, PsycINFO, and Education Resources Information Center (ERIC), regarding papers published after 2010. For each database, a specific search strategy was developed. Search terms included key words and synonyms for the concepts: autism, intellectual disability, and sensory processing. We also searched in Online First, a website on which articles are presented that have not been published yet but will be published soon in peer-reviewed journals. Identified studies were first screened for eligibility for possible inclusion based on title and abstract. The next step was full text reading of the selected articles, systematic data-extraction and testing on quality of research. To answer the research questions, the outcomes of the three groups under study were compared: 1) ASD&ID, 2) ASD alone, and 3) ID alone.

Results:

The search yielded 800 studies which in particular covered descriptions of different sensory processing profiles for individuals with autism and outcomes such as stereotyped and repetitive behavior. Evidence on the sensory processing of the group of individuals with ASD and ID was very limited. We will be able to present full findings at the conference, regarding both research questions. For aim 1, an overview of the current state of knowledge of the sensory processing for each group will be given. If possible, a specification into different categories will be made. For aim 2, studies about the relationship between sensory processing problems and outcomes linked to sensory processing problems for individuals with ASD and/or ID will be shown.

Conclusions:

We will give an overview of the current state of evidence on the sensory processing of individuals with ASD and/or ID. We will also have insight into background and severity of sensory processing problems and differences between groups. Also, we will have gained insight into the outcomes linked to sensory processing problems for all three research groups. This review shows that evidence on the research group of individuals with ASD and ID is particularly limited. Study findings will help in gaining a better understanding of the sensory processing of individuals with ASD and/or ID, and may direct future research.

171 **168.171** Sensory Stress in Primary Schools: Not Just a Problem for Autistic Children

D. R. Simmons*, S. Bell and N. Stack, School of Psychology, University of Glasgow, Glasgow, United Kingdom*

Background: It is well-known, and now enshrined in diagnostic criteria, that unusual sensory experiences are problematic for children with Autism Spectrum Disorder (ASD). A vexed question, however, is whether autistic children should be protected by adjusting the environment, potentially requiring segregation from their neurotypical peers. Much previous research into the sensory experiences of children with ASD has relied heavily on parent/teacher-report measures and may have underestimated the difficulties experienced by neurotypical children (Simmons, Robertson & Brown, 2016). In this study we focused on two UK primary schools (equivalent to Grade Schools in the USA), one specializing in children with Additional Support Needs (ASNs), like ASD, and another with a largely neurotypical population. Objective measurement of sensory stressors using the "sensory audit" technique (Robertson & Simmons, 2012) were combined with focus groups and interviews with the pupils to establish the impact of sensory stress in the school environment.

Objectives: To combine objective environmental data with self-report data from pupils to assess the impact of sensory stress in primary schools on both autistic and neurotypical children.

Methods: The sensory audit technique involves acquiring data on potential visual, auditory and olfactory sensory stressors. Data were obtained using cameras, light meters, sound level meters, recording devices and trained human inspectors. In addition 45 children (17 in the ASN school and 28 in the mainstream school) took part in "sensory workshops" during which they were asked questions about sensory stress both in general and at their school. Additional data collected included parent-reported autistic trait levels (using the Children's AQ; Auyeung et al, 2008) and parent-reported sensory reactivity using the parents' version of the Glasgow Sensory Questionnaire (Robertson & Simmons, 2013). Transcripts of the focus groups/interviews were analysed using Thematic Analysis (Braun & Clarke, 2006).

Results: Preliminary analysis has revealed that most children, whether autistic or neurotypical, reported issues related to sensory stress.

Particular examples included distraction and discomfort caused by strong sunlight streaming through Venetian blinds, difficulties tolerating noise in the busy school canteen at lunchtime, and unpleasant smells from toilets and changing rooms. Curiously, younger (typical) children (4-8 years old) preferred busy, colourful classrooms ("Because it looks like a party room!") although older children (9-11 years old) preferred a less stimulating visual environment ("I like how it's tidy"). Future correlational analysis between objective measurements obtained during the sensory audit and the subjective reports from the children will further clarify the details of these sensory preferences and dislikes.

Conclusions: These data underline that sensory stress is problematic for both autistic and neurotypical children in school environments. Given the clear data from parent/teacher-reports that there are differences in sensory reactivity between autistic and neurotypical children it could be that methods for coping with sensory stress amongst neurotypical children are more effective, although potentially becoming internalized and manifesting differently as, for example, anxiety (Robertson & Simmons, 2015). Clearly, careful consideration should be given to the sensory environment in all schools, with a particular focus on the provision of quieter, less intense spaces for the most sensitive children.

172 **168.172** Spontaneous Oculomotor Movement and Stereotyped and Rigid Behaviors: Results from the ABC-CT Feasibility Study

S. Hasselmo[1]*, F. Shic*[2]*, S. J. Webb*[3]*, C. Sugar*[4]*, G. Hellemann*[5]*, D. Senturk*[5]*, M. Murias*[6]*, R. Bernier*[3]*, G. Dawson*[7]*, S. Faja*[8]*, S. Jeste*[4]*, C. A. Nelson*[8]*, K. Chawarska*[1]*, J. McPartland*[1] *and A. Naples*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)University of California, Los Angeles, Los Angeles, CA, (5)UCLA, Los Angeles, CA, (6)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (8)Boston Children's Hospital, Boston, MA*

Background: Individual variability in oculomotor movements such as blinks and saccades has been noted between individuals with autism spectrum disorder (ASD) and typically developing peers (TD) and can reflect variability in underlying biological systems. Characteristics of blinks and saccades, such as frequency and regularity, may be linked to processes and behaviors relevant to ASD, including motor stereotypies, cognitive rigidity, and attentional processing. However, there is scant research linking variability in spontaneous eye-movements and clinically meaningful individual differences. Examining the relationships among these traits and individual variation in the properties of blinks and saccades may contribute to understanding of oculomotor features in ASD and cognitive processing more generally. Features that are strongly differentiated by group or degree of stereotyped and rigid behaviors may serve as potential stratification biomarkers.

Objectives: This study examines relationships among oculomotor characteristics, such as spontaneous blink rate and saccadic rhythmicity, and stereotyped and rigid behaviors in children with ASD and their TD peers.

Methods: Remote eye-tracking data were collected from 51 participants (ASD: n=25, 20 male; TD: n=26, 17 male; ages 4-11, mean age = 7.17) using an SR Eyelink 1000+ while participants freely viewed static images. Blink rate was calculated as the average number of blinks per second across all stimuli. Rhythmicity of eye movements was examined in the frequency domain; power spectra were generated from 250ms segments of data and amplitude was extracted for frequencies between 4 and 10 Hz based on prior studies of saccadic rhythmicity. Stereotypy and rigidity were measured using the stereotypy subscore of the ADOS-2, the frequency of restricted behavior subscale of the Autism Impact Measure (AIM), and the Behavior Assessment System for Children (BASC-3) adaptability and attentional control subscales.

Results: One-way ANOVA indicated a statistically significant difference in blink rate between diagnostic groups ($F(1,49)=6.097$, $p=0.017$), such that individuals with ASD blinked more than TD controls. However, no main effects of stereotypy or rigidity were seen in multiple regression models examining the effect of diagnosis, behavioral measures, and their interactions on blink rate. Saccadic rhythmicity was associated with frequency of restricted behavior as measured by the AIM, such that, among individuals with ASD, those with more regular eye movements scored higher on the AIM ($\beta=45.57$, $p=.034$). No independent effect of restricted behavior on saccadic rhythmicity was seen across diagnostic groups. A one-way ANOVA showed a significant difference in the power of the 4-10Hz frequency component between diagnostic groups ($F(1,49)=25.67$, $p<0.01$) suggesting that individuals with ASD exhibited a higher frequency of saccadic eye movements.

Conclusions: Preliminary analyses suggest that blink rate and frequency dynamics of spontaneous eye movements differ in children with ASD and their TD peers. Among children with ASD, saccadic rhythmicity exhibited a stronger frequency component from 4-10 Hz, which was further modulated by the degree of restricted behavior they display. Further research linking these measures to other measures of cognitive processes and to stereotyped behaviors may extend understanding of ways spontaneous eye-movements underlie stereotypical movement and rigidity of cognition and behavior in ASD.

173 **168.173** Statistical Learning of Dynamic Contingencies in Autism Spectrum Conditions

O. Parsons[1] *and S. Baron-Cohen*[2]*, (1)University of Cambridge, Cambridgeshire, United Kingdom of Great Britain and Northern Ireland, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: The capacity to implicitly process statistical regularities in one's environment is a core aspect of perception and cognition. Prior experiences of environmental regularities are used in conjunction with incoming sensory information to arrive at the perceived interpretation of the external environment.

There have been suggestions that there may be impairments in the ability to build these 'priors' in autism. Despite this, studies looking at implicit learning have failed to find significant differences between people with autism and the typical population. However, it is important to note that these studies predominantly focus on implicit learning under deterministic and stable conditions.

Objectives: We set out to assess i) whether differences in implicit learning occur in individuals with autism when underlying regularities are probabilistic rather than deterministic and ii) whether individuals with autism show differences in their ability to update these priors when the underlying regularities change.

Methods: We used a probabilistic serial reaction time task in which participants were asked to use key presses to respond to a visual target which appeared on the screen in one of four possible locations.

During the task, trial outcomes were determined by a probabilistic Markov chain. This was designed so that for each 2-back context, there was a probable and improbable target location for the subsequent trial. Acquiring implicit knowledge of the underlying structure of the trial sequence leads to reduced response times during probable trials when compared to improbable trials.

The participants (15 with a diagnosis of autism and 20 controls) were asked to complete a primary phase of 8 blocks (of 120 trials each) before moving on to a secondary phase of 8 blocks in which probable and improbable locations were reversed for all contexts.

Results: Individual differences in implicit acquisition of the underlying sequence in the task were assessed by comparing response times for probable and improbable trial types. To assess differences in the ability to adapt to changes in the underlying predictive structure, we calculated gain scores for performance in the second session relative to the first session.

We conducted a Bayesian Independent T-Test on the gain scores between the autism group (ASC) and the control group (CTR). The CTR group had higher gain scores on average than the ASC group (M = 0.67 and -1.21 respectively), with a Bayes factor of 19.90 in favor of the alternative hypothesis suggesting that there is strong evidence in support of a group difference.

We then used a computational model to assess how perceptual expectations are influenced by using different lengths of temporal window when calculating the level of uncertainty (Entropy) in the task environment.

Conclusions: Under stable probabilistic conditions, the ASC group showed increased rates of implicit learning relative to the CTR group. However, when the underlying probabilistic structure changed the ASC group were slower to update these expectations.

We discuss how data from computational models can be used to infer how attending to statistical regularities across different time scales might lead to the observed group differences in the behavioral data.

174 **168.174** Stereotypies in Autism: The Construction of a Large VIDEO Catalogue from a Cohort Study

E. Caminada[1], *F. Vanzulli*[1], *B. Vescovo*[1], *E. Alfiedi*[2] *and E. Grossi*[1], *(1)Autism Research Unit, Villa Santa Maria Foundation, Tavernerio, Italy, (2)Autism Research Unit, Villa Santa Maria, Tavernerio, Italy*

Background:

Stereotypies, despite their high frequency and strong diagnostic significance within autism, have not yet been fully elucidated due to their broad spectrum of presentation and pattern complexity. Standardized video-recordings can help to depict the complex pattern of stereotypies commonly observed in autism, thus allowing for a better definition of major phenotypes.

Objectives:

The aim of this study is to analyze stereotypies patterns observed in a sample of children and adolescents residing at our Institute and subsequently classify them by means of video-recordings.

Methods:

20 expert caregiver wearing a body cam recorded specific stereotypic behavior in a natural context during the everyday activities of 67 autistic subjects for 3 months of close follow-up. After a few minutes of recording, the possibility to interrupt their behavior by intervening physically to divert attention was registered.

A team consisting of a senior child neuro-psychiatrist and a senior psychologist reviewed all the video recordings (1868) selecting 780 of them as the most meaningful to summarize the whole spectrum in each individual in the given time window. Each video was classified according to components (motor, sensorial, vocal, intellective), complexity (2 classes, simple and complex), body parts involved (n=18) and sensory channels involved (hearing, sight, proprioception, taste, pain, smell).

Results:

The vast majority (87%) of the780 patterns occurred several times generally (73%) in a state of tranquility.

In more than half of cases (53.4%), the interruption required intervening physically, but a poor correlation was found between the pattern type and possibility to interrupt the behavior by way of verbal or physical intervention (r= -0.08/+0.08).

The individual stereotypies spectrum ranged from 1 to 33 different patterns (average= 11.6; S.D= 6.82). The most frequent pattern was represented by the combination of simple motor and sensorial components (accounting for 23% of the total number) followed by simple motor and simple sensorial (9% and 8% respectively). The other 47 patterns with combinations from 1 to 4 components accounted for the remaining 60%.

In the 569 patterns containing motor components, whole body and arms movements constituted the most frequent body parts involved (41% e 38% respectively) followed by mouth and hands (10% and 9.8% respectively).

In the 531 patterns containing sensorial components, the most frequent channel involved was tactile (50%) followed by proprioceptive(34%) and acoustic (19.5%).

Most of the 127 stereotypies with vocal components were constituted by simple vocalizations, 85.8% and only 14.2% by phonemes or words.

Conclusions:

This study represents a first attempt to systematically document the patterns of expression of stereotyped behavior in a cohort of autistic subjects closely followed by professional educators.

Open access to this video bank and to the clinical data will be allowed to interested researchers , with the aim of improving the comprehension of this complex phenomenon and its correlation with clinical and demographic features.

175 **168.175** Stop Making Noise! Auditory Sensitivity in Adults with Autism Spectrum Disorder: Physiological Habituation and Subjective Detection Threshold.

M. W. Kuiper[1], *L. Verhoeven*[2] *and H. M. Geurts*[3], *(1)University of Amsterdam and Dr. Leo Kannerhuis, Doorwerth, Netherlands, (2)Dr Leo Kannerhuis, Doorwerth, Netherlands, (3)University of Amsterdam, Amsterdam, Netherlands*

Background: One of the most commonly reported sensory sensitivities in ASD is sensitivity to sounds (e.g., Haesen et al., 2011). However, possible underlying mechanisms are still unknown. Some suggest that habituation might play a role, while others postulate that altered sensory detection thresholds might be an explanatory mechanism. So far, studies on auditory habituation show mixed results and focused mainly on ASD children (e.g., for review see Lydon et al., 2014). Altered sensory detection thresholds have been shown in ASD children (e.g., Tavasolli et al., 2015). Research on auditory detection thresholds in ASD adults is, however, limited.

Objectives: We examined whether ASD adults habituate slower and have lower auditory detection thresholds compared to typically developing (TD) adults. We also examined whether habituation and detection threshold are related to self-reported auditory sensitivities.

Methods: We included 33 ASD and 31 TD adults (25-45 years; IQ>70). Habituation is defined the number of trials until on two consecutive trials no skin conductance response (SCR; >0.03 uS; Boucsein et al., 2012) was given to a simple tone (1000Hz) and a Dutch ambulance siren. Detection threshold is measured by decreasing the volume of a simple tone until participants report not to hear the tone anymore. This is repeated until participants reach the same threshold twice. The self-reported auditory sensitivity is measured with the adolescent adult sensory profile (AASP).

Results: A MANOVA analysis revealed that the groups (N=24 each) did not differ on predefined habituation for both tone (*p*=.96; *Cohen's d*=.02) and siren (*p*=.92; *Cohen's d*=.03). There was also no significant Pearson correlation between habituation and self-reported auditory sensitivity (N=48; *r*=.02; *p*=.90). The groups also did not differ on auditory detection thresholds (N_{ASD}=33; N_{TD}=31; *p*=.20; *Cohen's d*=.32). There was, however, a significant correlation between detection thresholds and self-reported auditory sensitivity (N=64; *r*=.29; *p*=.02). Moreover, exploratory repeated measures analyses revealed that when habituation was defined as decreasing SCR amplitudes (Boucsein et al., 2012) that ASD adults had a significantly slower decline in SCR amplitude compared to ASD adults (*p*=.04; *Cohen's d*=0.64). Regarding the siren, no significant differences were found.

Conclusions: At first sight, no large differences between ASD and TD adults were observed on habituation and auditory detection threshold, but a higher auditory detection threshold did seem to be related to more self-reported auditory sensitivity. At second sight, concluding that no differences emerge between the groups might be premature as our exploratory analyses revealed that the intensity of the physiological response to auditory stimuli might remain heightened in ASD. Hence, it seems to depend on how habituation is operationalized whether or not one can conclude that ASD adults habituate slower than TD adults.

176 **168.176** The Relationship between Motor Performance and the Broad Autism Phenotype When Performing Movements of Varying Complexity

***I. Naiman**[1], B. M. Stoesz[2], J. M. Montgomery[3] and C. M. Glazebrook[4], (1)University of Toronto, Toronto, ON, Canada, (2)Psychology, University of Manitoba, Winnipeg, MB, Canada, (3)Psychology, University of Manitoba, Winnipeg, MB, CANADA, (4)University of Manitoba, Winnipeg, MB, CANADA*

Background: For effective social communication, we must proficiently interpret and use body language, which illustrates the link between social and motor behaviour. The proficiency of these skills progress based on an individual's experiences and interactions.
Objectives: The purpose of this study was to investigate the relationship between motor behaviour and self-reported social communication skills of individuals without a diagnosed psychological or physical condition using the Broad Autism Phenotype Questionnaire (BAPQ).

Methods: Twenty-four individuals without autism spectrum disorder were recruited. Each participant completed the BAPQ (measuring rigidity, aloofness, and pragmatic language) and a motor task. During the motor task, participants were asked to *look at*, make a *button-press*, or *point* to one of two pictures of animals that appeared with an 18° visual angle on the left and right sides of a computer monitor (CNE, Gainesville, FL; resolution 1920x1080 pixels, refresh rate = 60Hz). The target image was indicated by either an auditory (sound of the animal) or a visual (matching picture located central on the screen) cue. The dependent variables were mean and standard deviation of the reaction time (RT) and movement time (MT) of the saccade and hand movements. Gaze behaviour was sampled using the Eyelink1000plus eye-tracker (SR Research Ltd., Ottawa, ON) at 500Hz. Hand movements were recorded using custom built micro-switches that acted as home switches/buttons. A series of simple regression analyses were used within participants to examine the relationship between motor performance in the six conditions (2 sensory modalities by 3 motor tasks) and the BAPQ subscale scores.

Results: Overall, the analysis for motor planning demonstrated that the look conditions were the most challenging (i.e. longest RTs) for participants, and the auditory look condition was significantly more challenging than the visual look condition. The following results are presented by the three BAPQ subscales: (1) Rigidity was positively correlated with saccade RT during the auditory look condition (R^2=0.398), suggesting that individuals with higher rigidity experienced increased cognitive stress during this challenging task affecting their efficiency to create and carry out a motor plan. (2) Aloof behaviour was positively correlated with the variability of saccade RT during the auditory point condition (R^2=0.167), suggesting that more aloof individuals are less practiced in this type of multisensory (social communication) action. (3) Pragmatic language was negatively correlated with mean hand RT during the auditory point (R^2=0.311), the visual button-press (R^2=0.283), and the visual point (R^2=0.398) conditions, and negatively correlated with mean saccade MT during the visual button-press (R^2=0.277) and visual point (R^2=0.179) conditions. The latter findings suggest that individuals with higher pragmatic language scores (i.e. those less confidence in social verbal skills) attend better to visual information during eye-hand coordinated tasks.

Conclusions: The present study demonstrates explicit relationships between self-report social communication skills and motor performance. Specifically, auditory tasks were more difficult for rigid and aloof individuals and visual tasks were easier for individuals with higher pragmatic language scores (i.e. less confidence in pragmatic language skills). Results from these studies may inform new therapies targeting eye-hand coordination performance using auditory stimuli.

177 **168.177** The Relationship between Sensory over-Responsivity, Emotion Dysregulation Symptoms, and Psychophysiological Arousal to Sensory Stimuli in Youth with ASD

***J. E. Yeargin**[1], S. A. Green[2], T. Zbozinek[3], M. Dapretto[2], M. Craske[3] and S. Y. Bookheimer[2], (1)Brain Mapping Center, UCLA, Los Angeles, CA, (2)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (3)UCLA, Los Angeles, CA*

Background: Sensory over-responsivity (SOR) in youth with Autism Spectrum Disorder (ASD) is related to significant impairment in functioning, including greater emotional and behavioral symptoms (Ben-Sasson et al., 2009). Emotion dysregulation, the inability to effectively modulate emotions in response to an emotional experience, is a common area of difficulty found in ASD (Samson et al. 2014), but is rarely examined directly in relation to SOR. Emotion dysregulation also co-occurs with other negative outcomes including increased anxiety, depression, and poorer social functioning (Mazefsky et al., 2015) as well as observable maladaptive behaviors such as deliberate self-harm, tantrums, physical altercations with others, and general increases in irritability, nervousness, and worry (Quek et al., 2012; Lerner et al., 2012). It is possible that when individuals with ASD are exposed to aversive environmental stimuli, the need to modulate incoming sensory information disrupts adaptive emotional processing resulting in increased emotion dyrsregulation (Mazefsky et al., 2015). There is evidence that children with ASD show one of two patterns of psychophysiological arousal in response to sensory stimuli: either high arousal and slow habituation or low arousal and high habituation (Schoen et al., 2008). However, it is unclear whether and how these patterns may relate to SOR and/or to emotional arousal more generally. Thus, we sought to examine the relative contributions of SOR and emotion dysregulation to physiological responses to sensory stimuli.

Objectives: To examine the relationship between emotion dysregulation, sensory over-responsivity, and physiological arousal in youth with ASD.

Methods: Participants were 37 children and adolescents with ASD, aged 8-17 years. Participants completed a psychophysiological assessment measuring skin conductance response (SCR) across 6 15-sec blocks of mildly aversive, simultaneous auditory and tactile stimuli (white noise and a scratchy sponge). Sensory over-responsivity (SOR) was measured using a composite score from parent reports on the tactile and auditory sensory sensitivity items of the Short Sensory Profile (Dunn, 1999) and Sensory Over-Responsivity Inventory (Schoen et al., 2008). Emotion dysregulation was measured using parent report on the Emotion Dysregulation Index (EDI; Samson et al., 2014) of the Child Behavior Checklist (CBCL).

Results: A repeated-measures ANOVA with the 6 blocks of SCR response as within-subjects factors and SOR and ED as between-subject factors showed a main effect of SCR decreasing over time ($p<.001$). There was a significant SCR*SOR interaction ($p<.05$) such that SCR decreased less over time for youth with high (more severe) SOR. There was also a main effect of ED ($p<.05$) such that youth with high (more severe) ED had higher SCR arousal across all 6 blocks.

Conclusions: Results demonstrate that both SOR and emotion dysregulation play a role in physiological response to sensory stimuli in youth with ASD. Emotion dysregulation may be more directly related to high overall arousal, whereas SOR may be related to decreased habituation to sensory stimuli (consistent with Green et al., 2015, where the same pattern was observed with amygdala response to sensory stimuli). Results will be discussed in terms of implications for including emotion regulation strategies in intervention for SOR.

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168.178 The Relationship of Sensory Overresponsivity to Amplitude Discrimination

***E. P. McKernan**, J. Kopec, E. A. Kaplan, E. L. Koelmel and N. Russo, Psychology, Syracuse University, Syracuse, NY*

Background: Up to 95% of parents have reported differences in sensory processing for their child with ASD (Rogers & Ozonoff, 2005). An estimated 56 to 70% of youth with ASD meet criteria for sensory overresponsivity, defined as severe negative responses to sensory stimuli (Baranek et al., 2006; Ben-Sasson et al., 2007). Previous studies have suggested that hyperresponsivity is due to failure to habituate (Green et al., 2015). Use of vibrotactile methods can provide an objective, quantitative measure of tactile processing and adaptation.

Objectives: This study aims to relate performance on three amplitude discrimination tasks, two without adaptation and one with an adapting stimulus, to sensory overresponsivity in a group of typically developing (TD) children and children with ASD.

Methods: 42 children (21 TD, 21 ASD) matched on age and IQ completed a vibrotactile testing battery. For all three amplitude discrimination tasks, stimuli were delivered on two fingers of the left hand, with one of the stimuli having a higher amplitude. Participants were asked to determine which of the two stimuli had the higher amplitude. In the adaptation condition, each trial was preceded by an adapting stimulus delivered to a single site before the comparison stimulus, thus leveraging the effect of habituation. Parents of children completed the Sensory Profile (Dunn, 1999), which was used to measure sensory overresponsivity. Differences in amplitude discrimination task performance were investigated. A regression analysis was performed to determine whether sensory overresponsivity predicted task performance.

Results: There was a significant difference between amplitude discrimination with and without adaptation for TD children, but not for ASD children. Children with ASD had significantly greater sensory overresponsivity than did TD children. Sensory overresponsivity predicted performance on amplitude discrimination without adaptation for TD children, but did not significantly predict performance on any of the amplitude discrimination tasks for children with ASD.

Conclusions: Amplitude discrimination performance worsened with single-site adaptation for TD children, but not for ASD children, replicating previous research in this area. Children with ASD had higher sensory overresponsivity than did TD children; however, the restricted range of these values for children with ASD likely reduced the ability to predict amplitude discrimination performance. The performance of TD children with higher sensory overresponsivity appears to be less affected by the presence of an adapting stimulus, similar to that of children with ASD. These results may suggest that the level of sensory overresponsivity has a differential impact on adaptation.

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168.179 Types of Restricted Interests and Preoccupations: Are There Differences across Sex?

*K. Nowell[1] and **C. Jorgenson**[2], (1)Thompson Center for Autism & Neurodevelopmental Disorders, Columbia, MO, (2)Special Education, University of Missouri, Columbia, MO*

Background:

It is unclear if females are less likely to be diagnosed with autism spectrum disorder (ASD) because of a protective, female effect or the result of a unique female autism phenotype that current diagnostic tools and criteria do not detect (Van Wijngaarden-Cremers et al., 2014). With regard to restricted, repetitive behaviors (RRBs), parents and clinicians anecdotally report differences between males and females (Jamison et al., 2017). However, research findings are inconsistent (e.g., Van Wijngaarden-Cremers). Research suggests that there are differences in total number of RRBs, but this depends on the particular measure used and differences may only be apparent at the symptom level (e.g., Frazier et al., 2014). Given the inconsistent research results, researchers have proposed that difficulties in detection of RRBs is a result of females having more socially appropriate and difficult to detect RRBs (Halladay et al., 2015).

Objectives:

The aim of the current study was to investigate whether differences in *types* of restricted, circumscribed interests or preoccupations are associated with sex (i.e., male vs female), particularly restricted, circumscribed interests and preoccupations (CIs).

Methods:

Multivariate analyses were completed for the entire Simons Simple Collection (SSC; *N*=2648) to replicate previous findings (see Frazier et al., 2014). Qualitative data were collected from a local sub-sample of caregivers at a North American, SSC site (*N*=186). Qualitative phenomenological investigations are suitable when interested in a discovery-oriented approach of how individuals construct meaning of an experience (Creswell et al., 2007). In this particular case, qualitative methodology is appropriate to gain an in-depth understanding of how caregivers perceive and describe CIs. Responses describing restricted interests and unusual preoccupations on the *Autism Diagnostic Interview – Revised* (ADI-R) (i.e., questions 67 and 68) were transcribed and categorized using qualitative methodology. Categories were sorted by sex (females=30) and proportions of individuals with CIs in each category were calculated. Additional analyses will be completed to test for significant differences in obtained proportions and to investigate how differences in CI across gender might be associated with other phenotypic measures.

Results:

Multivariate analysis from the entire SSC was significant $F(10,2648)$, $p < .00$, partial $\eta^2 = .40$) with significant differences evident at the RBS-R Restricted Interest subscale level ($p < .00$) and ADI-R Encompassing preoccupation/circumscribed interest subscale level ($p < .00$). Males had more symptoms (i.e., higher scores) in both instances. Analysis of qualitative data found similar proportions of males and females with intense interests in television/movies; animals; and, food. Males were proportionally more likely to have CIs in categories such as factual information (13% vs 0%, respectively). Females had more CIs in several categories including arts and crafts (16.7% vs 5.77%),

Conclusions:

Preliminary analysis indicates that there are differences in the types of CIs described by parents that appear to be associated with sex. As suggested in previous research, it is plausible that females demonstrate socially acceptable restricted interests. Further, parent completed measures may not be capture socially acceptable circumscribed interests. Alternatively, there may be real differences between males and females in the number of restricted interests.

180 **168.180** Typical and Atypical Visuo-Spatial Information Processing in Korean Children with Autism Spectrum Disorder

M. K. Kwon[1] *and H. Song*[2]*, (1)Division of General Studies, Ulsan National Institute of Science and Technology, Ulsan, Korea, Republic of (South), (2)Seoul Woman's University, Seoul, Korea, Republic of (South)*

Background: Individuals with Autism spectrum disorder (ASD) are known to show atypical sensory processing. According to the complexity-specific hypothesis, adults with ASD are particularly impaired with complex (also called second-order or texture-defined) information, whereas their sensitivity to simple (also called first-order or luminance-defined) information is either intact (Bertone et al., 2003) or even superior (Bertone et al., 2005). A recent study (Rivest et al., 2013) found that ASD children also show atypical brain activity in response to complex gratings but this atypical processing was not observed at the behavioral level in the same test session.

Objectives: The present study examined 1) whether atypical processing of complex visual information at the behavioral level is a defining feature of ASD children at individual level as well as group level and 2) whether this processing has a strong relationship with processing speed, one of the general cognitive skills.

Methods: Participants were 28 Korean children - 14 ASD (13 boys; mean age = 8.41 year; SD= 1.70) and 14 TD children (12 boys; 8.14 year; SD = 1.46) matched by chronological age and overall IQ (ASD mean IQ = 90.14; SD= 14.33; TD mean = 97.07; SD = 10.99). Children's overall IQ was assessed using K-WISC-IV and its sub-component, processing speed, was used to examine the relationship between processing speed and costs of the complexity. Children's processing of simple and complex visual information was assessed using a shorter version - 24 trials in total - of Bertone et al.'s (2005) grating task. In this task, either a set of simple and complex static gratings was presented on a computer monitor either horizontally or vertically. Children were asked to report the orientation of each grating set by pressing one of the right or top arrow keys and their accuracy and reaction times were recorded by a computer. Additionally, unlike previous studies, we directly quantified costs of the complexity by computing differences in reaction times and accuracy between simple and complex conditions.

Results: Mean accuracy and reaction times did not differ across ASD and TD children in either simple or complex condition (ps > 0. 23). However, costs of the complexity in reaction times, not in accuracy, were greater in the ASD group than in the TD group ($F(1,31) = 9.699$, $p= .004$). This high cost was also observed at the individual level - 11 of 14 ASD children showed complex cost scores above the mean of the TD group, resulting in a good level of differentiation between ASD and TD (ROC-AUC: 0.801, 95% CI = 0.628-0.974). Spearman correlation analyses showed that within the ASD group none of the overall IQ and processing speed scores have a strong association with complexity cost scores (ps > .105).

Conclusions: Our findings support the complexity-specific hypothesis in ASD children. High costs in processing complex visual information in ASD children are not simply explained by slow processing speed and could serve as a defining feature of ASD at both group and individual levels.

181 **168.181** Understanding the Beliefs and Experiences of Practitioners Who Have Worked in Multi-Sensory Environments with Children on the Autism Spectrum

K. L. Unwin*, G. Powell and C. R. Jones, Wales Autism Research Centre, Cardiff University, Cardiff, United Kingdom*

Background: Multi-Sensory Environments (MSEs; also called sensory or Snoezelen rooms) are present in most special needs schools across the UK, and are widely used with individuals on the autism spectrum. MSEs typically contain a variety of equipment that changes the sensory environment for educational or therapeutic benefit. Despite the wide use of MSEs, their effect and overall efficacy has been under-researched, with previous investigations presenting mixed findings.

Objectives: To understand the possible effects and overall efficacy of using MSEs with children with ASD by asking school-based practitioners in the UK about their beliefs and experiences.

Methods: Data collection is ongoing, here we present data from forty-nine school-based practitioners (43 female, aged 24-60 years, M=38.6) who were predominantly (n=27) teachers or teaching assistants. Each practitioner completed a 28 item online survey about their use of MSEs with autistic children in schools. Items were based on our previous qualitative findings. The practitioners were asked how strongly they agreed or disagreed with each statement on a five-point Likert scale, with percentage agreement calculated.

Results: Practitioners believed that there were multiple benefits to MSE use with autistic children including, reducing anxiety (96%), creating or increasing positive mood (90%), and decreasing challenging behaviours (90%). A large majority of practitioners (90%) believed that benefits were possible because the MSE was motivating and allowed the child to control their sensory environment. 86% of practitioners believed that the MSE could bring benefits not achievable through other school activities. However, 51% stated that MSE use did not always bring benefits. All practitioners agreed that the method of MSE use should be determined by the pupil's needs, suggesting that MSE use should not be used as a 'one-size-fits-all' activity.

Conclusions: Practitioners believed that MSEs were useful for autistic children, producing a range of positive outcomes. They believed these positive outcomes were possible because of the properties of MSEs (e.g. motivating), suggesting that MSEs may hold a unique function within schools. However, although positive outcomes were possible within the MSE, practitioners also reported that children's experiences and their subsequent behaviours varied. The data suggest further investigation is needed to establish the circumstances in which MSE use brings benefit to autistic children. Consequently, a follow-up study directly observing the behaviour of autistic children in a purpose-built MSE at the Wales Autism Research Centre, Cardiff University is in progress.

182 **168.182** Upper-Limb Movement Kinematics and Motor Proficiency Are Associated with the Severity of Autism Spectrum Disorder

*S. Busti Ceccarelli[1], S. Grazioli[1,2], A. Cesareo[3], G. M. Marzocchi[2], M. Molteni[1], M. Nobile[1] and **A. Crippa**[1,2], (1)Scientific Institute, IRCCS Eugenio Medea, Bosisio Parini, Italy, (2)Department of Psychology, University of Milano-Bicocca, Milano, Italy, (3)Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Milano, Italy*

Background: Although the core features of Autism Spectrum Disorder (ASD) are social impairment, communication abnormalities, and restricted and repetitive behaviors, fine and gross motor disturbances can present alongside core characteristics of the disorder and can have a significant impact on quality of life and social development (Lai et al., 2014). Quantitative methods, such as kinematic analysis, can describe precisely the spatial and temporal dimensions of the motor impairments associated with ASD, potentially identifying a well-defined motor phenotype within the spectrum.

Objectives: To investigate whether a group of school-aged, high functioning children with ASD would show abnormalities in kinematics of a simple reach-to-drop task. On the basis of our previous findings in a sample of preschool children with ASD (Forti et al., 2011, Crippa et al., 2015), we hypothesized that children with ASD would differ from typical developing peers in terms of the basic kinematics related to the second part of the movement, in which the participant transported the ball from a support to the target hole. In addition, to investigate whether, in our sample of individuals with ASD, kinematics abnormalities are linked with core clinical symptom severity, we correlated performance on this task and on other standardized motor measures with severity scores of ASD.

Methods: Fifteen children with ASD and twenty typically developing children (TD) aged between 6 and 12, matched by gender, age, and perceptual reasoning were enrolled. Three-dimensional kinematic data were collected by a motion-capture system based on eight infrared cameras during a simple reach-to-drop task. In addition, we assessed motor proficiency using the Movement Assessment Battery for Children—2 (MABC 2; Henderson et al., 2007), the Beery-Buktenica Developmental Test of Visual-Motor Integration (VMI; Beery and Beery, 2010) and an abbreviated battery of test from NEPSY-II (Korkman et al., 2007). The severity of ASD spectrum symptoms was measured with Social Responsiveness Scale (SRS; Constantino, 2002).

Results: Children with ASD showed lower peak of deceleration in the second part of movement ($p<0.05$), and scored significantly lower in MABC 2 and NEPSY-II (all $p<0.05$). The degree of clinical symptom severity was positively correlated with difficulties in balance, tapping, and with anomalous upper-limb kinematics all $p<0.05$).

Conclusions: These preliminary findings extend earlier investigations of our group (Forti et al., 2011; Crippa et al., 2015), depicting kinematics abnormalities also in children with ASD of school age. These peculiarities and other impairments in the motor domain are significantly associated with core clinical symptom severity of ASD.

183 **168.183** Which Motor Stereotypy Subtypes Are Most Indicative of an Autism Spectrum Disorder in Early Childhood?

***A. K. McCullough**[1,2], S. Lopez-Pintado[3] and S. Goldman[4], (1)Neurology, Columbia University Medical Center, New York, NY, (2)Teachers College, Columbia University, New York, NY, (3)Biostatistics, Columbia Universty - Mailman school of Public Health, New York, NY, (4)Department of Neurology, Division of Child Neurology, Columbia University Irving Medical Center, New York, NY*

Background:

Motor stereotypies, defined as repetitive, patterned, purposeless behaviors, are one of the hallmark behaviors in children with a diagnosis of autism spectrum disorders (ASD). However, these hyperkinetic movements are also reported in selected populations of children with non-autistic neurodevelopmental disorders, and during infancy in typically developing children. To date, the majority of studies focusing on stereotypies have used parent-reported questionnaires, which offer insufficient details for targeted discriminative analyses of restrictive and repetitive motor behaviors.

Objectives:

Therefore, the purpose of this study was to use a reliable motor stereotypy video coding system (Goldman, 2008) to identify and score each motor stereotypy in children with ASD and children with non-ASD developmental disorders (NASDD) in order to 1) examine which stereotypy subtypes reveal the most salient characteristics of restrictive and repetitive motor behavior in early childhood, and 2) determine which stereotypy subtypes best distinguish children with ASD from NASDD children.

Methods:

Motor stereotypies were coded individually from the first 15 minutes of 30-minute standardized video-recorded play sessions. A cohort of N=277 preschool children with a neurodevelopmental disorder [F: 24.5%(68); age: 4.6(1.2) years], with and without a comorbid diagnosis of ASD [ASD: 47%(129)], was recruited through a multi-site study focusing on neuropsychological and psychiatric assessments. For each video, the following topographical descriptors were used to generate eight mutually exclusive stereotypy subtypes: face, head/trunk, arm/leg, hand/finger, hand/finger with object, gait, self-directed, and visual.

Data were analyzed in MATLAB R2016b, and descriptive statistics were calculated as Mean (SD), and Frequencies [%(n)]. Among children with stereotypies, frequencies of stereotypy subtypes were entered into a principal components analysis (PCA) with a varimax rotation. PCA stereotypy subtypes with loadings ≥0.40 were used to interpret components. Then, using the entire cohort, associations between an ASD diagnosis and the presence of select motor stereotypy subtypes, as determined by the PCA, were tested using logistic regression (LR) and the odds ratios (OR) were calculated. Finally, the Receiver Operating Characteristic Area Under the Curve (AUC) was evaluated. All models were run with an a priori significance level of $p<0.05$.

Results:

All children [*n*=122, ASD: 72%(88)] with stereotypy frequencies >1 were included in the PCA. Results showed that three components explained 76.6% of the variance, and could best be described by the following motor stereotypy subtypes: (1) self-directed, (2) limb (arm, leg, foot, and hand stereotypies combined), and (3) object-oriented. LR showed that, in the full cohort, the presence of limb (OR: 6.9) and object-oriented (OR: 3.01) stereotypies were significantly associated with an ASD diagnosis, while self-directed stereotypies were not (OR: 1.4). The LR model AUC was 0.75, with a sensitivity and specificity of 86% and 58%, respectively.

Conclusions:

A subset of motor stereotypies (self-directed, limb, and object-oriented) appear to be the most salient motor stereotypy subtypes at preschool in both children with and without ASD. Only the limb and object-oriented subtypes, however, appeared to sufficiently identify children with an ASD diagnosis. These results are particularly relevant to clinical assessments of autism in young children, as they may help to strengthen a diagnosis.

184 **168.184** "My Sensory Experiences": Everyday Sensory Preferences and Challenges Revealed By Young People on the Spectrum Using a Picture-Based Interview Tool

J. Ashburner[1] *and N. Bobir*[2]*, (1)Autism Queensland, The University of Queensland, Sunnybank, Australia, (2)Research and Business Development, Autism Queensland, Sunnybank, Australia*

Background: Information about the sensory responses of people on the spectrum is commonly gathered through parent/caregiver or teacher questionnaires. The perspective of the person on the spectrum is less commonly considered. As sensory sensitivities can contribute to distress and challenging behaviours, it is important that they are understood and accommodated.

Objectives: This project aimed to (a) evaluate the clinical utility of *My Sensory Experiences*, a tool which utilises photographic representations of every-day sensory experiences, combined with open-ended questions to assist individuals on the spectrum in describing their sensory experiences, and (b) analyse the nature of everyday sensory experiences that are frequently preferred or that present challenges.

Methods: Three cycles of participatory action research guided the development of *My Sensory Experiences*. Participants included 44 individuals on the spectrum (aged 8-49 years), 33 parents, and 5 occupational therapists. During the first two cycles, semi-structured interviews were conducted with 5 occupational therapists and 11 parents. In the final cycle, 21 children and 12 adults on the spectrum, and 21 parents completed surveys with closed- and open-ended questions. The feedback was analysed using (a) descriptive statistics, and (b) content analysis of the transcribed interviews and open-ended survey questions. The frequency with which items were identified as bothersome or calming, was also analysed using descriptive statistics.

Results: "My Sensory Experiences" uses photographs depicting sensory input in everyday contexts such as shopping centres, classrooms, and hairdressers, including everyday experiences that individuals often find challenging, calming or that they seek out. The tool includes child/adolescent and adult versions, and a family observation form. Although the tool can be completed independently by people on the spectrum and their families, administration through an interview provides a more in-depth, personalised perspective on the person's sensory preferences. The tool is intended to augment rather than replace standardised norm-referenced sensory processing assessments. In terms of clinical utility, the interview format and visual cues enabled people on the spectrum to express their preferences, and develop greater self-awareness of their sensory preferences, so that they were better able to self-advocate and develop their own strategies. The visual cues were reported to capture the full range of sensory experiences that are often liked or disliked. Occupational therapists appreciated the richness of the information gathered and its relevance to the person's life. Parents gained new insights into their child's sensory preferences. Analysis of the everyday sensory experiences that were frequently identified as challenging included unpredictable or uncontrollable sensations such as sirens, people talking or flickering lights. Sensations that are predictable and controllable such as repetitive patterns or sounds were often reported to be calming. Many people described difficulties filtering sensory information such as following someone talking in a noisy environment.

Conclusions: *My Sensory Experiences* effectively captures the voice of people on the spectrum. Analysis of items that are commonly preferred or that present challenges can inform the design of everyday environments to better accommodate the sensory needs of people on the spectrum.

Poster Session
169 - Social Cognition and Social Behavior
5:30 PM - 7:00 PM - Hall Grote Zaal

185 **169.185** Affective Salience Influences Looking Preference for Social Elements during Interactive Play Scenes in Young Children with Autism

L. Ruta[1]*, G. Tartarisco*[1]*, I. Dubey*[2]*, F. Fama'*[3]*, L. Spadaro*[3]*, C. Carrozza*[1]*, E. Leonardi*[3]*, F. Marino*[1]*, P. C. Torre*[4]*, S. Baieli*[4]*, R. Scifo*[4]*, G. Pioggia*[1] *and B. Chakrabarti*[2]*, (1)Institute of Applied Sciences and Intelligent Systems, "Eduardo Caianiello" (ScienceApp) – National Research Council of Italy (CNR), Messina, Italy, (2)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (3)Institute of Applied Sciences and Intelligent Systems, National Research Council of Italy (CNR), Messina, Italy, (4)Centre for Autism Spectrum Disorders, Child Psychiatry Unit, Acireale Hospital, Provincial Health Service (ASP), Catania, Italy*

Background:

In typically developing children, social elements within natural scenes substantially bias allocation of attention (Chevallier et al., 2012). Furthermore, affective salience and positive affect act as additional cues to drive attention and engagement within complex scenes (Pool 2016). Reduced preference for social stimuli has been reported in autism and related to social learning impairment (Dawson 2012; Chita-Tegmark 2016).

Eye-tracking studies using dynamic social stimuli, indicated that children with autism specifically fail to attend to social cues in more naturalistic conditions (Chawarska et al., 2012; Chevallier et al., 2015). However, none of these studies have systematically manipulated the level of emotional salience of social cues, and tested its impact on the looking patterns for natural interaction scenes.

Objectives:

To test, using an eye-tracking experiment, whether a) children with and without autism attend equivalently to videos of naturalistic interactive play; b) affective salience and positive affect are able to modulate attention to social-related elements of interactive play scenes equivalently in children with and without autism.

Methods:

Fifty-eight male children (19 children with autism (ASD) and 29 typically developing children (TD)), aged 35-75 months were enrolled in the study.

The experiment consisted of 6 trials (3 different trials, each repeated in a neutral and an affectively salient condition) of a child and an adult interacting with objects (fish game, blocks and toy train) in a naturalistic play interaction, presented on a computer screen. Each trial lasted 25 seconds and was presented in a random order. Gaze patterns were recorded with a SMI iView XTM RED dark-pupil 120Hz eye-tracking system (Sensomotoric Instruments, 2005) and exported using SMI BeGaze 2.4 software. Statistical analyses were conducted using R (http://www.r-project.org/). A linear mixed effects model (package: lme4) was applied to explore the effect of group and condition (neutral vs salient) to predict looking time (dwell time) in the regions of interest (adult and child face, activity area, background).

Results:

A main effect of group (Wald χ^2=10.02, p=.002 ; Wald χ^2=4.5, p=.03; Wald χ^2=3.5, p =.06) and condition (Wald χ^2=6.7, p=.01; Wald χ^2=4.6, p=.03; Wald χ^2=6.04 , p=.01) was observed on the looking time to the adult face in all the trials, with the ASD children looking significantly less than the TD children at the adult face and the salient condition significantly enhancing the looking time to the adult face in both ASD and TD children. No group by condition interaction was found (Wald χ^2=0.11, p=.74; Wald χ^2=0.4, p=.54; Wald χ^2=0.5, p=.5).

Conclusions:

We found a significant group difference in the amount of time spent attending to the social elements of the scene, with the ASD children attending less than the TD children to the adult face. Furthermore a significant effect of affective salience was noted, with an increase of time spent attending to the faces in both the ASD and TD children during the salient condition.

This study provides preliminary evidence of a substantial influence of affective salience in visual orientation and exploration of social-related elements in naturalistic play interaction scenes in young children with autism.

186 **169.186** Affective State and Decision Making in Autism Spectrum Disorder: Evidence from the Ultimatum Game

A. Acosta Ortiz[1]*, S. B. Gaigg*[2] *and S. Reimers*[2]*, (1)City University London, London, United Kingdom, (2)City, University of London, London, United Kingdom*

Background:

Classical economic models regards decision-making as an exclusively cognitive process, however Bechara et al., (1997) and Camerer (2003) show that emotions and their associated physiological process influence decision making. This was demonstrated by Sanfey et al., (2003) and Van't Wout et al., (2006), in the context of the Ultimatum game (UG; Güth et al, 1982), in which a proposer can decide how to split a given amount of money (£10) between themselves and a responder who can either accept or reject the offered amount. If s/he accepts, the money is paid out as proposed; if s/he rejects neither participant receives any amount. Both Sanfey et al., (2003) and Van't Wout et al., (2006) reported an association between high skin conductance and rejection of unfair offers, suggesting that emotional processes influence people's decisions. Social-cognitive processes are also thought to play a role, such as considerations of fairness and the intentions of proposers. The difficulties ASD demonstrate in social cognition and in processing emotional related information (Johnson et al, 2006; Maras, Gaigg, & Bowler, 2012) would lead to the prediction that the decisions ASD make in the UG would be less contingent on emotional responses to offers and be less influenced by whether offers stem from an intentional agent (human) or non-intentional machine (computer).

Objectives: To test the above prediction by examining the physiological responses to human vs. computer generated offers in ASD and comparison participants on a multitrial version of the UG that require a standard accept/reject response to offers that varied in fairness.

Methods: 36 ASD and 36 age and ability matched comparison adults completed 24 UG, half time receiving offers from people and the other half pseudo-randomly generated by a PC. In each condition, twelve trials were fair (£5 vs £5) and twelve unfair (£9 vs £1; £8 vs £2; £7 vs £3). Offers were presented in a random order and skin conductance and heart rate recorded. After offer presentation, in the form of a short video-clip or animation, which showed either a real person or the computer generating an offer, participants were prompted to accept or reject. Not time limit was imposed and feedback was given at the end, yet participants knew that all decisions would be paid out at 10% of their value at the end of the experiment

Results: Unfair offers proposed by humans were more frequently rejected than unfair offers proposed by the computers. Similarly, GSR responses to unfair compared to fair offers were greater in the human than the computer condition $F(1,65) = 5.911$, $p = .018$, $\eta^2 = .083$ .No differences between ASD and comparison participants was observed

Conclusions: The results confirmed observations by Sanfey et al., (2003) and van't Wout et al., (2006), which show that emotional and social-cognitive factors are involved in rejection of unfair offers in the UG. The predicted difference for the ASD was not supported, suggesting that difficulties in emotional and social-cognition might not confer a disadvantage in the context of social-economic decision making.

187 **169.187** Altered Responses to Social Chemosignals in Autism Spectrum Disorder

Y. Shapira[1]*, O. Perl*[2]*, A. Ravia*[2]*, D. Amir*[2]*, A. Eisen*[2]*, V. Bezalel;*[2]*, L. Rozenkrantz*[2]*, E. Mishor*[2]*, L. Pinchover*[2]*, T. Soroka*[2]*, D. Honigstein*[2] *and N. Sobel*[2]*, (1)Weizmann Institute of Science, Rehovot , Israel, (2)Weizmann Institute of Science, Rehovot, Israel*

Background:

Social chemosignals are volatiles secreted by one individual to affect the behavioral, physiological, brain activity and hormonal state of other individuals. A Growing body of evidence implies that social chemosignals likely play a major role in human social interaction, mostly without conscious awareness.

Objectives: Because Autism spectrum disorder (ASD) is characterized by impaired social communication, often attributed to misreading of emotional cues, we hypothesized that misreading of emotional cues in ASD partially reflects altered social chemosignaling.

Methods:

In a series of experiments we investigated this hypothesis by comparing the physiological and behavioral responses of typically developed (TD) adults and cognitively able adults with ASD to the subliminal presentation of social chemosignals. In the first two experiments, we tested the effects of *smell of fear* (actual body-odor collected from first-time tandem skydivers). We tested the physiological responses to the *smell of fear* in both TD (n =20) and ASD (n=20) participants, and in a second experiment we tested how TD (n =20) and ASD (n=20) participants respond behaviorally to the *smell of fear*. Then, we tested the impact of two different isolated putative social chemosignals. The first is a commonly studied putative social chemosignal, 4,16-androstadien-3-one (AND). we measured the impact of AND on physiological measures using a widely applied assay for human chemosignaling (TD, n =23, ASD, n = 17). The other chemosignal tested is a novel putative compound, hexadecanal (HEX), a molecule that promotes social buffering in rodents. Given that HEX is also present in human skin, we measured the impact of HEX on the acoustic startle response, a brainstem aversive reflex that occurs after a startling event such as a loud noise (TD, n =17, ASD, n = 17).

Results:

The undetected *smell of fear* increased physiological arousal in TD yet did not affect arousal in ASD ($F_{1,34}$ = 12.8, p = 0.001). In addition, the undetected *smell of fear* reduced explicit and implicit measures of trust in TD, but acted opposite in ASD ($F_{1,37}$ = 10.1, p < 0.003). The putative chemosignal AND drove increased arousal in TD yet decreased arousal in ASD ($F_{1,37}$ = 8.0, p = 0.007). Finally, the putative chemosignal HEX significantly reduced startle in TD but not in ASD ($F_{1,30}$ = 7.7, p < 0.01).

Conclusions: Experiments with subliminal presentation of a natural stimulus (*smell of fear*) and two different synthetic putative social chemosignals (AND and HEX) converged to imply altered autonomic and behavioral responses to social chemosignals in ASD. I speculate that altered response to chemosignals may be involved in part of the symptoms of ASD. This speculation suggests novel paths of research, diagnosis, and treatment.

188 **169.188** Analysis of Teacher-Student Interactions within Classroom Activities: Implications for Effective Instructional Practices

N. Sparapani[1]*, L. Towers*[1]*, J. Traser*[1]*, J. Suhrheinrich*[2]*, S. R. Rieth*[2,3] *and A. C. Stahmer*[4]*, (1)School of Education, University of California, Davis, Davis, CA, (2)San Diego State University, San Diego, CA, (3)Child and Adolescent Services Research Center, San Diego, CA, (4)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA*

Background: High quality interactions between teachers and students are associated with accelerated academic development (Burchinal et al., 2008), more student participation (Ponitz et al., 2009), and communication and language development (Walsh, 2002). During high quality interactions, teachers encourage children to contribute, generating ideas and questions that further the interaction while supporting the learning process by shaping and expanding on the children's contributions. Teachers' use of responsive language, which follows the child's lead, is delivered with positive affect, and is sensitive and respectful, is a key marker of interaction quality (Landry et al., 2006; Kim & Mahoney, 2004; Lawrence et al., 2015). Little research has examined teachers' use of responsive language and its impact on learning and development within educational settings for students with ASD.

Objectives: This study utilized video observations to examine the relations between teachers' responsive language and students' initiations within a sample of school-age children with ASD.

Methods: Participants included (*n* = 123) preschool–3rd grade students with ASD and their teachers across 66 schools and 16 districts enrolled in a longitudinal study evaluating the efficacy of classroom-based Pivotal Response Training (PI Stahmer). At study entry, ASD diagnoses were confirmed using the ADOS-2, and IQ was estimated using the *Differential Abilities Scales-II* (DAS-II; Elliott, 2007). Video-recorded classroom observations of students and their teachers were collected across a two-year period. The current study utilized video observations from the beginning of the school year, measuring the frequency of teacher responsive language and students' communication initiations across three categories, commenting, asking questions, and seeking clarification. Trained research assistants coded the teacher and student dimensions within classroom activities using Noldus Observer® Video-Pro Software (XT 14). Inter-rater agreement between the coders using percent agreement and Cohen's Kappa coefficients indicated overall good reliability, with coefficients ranging between 80–97% in agreement (Kappa = 0.72) across behaviors within each dimension.

Results: Lag sequential analysis was used to examine the frequency of student initiations following and preceding teachers' responsive language. Preliminary analyses including 30 students (M_{age} = 7.09, *SD* = 1.84) and 21 teachers indicated that on average students initiated communication 2.5 times following teachers' responsive language within a 10-second tolerance window (56% on-topic commenting; 30% seeking clarification; 12% asking content-related questions). Teachers responded 5.2 times on average (45% of the time) to students' communicative initiations across the observation. Furthermore, quality ratings (1–3) assigned to each activity as a measure of overall responsiveness were associated with a higher frequency of student on-topic commenting (*r* = .54, *p* < .01) and asking on-topic questions (*r* = .47, *p* < .01) after controlling for NVIQ (*M* = 85.09; *SD* = 13.49).

Conclusions: These data provide preliminary conceptualization and operationalization of key student and teacher interaction dimensions, providing insight into patterns of interaction between students with ASD and their teachers within classroom activities. Findings suggest that teachers' use of responsive language is associated with a higher frequency of student on-topic initiations. These data may have important implications for understanding the quality of instructional practices for students with ASD within educational settings.

189 **169.189** Anxiety and Social Initiation in Young Children with Autism Spectrum Disorder

R. A. Bowler*, E. A. Bisi and B. J. Wilson, Seattle Pacific University, Seattle, WA*

Background: Previous research indicates that children with autism (ASD) are less likely to initiate social interactions (Rivard et al., 2016) which may result in decreased opportunities for effective social development (Schietecatee et al., 2012). Many children with ASD also experience co-occurring anxiety, with recent studies reporting comorbidity rates as high as 40% (Kerns et al., 2016). Moreover, previous literature suggests that anxiety is associated with several social communication impairments (Taylor & Gotham, 2016), but the relation between anxiety and social initiation in school-aged children with ASD is not clear (Swain, Scarpa, White, & Laugeson, 2015).

Objectives: The purpose of this study was to examine the role of anxiety on social initiation behaviors in children with ASD compared to their TD peers. Anxiety was hypothesized to moderate the relation between developmental status and social initiation behaviors, such that children with autism and high anxiety would have the lowest level of social initiation behaviors compared to the TD sample.

Methods: Our sample included 110 children (ages 3:0 to 6:11), 71 (49 % female) TD children and 45 children with ASD (20% female). Video recordings of an 8-minute parent-child free-play task were coded using an adapted version of the Modified-Classroom Observation Schedule to Measure Intentional Communication (M-COSMIC; Clifford et al., 2010), from which percentages of child social initiations were obtained. Child anxiety ratings were collected using the Parent-Form Anxiety subscale of the Behavioral Assessment System for Children—Second Edition (BASC-2; Reynolds & Kamphaus, 2004).

Results: A moderated multiple regression analysis was conducted using the PROCESS macro for SPSS (Hayes, 2013). Child age, gender, and verbal ability were controlled for in the analysis. Findings included a significant main effect for developmental status on social initiation (B = -.225, CI_{95} [-.423, -.026], p = .027), which supported our hypothesis that children with ASD would initiate less than TD children. There was a nonsignificant main effect for anxiety on social initiation (B = .001, CI_{95} [-.002, .003], p = .558), contrary to our hypothesis that lower levels of anxiety would yield higher levels of social initiation. Finally, the interaction between developmental status and anxiety on initiation was nonsignificant (B = .002, p = .393), but trending in an unexpected direction. While the TD group demonstrated the highest levels of social initiation overall, children with ASD and high levels of anxiety demonstrated the highest levels of social initiation for the ASD group. Results suggest that the variables in our model accounted for 38% of the variance in initiations.

Conclusions: Consistent with previous research, children with autism initiated fewer social interactions with their parents than TD children (Humphrey & Symes, 2011; Rivard et al., 2016), but children with ASD in our study did not have higher levels of anxiety. Although nonsignificant, results suggest the frequency of social initiations in children with ASD tended to increase with higher child anxiety. Future research should investigate the function of anxiety in the social interactions of children with ASD, as moderate levels of anxiety may potentially be adaptive in young children with ASD.

190 **169.190** The Role of Theory of Mind on the Stress Intensity of Parents of Young Children with Autism

***R. A. Bowler**, T. Estrada, A. J. Lee, T. M. Rutter, B. Van Vleet and B. J. Wilson, Seattle Pacific University, Seattle, WA*

Background: A substantial amount of research indicates that parents of children with ASD experience higher levels of stress than parents of typically developing (TD) children (Rao & Beidel, 2009). In addition, research suggests that children with ASD have deficits in theory of mind (ToM), the ability to attribute mental states to others and oneself (Baron-Cohen, Leslie, Frith, 1985; Colle, Baron-Cohen, & Hill, 2007). Limited research suggests that increased parental stress may predict lower child ToM abilities, but this association has yet to be explored in children with ASD (Guajardo, Snyder, & Petersen, 2008).

Objectives: Understanding the factors that may contribute to parental stress is crucial in both treatment outcomes and family functioning. We hypothesized that a child's ToM ability would moderate the association between developmental status and the intensity of parental stress, such that parents of children with ASD and lower ToM skills would report the most intense stress.

Methods: Participants were 101 children (ages 3:0 to 6:11) and their parents. Sixty-one children were typically developing (38% female) and 40 children had a diagnosis of autism spectrum disorder (25% female). Children's theory of mind was assessed using a battery of tasks comprised of a diverse beliefs task, an unexpected contents false belief task and a changed location false belief task. Intensity of parenting stress was reported by parents on the Parenting Daily Hassles Scale (Crnic & Greenberg, 1990). Children's verbal abilities were measured using the verbal comprehension and naming vocabulary subtests of the Differential Ability Scales II (DAS-II; Elliot, 2007).

Results: A moderation analysis using the SPSS macro PROCESS (Hayes, 2013) evaluated whether the association between developmental status and intensity of parental stress is moderated by child ToM abilities. Controlled variables included children's language abilities and age. Results indicated the main effect of status on parental stress intensity (B = -1.509, CI_{95} [-12.386, 9.368], p = .783) and the main effect of ToM skills on parental stress intensity were not significant (B = -.956, CI_{95} [-4.673, 2.761], p = .611). The contribution of the interaction between status and ToM was significant, $\Delta R2$ = .04, F(1, 95) = 4.012, p = .048. Specifically, at higher levels of ToM ability in children with ASD, parental stress intensity is higher (ToM = 3: B = 16.516, CI_{95} [5.248, 27.784], p = .005; ToM = 2: B = 10.501, CI_{95} [3.217, 17.798], p = .005). When ASD children had low levels of ToM ability, parental stress intensity did not differ compared to parents of TD children.

Conclusions: The current study found that parents of children with ASD and higher ToM abilities experienced the highest intensity of stress, in contrast with our hypothesis and limited past research. The findings suggest that, although children with ASD and higher ToM abilities may appear more similar to their TD peers, their parents may be experiencing more intense stress than parents of TD children. More research is needed to better understand the experience of stress in parents with children with ASD.

191 **169.191** Atypical Scanning Patterns of Static Social Scenes in ASD: Results from the ABC-CT Feasibility Study

***E. Barney**[1], F. Shic[1], A. Naples[2], S. J. Webb[3], M. Murias[4], C. Sugar[5], J. Dziura[6], C. Brandt[6], R. Bernier[3], G. Dawson[7], S. Jeste[5], C. A. Nelson[8] and J. McPartland[2], (1)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (4)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (5)University of California, Los Angeles, Los Angeles, CA, (6)Yale University, New Haven, CT, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (8)Boston Children's Hospital, Boston, MA*

Background: Previous eye-tracking research has shown that children with ASD spend less time looking at faces and eyes than their typically developing (TD) peers (Hanley et al., 2013; Riby & Hancock, 2008, 2009; Sasson et al., 2007). When faces are shown in the context of complex social situations, these diagnosis group differences may be larger (Hanley et al., 2013; Speer et al., 2007).

Objectives: To examine face preference (%Face) of children with and without ASD when looking at static social photographs presented during eye tracking. These results were reviewed in conjunction with the preference for looking on screen at all (%Valid). Exploratory analyses were conducted to assess face preference differences across trials (to examine scene qualities that amplify group differences) and over time within trials (to investigate how long stimuli need to be shown for differences to be detected).

Methods: Eye-tracking data was collected from 51 children (N_{ASD} = 25, N_{TD} = 26) aged 4-11 using a 500 Hz EyeLink 1000 Plus. Forty-seven (N_{ASD} = 23, N_{TD} = 24; $\mathrm{M}_{\mathrm{Age}}$ = 7.3 ± 2.2 years) remained after quality exclusions (trials: <50% onscreen looking or >2.5 degrees of calibration error; participants: <2 of 6 valid trials). Each static social image (from the EU-AIMS LEAP task battery) was presented for 20 seconds.

Results: Linear mixed models controlling for image and full scale IQ were used to examine group differences on %Valid and %Face. For %Valid, we observed a main effect of group (ASD<TD; p<.01, d=1.6). Exploratory time bin analyses (5s bins) revealed a main effect of time (%Valid decreasing over time; p<.001) and a group*time interaction (p<.01): ASD and TD groups had similar %Valid in the first five seconds, but between-group differences increased over time (6-10s: p<.05, 11-15s: p=.001, 16-20s: p<.001). For %Face, a group effect was observed in the expected direction (ASD<TD; p<.001, d=0.91). Exploratory analyses including a group*image interaction showed the ASD group looked less at faces than TD participants for all images except an image of a single person coloring (all other images involved multiple people). Further analyses examined how long images needed to be shown to observe between group differences. A group effect appeared for all presentation times examined, ranging from 0-10s (p<.001, d=0.82) to 0-1s (p<.01, d=.77), indicating pervasive differences in face looking. The strongest effect size was seen for 0-5s (p<.001, d=1.02), matching up to the time when no between-group differences in %Valid were observed.

Conclusions: Eye-tracking results from static social images revealed consistent and large differences in face preference between children with and without ASD. An exploratory content analysis suggested increased social complexity may increase group differences. An exploratory time analysis revealed face-looking differences as early as the first second of presentation, indicating that shorter trials may be sufficient for between group differentiation. Finally, the correspondence of the largest face-looking effect size in the first five seconds to a period where no between-group differences existed in overall looking potentially highlights the separability of social attention differences specific to ASD from general attention differences.

192 **169.192** Autism Spectrum, Risk Behavior, and Law Involvement: Contrbutions of Theory of Mind and Executive Function

ABSTRACT WITHDRAWN

Background:
Are young adults with autism spectrum disorder (ASD) overrepresented in the criminal justice system? Research is inconclusive. However, examining the relation of risk behaviors and law involvement to the core features of ASD may be a more useful than examining prevalence per se (Woodbury-Smith, 2014).

Objectives:

We sought to explore pathways by which individuals with ASD may be at risk for criminal justice involvement: a direct path in which ASD increases the likelihood of risky and unlawful behaviors, or an indirect path in which persons with ASD may react poorly to the social demands of interactions with law enforcement around lesser offenses, e.g., traffic violations, to escalate the situation. In this exploratory study, we tested cognitive and social-cognitive functions associated with ASD, but that also vary in the general population, to explore their relation to risk behavior among college-aged males, both neurotypical and with ASD.

Methods:

Participants were 40 college aged males, 12 with ASD. Measures included both self-report and direct observations. We combined correlated scores from the AQ and SRS-2 (Baron-Cohen, Hoekstra, Knickmeyer, & Wheelwight, 2006; Constantino, 2012) to create an autism index. We assessed theory of mind and executive function using report, Basic Empathy Scale (Joliffe & Farrington, 2006) and BRIEF-A (Roth, Isquith, & Gioia, 2013), and behavior, Flanker (Eriksen & Eriksen, 1974), Go/NoGo (Filmore, 2006), Wisconsin Card Sort (Grant & Berg, 1948), Reading the Mind in the Eyes (Baron-Cohen, et al. 2001), and Mentalistic Interpretation (Channon & Crawford, 2010). Risk behaviors, assessed by self-report, included general risk proneness (de Haan et al., 2011), antisocial behavior (Cho, Martin, Conger, & Widaman, 2010), and risk behavior and involvement with the law (arrest, probation, incarceration; MSALT, http://www.rcgd.isr.umich.edu/msalt/researchers.htm).

Results:

Concurrent predictions were tested across the entire sample, yielding several key results. Impulsivity as indicated by Flanker reaction time (r = -.46, p < .01) and a high autism index (partial r = .35, p < .05) predicted criminal justice involvement, but elevated autism index scores were not associated with any risk behaviors per se. In fact, a low autism index and poor executive function (self-report; Go-No Go inhibition errors) predicted proneness to risk (adjusted r-square = .39, p < .001). Race (white) and impulsivity (Flanker RT) predicted antisocial behavior (adjusted r-square = .15, p < .05). Impulsivity (Flanker and Go/No-Go RT) and race (white) predicted unsafe/unlawful risk behavior (adjusted r-square = .16, p = .05).

Conclusions:

We found that the ASD index predicted law involvement, but not risk behaviors. Executive function, but not theory of mind, contributed to risk. We believe these results are consistent with an indirect pathways hypothesis. Because of failure to regulate social behavior in ways that might keep minor transgressions or altercations from becoming more serious, aspects of ASD such as compromised executive function may place these individuals at risk for a cascade of negative events that result in justice involvement. Results are limited by sample size and age, and will be discussed in the context of preliminary follow-up data from college-aged males diagnosed with ADHD.

193 **169.193** Autism, Mentalising and the Effect of Social Presence

***E. J. Morgan**, D. J. Carroll and M. Freeth, Psychology Department, University of Sheffield, Sheffield, United Kingdom*

Background:
Recent research has shown that neurotypical participants perform significantly better on explicit mentalising tasks when a real person is present, but that participants with autism do not show the same social facilitation effect (Chevallier et al., 2014). In an earlier study we studied explicit and implicit mentalising in neurotypical adults. Our findings showed that implicit mentalising was highly sensitive to a social presence, with significantly improved accuracy when a task was completed in the presence of real people. Participants with autism have been shown to display pervasive deficits in implicit mentalising ability (Senju et al., 2009; Schuwerk et al., 2016), however, no previous studies have tested the effect of a social presence on implicit mentalising in adults with autism.

Objectives:

The aim of the current study was to investigate the effect of a social presence on explicit and implicit mentalising ability in adults with an autism spectrum condition.

Methods:

We used a non-verbal second-order theory of mind task to study explicit and implicit mentalising in adults with autism (n=18, m= 40.83, SD= 15.89), and age, gender and non-verbal IQ matched neurotypical controls (n=18, m= 41.66, SD= 15.49). The task was completed in two conditions: A 'live' condition where the task was acted out in real time in front of the participant, and a 'recorded' condition where the participant was shown recorded videos of the same task.

Results:

A Mixed-Model ANOVA on data from the implicit task revealed a main effect of condition ($F(1,35) = 6.967$, $p=.012$, partial $\eta^2= .170$), as participants were significantly more accurate at the implicit task when it was completed in the live compared to the recorded condition. There was no interaction between condition and group, indicating that neurotypical participants and autistic participants showed the same improvement and performed comparably on each task. By comparison, a Mixed-Model ANOVA on data from the explicit task found that participants in both groups were as accurate in both the live and recorded conditions as there was no main effect of condition, no main effect of group and no interaction between condition and group.

Conclusions:

Our findings showed that implicit mentalising was highly sensitive to a social presence, with significantly improved accuracy when completed in the live condition. This suggests that individuals may implicitly mentalise within real life environments when faced with powerful social cues, but that this is less apparent when in environments without the potential for a social interaction. In contrast to previous research, our results showed no difference in mentalising ability between the neurotypical and autistic participants, suggesting that implicit mentalising deficits are not as pervasive as previously assumed and that adults with autism also demonstrate a social facilitation effect.

194 **169.194** Caregiver Viewing Patterns during Infant-Caregiver Dyadic Interactions

A. Kreuzman[1,2,3]*, S. Glazer*[1,4]*, S. Shultz*[5]*, A. Klin*[5] *and W. Jones*[5]*, (1)Marcus Autism Center, Atlanta, GA, (2)Children's Healthcare of Atlanta, Atlanta, GA, (3)Emory University Department of Pediatrics, Atlanta, GA, (4)MD Anderson Cancer Center, University of Texas, Houston, TX, (5)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: The first six months of life constitute a uniquely important period of growth and development for human infants, during which normative social development in typically developing (TD) infants is scaffolded and facilitated by highly contingent and mutually-reinforcing interaction with caregivers. In order to create and sustain high degrees of contingency, caregivers and infants must be closely attuned to one another's behavior on a moment-by-moment timescale. Caregivers, for example, must allocate their visual resources to maximize perception of developmentally important infant cues, such as smiling or the initiation of eye contact, in order to optimally respond to these signals and thereby elicit further signaling. In doing so, caregivers promote future opportunities for learning via continued social interaction. Infants later diagnosed with autism spectrum disorder (ASD), however, show a reduction in shared smiles and mutual eye gaze, behaviors that would otherwise serve as important signals to caregivers (Stallworthy et al., 2016; Ozonoff et al., 2009). These differences in infant signaling may then alter or disrupt social contingency in the infant-caregiver dyad, in turn influencing caregiver behavior. This study seeks to investigate whether subtle differences in the behavior of infants later diagnosed with ASD are reflected in changes in caregiver viewing patterns.

Objectives: To examine and quantify caregivers' visual scanning of infant faces during dyadic interactions with TD infants and infants with ASD.

Methods: Eye-tracking data were collected from caregivers and their 2- to 6-month-old infants during three 30-second interactions via closed-circuit live video feed. Diagnostic evaluations at 24 and 36 months were used to separate participants into two groups: caregivers whose infants received an ASD diagnosis at outcome (n=6), and those whose infants were TD and had no family history of ASD (n=6) (Table 1). Caregiver eye-tracking fixation locations were coded relative to four mutually exclusive regions of interest (ROIs): eyes, mouth, nose/body, and background.

Results: To compare caregiver fixation patterns across groups, we performed a repeated-measures ANOVA with diagnosis as a between-subjects factor and ROI as a within-subjects factor. We observed a significant main effect of ROI ($p<0.001$), with caregivers fixating more on their infant's eyes than mouths, and more on infant's mouths than bodies (all p's<.05). The diagnosis by ROI interaction trended towards significance ($p=0.096$). Exploratory independent-samples t-tests revealed a trend towards increased mouth-looking in caregivers of TD infants compared to caregivers of infants with ASD (p=0.067) (Figure 1).

Conclusions: Preliminary analyses provide the first exploration of caregiver viewing patterns during infant-caregiver dyadic interactions, revealing that caregivers spend more time fixating on their infant's eyes, followed by mouth, and body. Immediate next steps include increasing the sample size to further investigate the observed trend towards increased mouth-looking in caregivers of TD infants. Additionally, longitudinal analyses of infant affect, facial cues, and vocalizations will be completed to identify specific infant signals that influence moment-by-moment shifting of caregiver visual attention. These analyses have important implications for understanding how early disruptions to interactive contingency within the infant-caregiver dyad may impact subsequent development in infants with ASD.

195 **169.195** Changes in Social Referencing in Response to Pivotal Response Treatment in ASD: A Preliminary Eye Tracking Study

M. Kim[1]*, C. Foster*[2]*, Q. Wang*[3]*, C. A. Wall*[4]*, B. Li*[5]*, E. Barney*[6]*, Y. A. Ahn*[7]*, L. L. Booth*[8]*, M. Lyons*[3]*, C. A. Paisley*[9]*, C. C. Kautz*[8]*, F. Shic*[6] *and P. E. Ventola*[10]*, (1)Seattle Children's Research Institute, Seattle, WA, (2)Binghamton University, Binghamton, NY, (3)Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Department of Psychology, University of South Carolina, Columbia, SC, (5)Computer Science and Engineering, University of Washington, Seattle, WA, (6)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (7)University of Miami, Miami, FL, (8)Yale Child Study Center, Yale School of Medicine, New Haven, CT, (9)The University of Alabama, Tuscaloosa, AL, (10)Yale Child Study Center, Yale University School of Medicine, New Haven, CT*

Background: Social referencing behavior is exhibited less in children with ASD than those with typical development (TD; Dawson et al., 2004). Pivotal Response Training (PRT) addresses this by targeting social motivation and social use of language. In an ongoing study, we used eye tracking paradigms designed to capture intervention outcomes. Here we report preliminary results from a Social Referencing paradigm that examines the monitoring of nonverbal information.

Objectives: To explore PRT treatment effects by comparing eye tracking data at Baseline and Endpoint (16 weeks later) between PRT and Waitlist

Control (WLC) groups and examine the utility of eye tracking in capturing phenotypic changes moderated by PRT.

Methods: 4-to-8 year olds with ASD randomized to either PRT (*n*=16) or Waitlist Control (WLC, *n*=13) watched videos of an actor involved in an escalation of stressful activities (e.g. stacking a tower) that comes to a resolution (e.g. tower falls down). A linear mixed model, controlling for age, was used to examine eye tracking variables of valid onscreen looking time (ValidLooking%) and looking percentages to actor/scene regions (Face%, Activity%, Eyes%, and Mouth%) throughout the different stages of the activity (Escalation and Resolution). Participants re-watched the videos at 8-week Midpoint (PRT *n*=14, WLCl *n*=9) and 16-week Endpoint (PRT *n*=12, WLC *n*=9). Relationships between changes in clinical variables and eye tracking variables were examined using Pearson's correlations.

Results: Between-group differences were only detected for Mouth% at Endpoint during the Resolution (*p*=.048), with lower mouth looking in the PRT group (*M*=10.1, *SD*=1.10) than WLC (*M*=6.60, *SD*=1.00). Within the PRT group, there was a negative correlation between time point changes in Face% during the Resolution and time point changes in SRS T-scores in Autistic Mannerism (*r*(10)=-.725, *p*=.018), suggesting face looking increases were associated with reduced severity in autism mannerisms. However time point changes in Face% during Resolution was also negatively correlated with time point changes in behavioral coding of reciprocal turns in conversations (*r*(12)=-.657, *p*=.020), suggesting that increased face monitoring during Resolution was not a prerequisite for improving social reciprocity.

Conclusions: Preliminary results suggest that PRT is associated with Endpoint outcomes of decreased attention to the mouth compared to WLC. Previous studies have suggested that mouth scanning can supplement communicative cues, especially in uncertain situations (Klin et al., 2002). However when the situation is easier to understand, attention to the mouth may be less necessary (Norbury et al., 2009). By treatment Endpoint, PRT participants may have developed efficient processing skills and begun to rely less on mouth scanning. Caution is warranted, however, as correlational results suggest heterogeneity within the PRT group in treatment and eye tracking results. Furthermore, improvements in PRT targets may not be adequately captured by time point increases in looking at actor/scene regions of the Social Referencing paradigm. Future analyses will examine the complicated and nuanced relationships between eye tracking data and behavioral coding of PRT intervention goals.

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169.196 Comparing Intensity Ratings of Emotions in Music and Faces By Adolescents with Autism Spectrum Disorder

***H. Dahary**[1], S. Sivathasan[2] and E. M. Quintin[2], (1)McGill University, Montreal, QC, Canada, (2)Educational & Counselling Psychology, McGill University, Montreal, QC, Canada*

Background: Individuals with autism spectrum disorder (ASD) often demonstrate difficulty in processing basic emotions in faces particularly with specific negative emotions, including sadness (Boraston et al., 2007) and fear (Humphreys et al., 2007). However, little research has compared emotion processing of faces to that of other modalities. Music is a powerful emotional vehicle (Juslin & Sloboda, 2001), an area in which individuals with ASD often show great interest and skills (Heaton, 2009), and is thus an alternative (and potentially preferred) domain for measuring emotion processing. Further, studies on emotion recognition with low-functioning adolescents are virtually non-existent which limits the applicability of findings to individuals with varying cognitive abilities.

Objectives: The purpose of this research is two-fold: 1) To directly compare intensity ratings of music-evoked and facial expressions of emotions, and 2) to extend the applicability of findings to children with varying levels of cognitive functioning.

Methods: Twenty-three participants aged 12 to 16 with ASD and low to high WISC-V Verbal IQ (50-111) completed three emotion recognition (ER) tasks: A Music ER task and two Facial ER tasks (1.Face Only ER task, 2.Combined ER task). Across the three tasks, the participants identified and rated the intensity of emotions (i.e., happy, sad, or fearful) in music excerpts (Music ER task) and in faces (Facial ER tasks). The Face Only ER task presented each face without the accompaniment of music, while the Combined ER task presented each face simultaneous to music that evoked the same emotion presented on the face. Each ER task included 18 trials (6 trials per emotion) of 4 seconds in length and took about 2-3 minutes to complete.

Results: Participants with lower cognitive ability (VCI: ≤80; n=12) rated emotions more intensely than those with higher cognitive ability (VCI: >80; n=11) across Music and Facial ER tasks (*p* < .01). However, cognitive ability did not have a significant effect on intensity ratings of specific emotions and intensity ratings of emotions within any of the three ER tasks (p < .05). Across participants, a main effect of emotion revealed that happy and fearful were rated more intensely than sad (*p* < .01). A marginal main effect of task showed that participants rated emotions more intensely in the Combined ER tasks than in the Music ER task (*p* = .07). A two-way interaction between task and emotion was also found such that in the Music ER task, fearful and sad were rated more intensely than happy, but in the Combined ER task, the reverse was found (*p* < .05).

Conclusions: Adolescents with ASD with lower cognitive ability appear to be more sensitive to emotions presented in faces and music than adolescents with ASD with higher cognitive ability. Higher intensity ratings for arousing emotional stimuli (happy and fearful) may support previous accounts of atypical development or connectivity of limbic brain areas including the amygdala (Baron-Cohen, 2000). Findings provide important implications for using targeted music interventions that capitalize on disorder-specific strengths (musical ability) to teach emotion processing skills to individuals with ASD.

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169.197 Comparing the Communication Profiles of Children with Autism Spectrum Disorder & with Multisensory Impairments

***M. Nunez**, A. San Jose Caceres and E. Loth, Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Communication is severely affected both in young children with Multisensory Impairments/deafblindness (MSI) and children with ASD (Autism Spectrum Disorders). This can lead to apparent similarities in the surface behaviour that, however, may have very different causes, relations with other developmental processes and implications for developmental outcomes

Objectives: This exploratory study aimed to compare the early communication and other behavioural profiles of young children with MSI and children with ASD in order to identify specific markers/associations of behaviours that can help to distinguish the communication characteristics of each group and inform practice

Methods: Fifteen young children (aged 2 -6 years) and their families took part in our study. All children had either an ASD diagnosis or a MSI diagnosis only as a prerequisite for their inclusion in this study. Children were assessed with a set of observational tools, including parental reports (e.g., Rowland's Communication and Matrix, a tool for special needs populations) and direct observations of child/parent interactions in a semi-structured free-play situation

Results:

Results showed both quantitative and qualitative differences in the *communication behaviour* of the two groups. Children with ASD were at a higher level of communication than MSI children in terms of the percentages of skills credited in the Communication Matrix (e.g. at level VI, 94% in the ASD group as compared to 21% in the MSI group). Differences in favour of the ASD group, however, were mainly for skills categorised with the Obtain function (ASD, 78% vs MSI 31%) A microanalysis of the parent/child interactions showed *qualitative differences* between the two groups in three aspects; the typicality of the developmental path to Joint Attention (JA), the structure of the interactions and the quality of the engagement. JA episodes are not frequent in any group but are more "typical" in the MSI group. Initiation of attention bids by the children are rare in both groups but the responses to attention bids by the mothers and their engagement in the communication event was easier and clearer in the MSI group. Repetition of actions is common in both groups but the repetition of shared actions is more frequent in the MSI group. The strategies used by the mothers to get the child's attention and her/his engagement in the interactions are adapted to each child but also have some common differences between the two groups.The two groups also differed in their repetitive behaviours scores (much higher in the ASD group). They did not differ, however, in their sensory profiles where both rated in the "atypical" range

Conclusions: These findings indicate that, despite the enormous heterogeneity within each group and their different levels of development, there are core differences between the two groups in their communication profiles. These differences can be identified in the *typicality, structure* and *function* of the parent/child communication. Other behaviours that can affect communication, such as the prevalence of repetitive behaviours, proved to be a good way to discriminate between the two groups too

198 **169.198** Construct Validity of Eye-Tracking Indices of Active Engagement in School-Aged Children with ASD

L. A. Edwards[1]*, L. Morgan*[1]*, M. Siller*[1]*, A. Wrencher*[2]*, J. M. Moriuchi*[3]*, A. Klin*[1] *and W. Jones*[1]*, (1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Andrew Young School of Policy Studies, Georgia State University, Atlanta, GA, (3)Department of Psychiatry, Rush University Medical Center, Chicago, IL*

Background: Autism Spectrum Disorder (ASD) is associated with a heterogeneous phenotype marked by social interaction difficulties as well as restricted and repetitive behaviors. Evidence-based treatments targeting core social difficulties in ASD are limited to behavioral or educational methods, and show wide variability in effectiveness and post-intervention outcomes. A major obstacle in the development of more effective, individualized, developmentally-appropriate ASD interventions is the absence of validated clinical outcome measures that objectively quantify treatment effects. From educational theory, the construct of 'active engagement' describes how children attend to and participate in learning opportunities. Active engagement is the means by which the content of educational interactions is accessed, and is one of the best predictors of successful learning for children with disabilities (Iovannone et al., 2003). Assays for rapidly and reliably quantifying active engagement are thus crucial for improving educational interventions for ASD. Eye-tracking-based measures of social visual engagement—the way children look at and attend to social information in their surrounding environment—are strong candidates for monitoring active engagement, pinpointing precise opportunities for intervention, and assessing response to treatment in ASD.

Objectives: This study aims to assess the validity of eye-tracking-based, quantitative assays of social visual engagement as measures of active engagement to be used in educational interventions aimed at addressing social difficulties in school-aged children with ASD.

Methods: Eye-tracking data were collected from a large and heterogeneous sample of children with ASD (mean age=10.08 years, n=159), as well as from an age-matched comparison sample of typically developing children (TD, mean age=9.50 years, n=43), during free viewing of naturalistic videos of social interaction. Data were quantified in terms of overall engagement (percent total fixation) and engagement with social information (percent fixation to people's eyes, mouths, or bodies), and assessed for specificity and sensitivity to ASD severity, and test-retest reliability.

Results: Sensitivity and specificity to ASD social impairment severity were determined using regression analyses of ADOS social affect (SA) and restricted and repetitive behavior (RRB) scores (respectively), on eye-tracking indices of active engagement, controlling for age and cognitive level. Results indicate significant associations between ADOS SA and overall engagement (b=-8.82, p=0.003), and ADOS SA and social engagement (b=-12.47, p=0.002), as well as a significant association between ADOS RRB and overall engagement (b=-3.31, p=0.005), but no association between ADOS RRB and social engagement (p=0.152). Preliminary analyses of test-retest reliability for ASD and TD are promising: overall engagement, ICC>0.8, $p<0.001$; social engagement, ICC>0.6, $p<0.001$.

Conclusions: Eye-tracking measures of social visual engagement show promise as reliable, specific, and sensitive quantitative biomarkers of active engagement and social abilities in ASD. Higher overall engagement is associated with higher social affect and lower restricted and repetitive behavior, and higher engagement with social information is associated with higher social affect, but is not related to restricted and repetitive behaviors. Future analyses will explore convergent validity of these measures with clinician-administered assessments of child engagement, as well as comparative validation of eye-tracking measures of moment-by-moment perceived stimulus salience for objective, quantitative monitoring of active engagement, treatment response, and social development.

199 **169.199** Divergent Patterns of Time-Varying Visual Attention to Social Stimuli in Toddlers with Autism Spectrum Disorder and Williams Syndrome

A. L. Ford[1]*, S. K. Markert*[2]*, J. A. Olmstead*[3]*, M. D. Lense*[4]*, A. Klin*[3]*, S. Shultz*[3] *and W. Jones*[3]*, (1)Marcus Autism Center, Atlanta, GA, (2)Department of Pediatrics, Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (4)Vanderbilt University Medical Center, Nashville, TN*

Background:

When looking at the world, a child faces an array of almost unlimited visual information, yet at each moment in time she can look at just one thing. Remarkably, typically developing (TD) toddlers, when watching video scenes of social interaction, exhibit patterns of time-varying visual attention that are tightly synchronized with one another. The majority of TD toddlers look at the same stimuli at the same moments in time: they orient towards caregiver faces, affective cues, and gestures in a tightly time-locked fashion that scaffolds their social learning. In autism spectrum disorder (ASD), however, research suggests that these patterns of time-varying visual attention may be disrupted, potentially driving a developmental cascade towards atypical experiences of and interactions with the social world. In comparison, time-varying visual attention in young children with Williams syndrome (WS), a neurodevelopmental genetic disorder with a behavioral phenotype characterized by hypersociability, is relatively unstudied. Quantifying moment-by-moment patterns of visual scanning in these groups situated at the extremes of the spectrum of sociability has the potential to reveal how and when toddlers attribute meaning to signals in their environments and the resulting impact on developing socio-cognition.

Objectives:

To map patterns of time-varying visual attention in toddler cohorts with distinct diagnoses of social impairment (ASD, WS) in order to study how early deviations from typical developmental patterns of attention may scaffold later manifestations of both hypo and hyper-social behavior.

Methods:

Participants were 24-to-45-month-old children with ASD (n=30) chronological-age and sex-matched to cohorts of children with WS (n = 9), and typical development (n=30). Diagnoses were made by licensed clinicians blind to experimental eye-tracking data, with genetic testing to confirm the WS deletion. Eye-tracking data were collected as children viewed video clips of toddlers engaged in a variety of naturalistic social interactions. Time-varying kernel density estimation quantified dynamic visual scanning.

Results:

Visual attention in TD controls was synchronized (looking at the same location at the same time) 41.9% of the time (with statistically significant synchronization defined by comparison with results expected by chance, $p<0.05$). When TD viewing patterns were synchronized, the visual scanning of ASD and WS children differed significantly ($p<0.05$) from TD controls for 15.03% and 4.52% of viewing time, respectively. Moreover, there was little overlap between the WS and ASD groups in when these moments of divergence occurred (Figure 2), suggesting that WS and ASD children diverge from TD viewing patterns in unique ways. Further study will focus on identifying scene-specific stimuli that are uniquely captivating to viewers with ASD relative to WS and TD viewers.

Conclusions:

Findings reveal disorder-specific patterns of divergence in dynamic visual scanning in toddlers with ASD. Patterns of dynamic visual scanning were more atypical amongst ASD compared to WS viewers, with visual scanning of ASD viewers diverging from that of TD viewers nearly 3 times as often as for viewers with WS. These analyses offer insight into how atypical allocation of attentional resources in toddlerhood may contribute to the emergence of the social phenotype of ASD.

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169.200 Educator Practices and Perspectives on Social and Emotional Skills Teaching in UK Autism Education

*S. Mantinioti[1], **E. Ainger**[1], A. M. Alcorn[1] and E. Pellicano[2], (1)Centre for Research in Autism and Education, University College London, London, United Kingdom, (2)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom*

Background: Difficulties with social skills and with recognising and managing emotions can impact autistic individuals across almost all areas of their lives. It is widely agreed that autism education must go beyond academics, to also develop children's social, emotional and communicative skills (e.g. Helps, Newson-Davis & Callias, 1999). Nevertheless, educators may receive insufficient support to incorporate these skills into the curriculum and help learners apply them *outside* the classroom. Morrier, Hess & Heflin (2011) found that US teachers received some 'teaching strategies' training for autistic students, but that programmes often were not evidence-based, and only a few addressed social and emotional skills. The current picture of social and emotional skills teaching in UK autism education is unclear, making it difficult to identify needs and potential improvements in this area.

Objectives: To understand UK educators' current practices for, and attitudes towards, teaching social and emotional skills to autistic students.

Methods: Fifteen autism education staff (including teachers, teaching assistants, subject specialists, and speech and language therapists) took part in individual semi-structured interviews lasting 40-60 minutes. Five additional staff members took part in a focus group. Participants represented a range of mainstream, special, and independent UK schools. Interviews asked about existing social and emotional skills teaching practices, in the broader context of educator aspirations for their students, how aspirations are communicated to families, and the use of autism-specific programmes and supports in their settings. Interviews and focus groups were transcribed verbatim and analysed thematically.

Results: Five themes and multiple interlinked subthemes were developed from the data (see Figure 1). Across the areas discussed (current practice, aspirations, etc.) educators consistently placed high importance on teaching social and emotional skills. They highlighted that **every child is different** and therefore each child may need different strategies and supports to develop these skills. A widely shared goal was to help children work towards **leading independent lives**, through communication and self-regulation of their emotions. With this in mind, educators stressed that such skills need to be **generalizable** to the community and home, as well as school. Staff were understood to play a huge role in successful teaching; they shared **effective ways of working** including consistency across contexts and shared ideas within school teams. Despite the perceived importance of children developing these skills, participants felt ill-equipped to teach them due to a lack of training and guidance. Participants disagreed on the ideal **balance between social and academic teaching**. Overall, participants were either not including social and emotional skills in their teaching, or had developed personal strategies to teach these skills.

Conclusions: There was a notable gap between UK educators' views and aspirations regarding social and emotional skills, and what they felt equipped to teach their autistic students. Participants reported a lack of training and guidance to address these skills in the classroom *at all*, let alone with evidence-based strategies. This indicates a clear area in which autism education in the UK may be strengthened better reflect "best practices", by improving the support and professional development available to teachers.

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169.201 Observing Interactions between Teaching Staff and Autistic Children: Who Communicates, How Often, and Why? a Cross-Cultural Comparison between UK and Serbia

***E. Ainger**[1], Y. Shek[2], A. M. Alcorn[1] and E. Pellicano[3], (1)Centre for Research in Autism and Education, University College London, London, United Kingdom, (2)Centre for Research in Autism and Education, UCL, London, United Kingdom, (3)Centre for Research in Autism and Education (CRAE), UCL Institute of Education, University College London, London, United Kingdom*

Background: Interactions with school staff are a central opportunity for autistic children to develop and practice social and communicative skills, and to develop trusting, reciprocal relationships. There is remarkably little research examining the nature of adult-child interactions in the classroom, particularly for children who have intellectual disability, are preverbal or have emerging language skills, or may communicate

idiosyncratically. The potential effects of culture on the nature, frequency, and purpose of adult-child communications is also essentially unknown. For many countries including Serbia, there is little existing research on autistic children in the classroom.
Objectives: To describe and compare child-adult interactions during observations of structured and unstructured activities in UK and Serbian special education settings.

Methods: 16 autistic children (aged 5-11 years; 2 female) from three UK special schools were observed during at least two structured and two unstructured classroom activities, equalling 80 minutes of interaction per child over multiple days (~22 hours total). Observations of seven additional children are ongoing in Serbia. Researchers recorded adult-child interactions every two minutes for a 20-minute activity period, recording who initiated, using what modality and for what purpose. Researchers noted if any supports were used during the interaction, the response from the communicative partner, and any reciprocal interactions (Figure 1). Researchers subsequently recorded a qualitative narrative of the entire activity. Some adults observed were classroom teachers, while others were teaching assistants or subject specialists. Standardised measures of autism severity (CARS-2 ST) were completed for each child (Table 1).

Results: Data analysis is ongoing. We observed 1,238 interactions (per child, M=29.4 child-initiated, SD=24.49; M=47.9 adult-initiated, SD=17.70). 40% of these were child-initiated. While adult initiations most frequently had social or instructional purposes, most child initiations were commenting and requesting. Children and adults frequently responded to one another's initiations (children 87%; adults 82%). Surprisingly, additional supports such as PECS were used less than 20% of the time. Adults responded more to children categorised on the CARS-2 ST as having 'mild to no symptoms of autism' (90% of the time) in comparison to 'mild-moderate' (83% of the time) or 'severe' (75% of the time). Child mood also appeared to influence interactions, with fewer adult initiations observed when adults had rated children as having a negative mood during an observed activity, versus a positive or neutral mood. Child mood did not appear to affect adults' responses to the child, and therefore may be due to child bids being more frequent when they are anxious. Additional cross-cultural analyses will be conducted following Serbian data collection.

Conclusions: Child-adult interaction observations revealed that adults initiate interactions more frequently than do autistic children, and that initiation varies with children's mood. The rate of child-initiated interaction in this sample is surprisingly high, more than double that of previous research with comparable participants and settings. This discrepancy may reflect subsequent positive developments in early intervention and autism practice. Yet, very few additional communicative supports were used during interactions within any of the schools, despite literature recommending such supports as best practice in autism education.

202 **169.202** Estimating Social Communication Functioning (ACSF:SC) from ADOS-2 Data: Development of an Algorithm

S. J. Gentles[1], *B. Di Rezze*[1], *P. Rosenbaum*[2], *E. Duku*[1], *L. Zwaigenbaum*[3], *M. J. C. Hidecker*[4] *and S. Georgiades*[1], *(1)McMaster University, Hamilton, ON, Canada, (2)CanChild Centre, McMaster University, Hamilton, ON, Canada, (3)University of Alberta, Edmonton, AB, Canada, (4)Communication Disorders, University of Wyoming, Laramie, WY*

Background: Innovative algorithmic tools have exciting potential for extracting novel information from commonly used measures used in ASD, such as the item-level ADOS-2 data that are abundantly available in existing datasets, vastly increasing the utility of such datasets for research purposes. The Autism Classification System of Functioning: Social Communication (ACSF:SC) allows parents and professionals to categorize the social communication functioning of children aged 3-5 years into one of five meaningfully distinct levels. Grounded on WHO's International Classification of Functioning, Disability, and Health (ICF) framework, the ACSF:SC differs from traditional measures, including severity metrics, by assessing abilities rather than deficits. At IMFAR 2016, we presented pilot results regarding the feasibility of developing and validating an algorithm to generate estimates of social communication functioning (descriptive ACSF:SC levels) from existing ADOS data, including (a) results of a modified Delphi process to identify ADOS items most relevant to the social communication construct used in the ACSF:SC, and (b) a preliminary decision tree algorithm predicting ACSF:SC from a limited data sample comprising paired SRS-2 social communication subscale and ACSF:SC assessments.
Objectives: We now present the initial decision tree algorithm developed from analysis of prospectively collected paired ADOS-2 and ACSF:SC data from multiple diagnostic clinics in Ontario, Canada.

Methods: Classification and Regression Tree (CART) analysis is being used to develop and validate the ADOS-to-ACSF:SC algorithm. CART requires paired data (i.e., contemporaneous ADOS-2 assessment and ACSF:SC level in the same child). A required sample size of n=300 was estimated from pilot work. Data will be split on response items within A and B groupings of the ADOS-2 when developing the algorithm. CART interim and final analyses are being run using IBM SPSS Statistics per the pilot work.

Results: In work to date, we have gained the necessary ethics approvals and site agreements, and begun recruitment and data collection from partners at 6 diagnostic clinics from varying regions across Ontario. Generating ACSF:SC tool adoption and enthusiasm was important for this recruitment. At the time of writing (approximately 3 months into data collection), paired data from 29 cases have been collected. This number of cases was insufficient to conduct interim analysis to reliably identify ADOS-2 items that are predictive of ACSF:SC level. Data collection will continue, and a CART analysis and decision tree based on the latest data will be presented in the poster.

Conclusions: An ADOS-to-ACSF:SC algorithm would increase the utility of available ADOS-2 data by providing a means to conduct secondary analysis to characterize the social communication functioning of children within historic datasets. For example, such estimates derived from previously collected data could facilitate examination of longitudinal trajectories of social communication functioning in ASD; work is currently ongoing to extend the age range of the ACSF:SC beyond age 3-5 years. This methodology has value as a template for developing additional algorithmic means for deriving ICF-based ratings of functioning in ASD (not limited to social communication) and creating longitudinal perspectives from previously collected, routinely available data generated by commonly used instruments—extending opportunities for secondary data analysis.

203 **169.203** Exploring Theory-of-Mind in Children, Adolescents and Adults with Autism Spectrum Conditions in a Large European Cohort

H. L. Hayward[1], *K. L. Ashwood*[2], *F. Happé*[3], *R. Holt*[4], *S. Baron-Cohen*[5], *E. Loth*[6], *M. C. Lai*[7], *D. V. Crawley*[6], *D. G. Murphy*[8], *A. San Jose Caceres*[6] *and J. Ahmad*[6], *(1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, King's College London, London, United Kingdom, (2)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Social, Genetic and Developmental Psychiatry Centre,* *Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)University of Cambridge, Cambridge, United Kingdom, (5)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (6)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Centre for Addiction & Mental Health, University of Toronto, Toronto, ON, Canada, (8)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:
'Theory of Mind' (ToM) hypothesis is a prominent account of social-communicative impairments in ASC; the ability to ascribe mental states to others/self to predict behaviours (Baron-Cohen, et al., 2000). Studies report many adolescents/adults with ASC pass 'first-order' tasks, yet struggle in social situations (Klin, 2000). This has led to the distinction between 'first order' *ToM* abilities (e.g. 'false belief' measured in a continuous manner by the "Sandbox" task (Begeer et al., 2012)), and perhaps more pervasive impairments in *spontaneous* usage (Klin, 2000; Volkmar et al., 2004). One paradigm that taps spontaneous attribution of mental status is the 'animated shapes' task that elicits a (verbal)ToM response more akin to the "social demands" inherent in real-life.

Objectives:

To investigate *false belief* and *spontaneous* ToM usage in a mixed sex cohort of males and females with ASD across different ages and IQ. Associations between ToM and social-communicative abilities will also be examined

Methods:

Participants with ASCs (N=363) and age-matched typically developing (TD) participants (N=262) recruited as part of EU-AIMS Longitudinal European Autism Project (LEAP). A battery of cognitive tasks included the Frith-Happe Triangles animations 'Animated Shapes' task (Abell et al 2000; Castelli et al., 2002) and the continuous false belief 'Sandbox' task to assess theory of mind. The 'Triangles' task were audio-recorded/transcribed /analysed for "accuracy" (I.e. correct inference of underlying scenarios) and "psychological state descriptions" (i.e. use of mental state terms) using a scoring system developed by the authors, based on Castelli (2000). 100% of the narratives were scored by two raters at each LEAP site, inter-rater reliability was above 91% across.

IQ assessed using the WASI, autism symptomatology using the (parent-report) Social Responsiveness Scale (SRS-2), adaptive functioning using the Vineland (VABS-III).

2 (group) x 2(sex) x 3 (age group: child, adolescent, adult) between-subject ANOVAs were used.

Results:

Both tasks revealed moderate correlations in both groups (ASC: $r = .25$, $p = .01$;TD: $r = .14$, $p = .05$).

The "Sandbox" task found a significant effect of group ($F(1,516)=8.403$, $p<.05$, $d= 0.24$) with the ASC group performing significantly worse (i.e. greater egocentric bias) than TDs.

No group differences found on the 'Triangles' task. Significant effect of sex($F(1,609)=6.938$, $p<.05$, $d=0.28$)(females<males) and age($F(3,609)=33.349$, $p<.001$)(children<adolescents<adults) found, effects do not hold with diagnosis.

The 'triangles' task was moderately correlated with ASD symptomatology in both groups (TD; $r =-.31$, $p < .01$, ASC; $r =-.21$, $p < .01$). 'Sandbox' task correlated with ASC symptomatology in the ASC group only($r =-.16$, $p < .01$).

In the ASC group, the 'triangles' task was correlated with adaptive behaviour ($r =-.14$, $p = .05$) in males, and adolescents (social domain, $r =-.23$, $p = .05$). TD group; the 'triangles' task correlated with Communication($r =-.20$, $p = .05$).

The continuous FB task correlated with adaptive behaviour in the ASC group, (daily living($r =.22$, $p = .01$.;communication($r=.15$, $p=.05$);social($r=.30$, $p=.01$)) in males. In the TD males, it correlated with all domains of adaptive behaviour.

Conclusions: We report group differences in *prompted* ToM usage, though find no group deficits in *spontaneous* ToM usage in individuals with ASC.

204 **169.204** Exploring the Underlying Mechanisms of Spontaneous and Voluntary Facial Expressions

D. A. Trevisan[1], *G. Iarocci*[2] *and E. Birmingham*[1], *(1)Faculty of Education, Simon Fraser University, Burnaby, BC, Canada, (2)Simon Fraser University, Burnaby, BC, Canada*

Background:
Facial expressions can be the physiological outcome of an internal emotional state (i.e., spontaneous productions), or consciously controlled displays used for social communication purposes (i.e., voluntary displays; Gordon et al., 2014). Previous research has shown that individuals with ASD are less spontaneously expressive (McIntosh et al., 2006) contributing to 'flat affect', and are more likely to produce confusing or inaccurate facial expressions (Brewer et al., 2016) impairing social interaction quality.

Objectives:

The goal of this study is to determine whether *reduced* spontaneous expression and *inaccurate* voluntary expression have distinct underlying mechanisms. The prediction is that reduced spontaneous expression will be better explained by alexithymia than ASD traits because interoceptive difficulties (poor awareness of one's internal affective cues) will impair proprioceptive processes (i.e., automatic facial muscle movements). In contrast, inaccurate voluntary expression will be better explained by ASD traits than alexithymia because voluntary nonverbal expression represents the core social communication difficulties characteristic of ASD.

Methods:

This study examined ASD traits and alexithymia using the Autism Spectrum Quotient (AQ) and the Toronto Alexithymia Scalef (TAS-20) in a sample of neurotypical undergraduates to predict variance in spontaneous and voluntary expressions. Spontaneous expressions were assessed in response to participants telling emotional stories about their lives, or from watching emotional video clips. Voluntary expressions were assessed by asking participants to pose various emotional facial expressions. Facial expressions were analyzed using iMotions software.

Results:

Spontaneous expression was calculated as the total amount of emotional expression detected while telling a negative story, or while watching the movie clips. A hierarchical multiple regression with quantity of negative expression entered as the dependent variable was conducted with AQ entered into the first step, and TAS-20 entered into the second step. The model approached significance in step 1, F Change$(2,39) = 3.84$, $p = .057$, accounting for 9.0% of the variance (R^2 Change = .090). Upon entering TAS-20 into the regression in step 2, the model was significant, *F* Change(2,39) = 14.11, *p* < .001, adding 24.7% explained variance (R^2 Change = .247).

Voluntary expression accuracy was calculated dichotomously based on whether the target emotion was judged by iMotions as being the dominant emotion. A hierarchical multiple regression with expression accuracy entered as the dependent variable was conducted with TAS-20 entered into the regression in step 1 and AQ entered in step 2. The model approached significance with TAS-20 entered into the model in step 1, *F* Change(2,37) = 2.164, *p* = .150, and accounted for 5.7% of the variance (R^2 Change = .057). Upon entering AQ into the regression in step 2, the model became significant, *F* Change(2,37) = 6.38, *p* = .016, adding 14.5% explained variance (R^2 Change = .145).

Conclusions:

As predicted, alexithymia is more strongly related to spontaneous expression of emotion than ASD traits, whereas ASD traits are more strongly related to voluntary expression. Research is needed to replicate this study in individuals with ASD to determine whether “flat affect” is a symptom of alexithymia, and “confusing expression” is a symptom of ASD.

205 **169.205** Gaze Patterns during Parent-Child Versus Clinician-Child Interactions

E. Ajodan[1], *B. Silver*[2], *M. R. Silverman*[1], *A. Southerland*[3], *K. Chanda*[3], *E. A. Stubbs*[3], *C. Lord*[4], *J. Rehg*[3], *A. Rozga*[3] *and R. M. Jones*[2], *(1)Sackler Institute for Developmental Psychobiology, New York, NY, (2)Weill Cornell Medicine, New York, NY, (3)Georgia Institute of Technology, Atlanta, GA, (4)University of California Los Angeles, Los Angeles, CA*

Background: Atypical eye contact during social interactions is a hallmark of autism spectrum disorder (ASD). Prior literature suggests that social communication behavior varies in children with ASD depending on whether they are interacting with a familiar or unfamiliar person. It is unknown if young children with ASD will vary their gaze pattern depending on whether they are interacting with a clinician or their caregiver.
Objectives: We examined the frequency and duration of direct gaze in young children with ASD when engaging with their caregiver versus a clinician during a semi-structured play interaction.

Methods: 18 more verbally able children diagnosed with ASD (mean 40 months;25-59 months, mean VIQ= 80; mean NVIQ= 87) completed a modified version of the Brief Observation of Social Communication Change (BOSCC), while seated at a table. Children first completed the BOSCC with a clinician, and then completed the same procedures with their caregiver. The adult sat across from the child and wore a pair of Pivothead Kudo glasses that had an outward facing camera embedded between the eyes, so that the videocamera readily captured the child’s face and shifts in eye gaze to the adult. Video data was manually coded at the frame level using Mangold Interact for the child’s direct gaze to the adult. Repeated Measures ANOVAs determined differences in the duration and frequency of direct gaze across the two conditions (unfamiliar clinician versus caregiver). Age, verbal IQ and autism symptom severity (ADOS CSS) were included as covariates to determine whether child characteristics influenced gaze patterns.

Results: The frequency and duration of gaze were not significantly different during play interactions with a caregiver versus an unfamiliar clinician (p’s >0.2). Of note, there were no differences between caregivers and clinicians in how well they captured the child’s gaze with the Pivothead glasses, suggesting the lack of condition effects were not explained by sampling differences. There were no significant interaction effects with age, VIQ or ADOS severity scores (p’s > 0.1). A pilot sample of two children completed the procedures twice across three months, before and after their caregivers completed a 12-week behavior training program at the clinic and there were also no significant differences in gaze frequency or duration across condition (p=0.5) or time point (p=0.6) and no interaction (p=0.3).

Conclusions: Surprisingly, there were no differences in gaze patterns in young children with ASD when interacting with their caregiver compared to an unfamiliar clinician. This data represents a subset of participants as data collection is ongoing, thus a larger sample size may illuminate more subtle differences in gaze behavior across the two conditions. Determining whether familiarity can facilitate gaze patterns in young children with ASD may ultimately be a critical first step for designing treatment strategies that address social communication difficulties.

206 **169.206** Good Social Skills Despite Poor Theory of Mind: Exploring Compensation in Autism Spectrum Disorder

L. Livingston[1], *E. Colvert*[1], *P. Bolton*[2] *and F. Happé*[1], *(1)Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: It is proposed that some individuals with Autism Spectrum Disorder (ASD) can ‘compensate’ for their underlying difficulties (e.g., in theory of mind; ToM), thus demonstrating relatively few behavioural symptoms, despite continued core cognitive deficits. More broadly, the phenomenon of compensation may have the potential to explain heterogeneity in outcome, the female autism phenotype, and late diagnosis. The mechanisms underpinning compensation, however, are largely unexplored, as is its potential impact on mental health.
Objectives: This study aimed to estimate compensation patterns in adolescents with ASD, by contrasting overt social behaviour with ToM task performance, in order to compare the characteristics of ‘Low’ and ‘High’ Compensators.

Methods: 136 autistic adolescents, from the ongoing Social Relationships Study, completed a range of cognitive tasks, the Autistic Diagnostic Observation Schedule (ADOS), and a self-report anxiety questionnaire. Participants were assigned compensation group status; High Compensators demonstrated good ADOS scores despite poor ToM performance, while Low Compensators demonstrated similarly poor ToM, accompanied by poor ADOS scores.

Results: High Compensators demonstrated better IQ and executive function (EF), but greater self-reported anxiety, compared to Low Compensators. Such differences were not found when comparing individuals who had good ToM performance with good versus poor ADOS scores. Other core autistic characteristics (weak central coherence, non-social symptoms) did not differentiate the High and Low Compensators.

Conclusions: IQ, EF and anxiety appear to be implicated in the processes by which certain autistic individuals can compensate for their underlying ToM difficulties. This tendency to compensate does not appear to reflect the severity of ‘hit’ for ASD *per se,* suggesting that well compensated individuals are not experiencing a milder form of ASD. The construct of compensation in ASD has a number of implications for research and clinical practice. The findings have informed a novel theoretical framework for understanding compensation in ASD and other neurodevelopmental disorders.

207 **169.207** How Children with Autism Spectrum Disorder Recognize Facial Expressions Displayed By a Rear-Projection Humanoid Robot

*F. Askari[1], H. Feng[2], **A. Gutierrez**[3], T. Sweeny[4] and M. Mahoor[2], (1)Electrical and Computer Engineering, University of Denver, Denevr, CO, (2)University of Denver, Denver, CO, (3)University of Miami, Miami, FL, (4)Psychology, University of Denver, denver, CO*

Background:

Children with Autism Spectrum Disorder (ASD) experience reduced ability to perceive crucial nonverbal communication cues such as eye gaze, gestures, and facial expressions. Recent studies suggest that social robots can be used as effective tools to improve communication and social skills in children with ASD. One explanation has been put forward by several studies that children with ASD feel more contented and motivated in systemized and predictable environment, like interacting with robots.

Objectives:

There have been few research studies evaluating how children with ASD perceive facial expression in humanoid robots but no research evaluating facial expression perception on a rear-projected (aka animation-based) facially-expressive humanoid robot, which provide more life-like expressions. This study evaluates how children with high functioning autism (HFA) differ from their typically developing (TD) peers in recognition of facial expressions demonstrated by a life-like rear-projected humanoid robot, which is more adjustable and flexible in terms of displaying facial expressions for further studies.

Methods:

Seven HFA and seven TD children and adolescents aged 7-16 participated in this study. The study uses Ryan, a rear-projection, life-like humanoid robot. Six basic emotional facial expressions (happy, sad, angry, disgust, surprised and fear) with four different intensities (25%, 50%, 75% and 100% in ascending order) were shown on Ryan's face. Participants were asked to choose the expression they perceived among seven options (six basic emotions and none). Responses were recorded by a research assistant. Results were analyzed to obtain the accuracy of facial expression recognition in ASD and TD children on humanoid robot face.

Results: We evaluated the intensity of expression in which participants required to reach the peak accuracy. They were best for happy and angry expressions in which the peak accuracy of 100% was reached with at least 50% of expression intensity. The same peak accuracy was reached for surprised and sad expressions in the intensity of 75% and 100%, respectively. But fear and disgust recognition accuracy never reached above 75%, even in the maximum intensity. The experiment is still in progress for TD children. Results will be compared to a TD sample and implication for intervention and clinical work will be discussed.

Conclusions:

Overall, these results show that children with ASD recognize negative expressions such as fear and disgust with a slightly lower accuracy than other expressions. On the other hand, during the test, children showed engagement and excitement toward the robot. Besides, most of the expressions were sufficiently recognizable for children in higher intensities, which means, Ryan, a rear projected life-like robot could be able to successfully communicate with children in terms of facial expression, though more investigations and improvements should be done. These results serve as a basis to advance the promising field of socially assistive robotics for autism therapy.

208 **169.208** Individual Differences in Distinct Aspects of Executive Function Predict Theory of Mind in School-Aged Children with ASD

***M. R. Altschuler**[1], R. Gilbert[2], A. Vaidyanathan[3], S. Kala[4], M. Warshawsky[5], D. P. Carroll[6] and S. Faja[2], (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Boston Children's Hospital, Boston, MA, (3)The Banyan Academy of Leadership in Mental Health, Mugappair west, Chennai, India, (4)Dartmouth College, Hanover, NH, (5)Tufts University, Medford, MA, (6)Autism Spectrum Center, Boston Children's Hospital, Boston, MA*

Background: Executive function (EF) and theory of mind (ToM) are often difficult for children with ASD. Previous research has consistently documented theory of mind (ToM) delays in preschoolers with ASD, but investigations examining ToM in school-aged children with ASD and average IQ have produced mixed results. Moreover, research is limited on whether distinct aspects of EF predict different types of ToM in ASD, above and beyond the influence of age and IQ.

Objectives: To examine the relation between individual differences in EF and ToM in school-aged children with ASD and average IQ using large batteries of ToM and EF measures.

Methods: Sixty-four children with ASD between the ages of 7-11 years participated. All children had an ASD diagnosis (ADOS-2, ADI-R, DSM-5) and WASI-2 Full Scale IQ of 80 or higher. The ToM battery included tasks measuring: (1) emotion recognition (TOM Test-Level 1), (2) first-order false belief (Location Change and Unexpected-Contexts False Belief Videos [TOM Videos], and TOM Test-Level 2), (3) second-order false belief (TOM Test-Level 3), and (4) spontaneous social attribution abilities (Social Attribution Task [SAT]). For the TOM Test (Muris et al., 1999) and TOM Videos, children viewed pictures and videos with pre-recorded questions. For the SAT (Klin, 2000), children viewed animated geometrical figures enacting a social scene and answered open-ended questions, which were coded into six index scores representing different aspects of spontaneous social attribution: Pertinence, Salience, Cognition, Affect, Person, and Problem-Solving. The EF battery included tasks measuring: (1) interference suppression (Attention Network Task [ANT] and Stroop task), (2) behavioral inhibition of a dominant response (Change task), and (3) working memory (Backward Digit Span).

Results: A bigger reaction time (RT) difference on the ANT task (more mistakes for the incongruent versus congruent flanker condition) related to lower TOM Videos scores, when controlling for age and VIQ ($\beta = -.31$, $p = .01$). A bigger RT difference on the Stroop task (more mistakes for the incongruent versus congruent condition) related to lower SAT Salience scores, when controlling for age and IQ ($\beta = -.39$, $p < .01$). Decreased verbal working memory on the digit span related to lower TOM Test-level 2 performance, when controlling for age and VIQ ($\beta = .26$, $p = .04$).

Conclusions: Above and beyond the influence of age and verbal IQ, individual differences in EF predicted ToM in school-aged children with ASD. First, children with ASD with decreased interference suppression for incongruent flankers had worse first-order false-belief performance. Second, children with ASD with decreased interference suppression of incongruent color-word pairs had a decreased ability to make salient social attributions about animated geometrical figures enacting a social scene. Finally, children with ASD with decreased working memory had worse first-order false belief performance. Overall, our results indicate that for school-aged children with ASD, interference suppression predicts both spontaneous ToM and first-order false belief, while verbal working memory predicts first-order false belief. Results suggest a clinically relevant link between individual differences in specific aspects of EF and social cognition in ASD.

209 **169.209** Individuals with and without ASD Describe “Funny” Videos in Similar Ways

E. F. Ferguson[1], *L. Bateman*[1], *M. Cola*[2], *Z. M. Dravis*[2], *S. Uh*[2], *S. Plate*[2], *N. Minyanou*[2], *A. Pomykacz*[3], *K. Bassanello*[2], *A. Zoltowski*[4], *J. D. Herrington*[5], *K. Bartley*[5], *E. S. Kim*[2], *A. de Marchena*[6], *J. Pandey*[2], *R. T. Schultz*[2] *and J. Parish-Morris*[2], *(1)The Center for Autism Research/CHOP, Philadelphia, PA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (4)Vanderbilt University, Nashville, TN, (5)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of the Sciences, Philadelphia, PA*

Background: Humor is key to positive social interactions, but very little is known about humor in individuals with Autism Spectrum Disorder (ASD). Prior research suggests that individuals with ASD are more likely to select straightforward endings to jokes, which require more abstract thought than stories (Emerich et al., 2003), and are less likely to take mental states into account when describing cartoons (Samson & Hegenloh, 2009). This study is the first to explore verbal descriptions of two funny videos; one that is simple slapstick and one that is more socially complex and includes contrasting emotions. We hypothesized that participants with ASD and typical development (TD) would produce more positively-valenced descriptions of the slapstick video, and that the ASD group would use fewer cognitive words when describing the socially complex video.
Objectives: Compare verbal descriptions of two funny videos in individuals with and without ASD.

Methods: Fifty-eight individuals (ASD=37, 12f; TD=21, 14f) watched and then described two short videos that showed: 1) a baby laughing at a dog chasing bubbles (Fig.1a), and 2) a father giving his baby a lemon wedge to taste for the first time (Fig.1b). Groups did not differ on mean age (15y) or IQ (M=106), but did differ on sex ratio (this limitation will be addressed by May, 2018). Verbal descriptions of each video were orthographically transcribed and processed using the *qdap* package (R) and Linguistic Inquiry and Word Count software (Tausczik & Pennebaker, 2010). Our primary dependent variables were the polarity of each video description (dimensional valence from negative to positive), and proportion of total words that referred to cognitive processes.

Results: The average duration of each video description (~18s) and number of words produced per video (~30) did not differ by group. Linear mixed effects models tested effects of diagnosis (ASD/TD), video (Bubbles/Lemon), and diagnosis*video on polarity and cognitive words. As predicted, ASD and TD participants produced more positively polarized descriptions of the Bubbles video than the Lemon video, $F(1, 112)=51.81$, $p<.001$. The Lemon video elicited words such as “disgusted”, suggesting that participants in both groups were sensitive to the baby’s emotional state. The Lemon video also elicited a higher proportion of words about cognitive processes in both groups, $F(1, 112)=20.42$, $p<.001$. This confirmed our assessment that it is imbued with more social-cognitive complexity than the Bubbles video, but the lack of interaction with diagnostic group was contrary to our expectation that the ASD group would talk comparatively less about cognitive processes.

Conclusions: Our findings contrast with prior literature, suggesting possible next steps in the goal of understanding humor in ASD. To capture response patterns more fully, we will use coded facial expressions (e.g., smiling, grimacing) to predict video descriptions. We are increasing our sample size to explore developmental change, and equalizing sex ratios to examine sex differences. Audible laughter is an area of relative social strength for individuals with ASD (Hudenko & Magenheimer, 2011), and humor research thus has important implications for promoting positive peer outcomes in social skills interventions.

210 **169.210** Lower Lifetime ASD Symptom Severity Predicts Increase in Separation Anxiety with Age in Adolescents with ASD

S. L. Sommer[1], *C. E. Simson*[1], *L. A. Santore*[1] *and M. D. Lerner*[2], *(1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background:

Separation Anxiety (SA) has a distinct presentation in youth with autism spectrum disorder (ASD; White et al., 2014). SA symptoms reliably decline in typically developing (TD) populations throughout childhood (Copeland et al., 2014; Allen et al., 2010). However, previous research in adolescents suggests the opposite pattern in ASD, wherein greater age predicted *greater* self-reported SA symptoms (Sommer et al., 2016). This presentation may reflect difficulty transitioning social support from parents to peers, as seen in TD populations (Lieberman et al., 1999). Additionally, in ASD populations, past research has shown ASD symptoms predict atypical presentations of anxiety (Kerns et al., 2014). However, whether this relationship between symptom severity and anxiety accounts for the typical trajectory of SA in ASD over time remains unknown.

Objectives:

This study examined the relationship between age and SA symptoms as a function of ASD symptom severity in adolescents with ASD. It was hypothesized that greater age would predict increased SA, and that this effect would be moderated by ASD symptom severity, such that individuals with more severe ASD symptoms would report a stronger relationship between age and SA.

Methods:

56 youth (M_{age}= 12.168, SD_{age}= 2.897, 41 male) with ADOS-2 confirmed (Lord et al., 2012) ASD completed a measure of self-reported anxiety (MASC-2; March, 2012). Parents completed a lifetime measure of ASD symptoms (SCQ; Rutter et al., 2003).

Results:

Age predicted *greater* SA ($b = 1.388$, $p = 0.02$). This relationship was moderated by ASD symptoms ($b = -0.28$, $p = 0.0098$), such that it was evident *only* among those with *fewer* symptoms ($b = 2.83$, $p < 0.001$). Probing of the SCQ subscales revealed this effect was driven by the reciprocal social interaction domain ($b= -0.42$, $p = 0.018$). No other SCQ subscale moderated the relation between age and anxiety for any other anxiety subscale (all $p > 0.07$)

Conclusions:

Results suggest, contrary to the robust normative decrease in SA seen in TD populations, ASD adolescents may struggle to separate from their parents with age. This effect was augmented by parent-reported SCQ scores, specifically in the reciprocal social interactions domain, but was only significant for youth with *lower* scores, or perceived *better* social interaction skills. Adolescents with confirmed ASD diagnoses but fewer parent-reported social deficits may reflect the phenomenon of social camouflage (Head et al., 2014), in which – typically beginning in adolescence (Lai et al., 2016) – individuals with ASD learn to mask their symptoms and mimic normative behaviors of peers. It may be that doing this exerts a cost on the individual with ASD – specifically in terms of their ability to shift to normative reliance on peers for social support and separate from their parents. This is consistent with findings that youth with ASD and anxiety often exhibit greater parent-reported communication skills (Kerns et al., 2015). Thus, the moderating effect here may represent a mechanism by which this occurs. These findings further highlight the importance of understanding the heterogeneity of phenotypic expressions of SA in adolescents with ASD.

211 **169.211** Effect of Excitatory rTMS Applied to the Posterior STS in Adults with ASD

A. Saitovitch[1]*, J. C. Lamy*[2]*, E. Rechtman*[3]*, A. Vinçon-Leite*[4]*, T. Popa*[5]*, N. Chabane*[6]*, A. Philippe*[7]*, F. Bonnet-Brilhault*[8]*, G. Martinez*[9]*, R. Gobbo*[10]*, A. Cavalcanti Ferreira*[10]*, H. Lemaitre*[11]*, D. Grevent*[12]*, R. Calmon*[12]*, S. Meunier*[2]*, F. Brunelle*[7]*, N. Boddaert*[13] *and M. Zilbovicius*[12]*, (1)INSERM, Paris, France, (2)Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06, ICM, CENIR, Paris, France, (3)INSERM U1000, Institut Imagine, Paris, France, (4)INSERM U1000, Paris, France, (5)Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06, ICM, CENIR, Inserm U 1127, CNRS UMR 7225, Sorbonne Universités, UPMC Univ Paris 06, ICM, CENIR, Paris, France, (6)CHUV, Lausanne, Switzerland, (7)Necker Hospital, Paris, France, (8)UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, (9)Hôpital Sainte Anne, Paris, France, (10)Inserm U1000, institut Imagine, UNICAMP, Paris, France, (11)Inserm U1000, institut Imagine, Université Paris Sud, Paris, France, (12)Inserm U1000, institut Imagine, Paris, France, (13)Hospital Necker, Paris, France*

Background:

The superior temporal sulcus (STS) is known to be implicated in processing social information. Previous brain imaging studies have suggested that abnormalities within the STS would be related to social impairments in autism. In addition, eye-tracking studies have shown abnormalities in gaze behavior while viewing social stimuli in participants with ASD, mainly characterized by a lack of preference for socially relevant stimuli. In a recent study with healthy volunteers, we have shown that it is possible to change gaze pattern by transitory inhibition of the neural activity of the STS using repetitive transcranial magnetic stimulation (rTMS). Indeed, inhibition of the right STS reduced fixations to the eyes of characters during visualization of social movies, as measured with eye-tracking (Saitovitch et al. 2016).

Objectives:

In this study performed in adults with ASD, we investigated changes induced by rTMS stimulation of the right STS in gaze behavior using a paradigm of visual preference displaying biological and geometric motion simultaneously.

Methods:

Forteen adults with ASD (mean age = 21.7 ± 2.9) participated in the study. ASD diagnosis was based on DSM IV-R and ADI-R criteria. All subjects underwent a structural MRI for a precise localization of the stimulation target for each individual. Subjects underwent both sham stimulation and excitatory rTMS delivered over the right posterior STS (mean Talairach coordinates: 50 -53 15). The rTMS stimulation was delivered following protocol described by Huang et al., 2005. Stimulation was delivered in 2sec trains every 10sec, a total of 190sec (600 pulses), with an intensity of 90% of the active motor threshold. Gaze parameters were measured with a Tobii-120 eye-tracker during passive visualization of a 1min movie preference paradigm displaying biological and geometric motion simultaneously. Eye-tracking measures were performed at three time-points: at baseline, after sham (placebo) and after TMS and we measured percentage of viewing time to biological motion and geometric motion scenes for all participants. Data was processed with Tobii-Studio® software and analyzed at the group level and at the individual level.

Results:

At the group level, no significant changes in gaze behavior were observed after stimulation of the STS. Qualitative analysis of data indicates strong heterogeneity in the response. Therefore, individual analysis of data has allowed to identify three different groups within participants: 4 subjects respond to the stimulation by increasing the viewing time to the biological motion scenes; 5 subjects respond to the stimulation by reducing the visual duration of the geometric motion scenes and 2 participants presented no changes in gaze pattern.

Conclusions:

This study shows the feasibility of a TMS protocol in participants with ASD. Preliminary results show that, in line with the heterogeneity observed in ASD, response to the TMS varies among individuals.

212 **169.212** Overlap in Parent and Teacher Reports of Externalizing and Problem Behaviors in School-Age Children with Autism Spectrum Disorder

M. Reid[1]*, A. A. Pallathra*[2]*, M. K. Alvord*[3] *and B. Rich*[1]*, (1)Catholic University of America, Washington, DC, (2)Department of Psychiatry, Catholic University of America, Washington, DC, (3)Alvord, Baker & Associates. LLC, Rockville, MD*

Background: Parent and teacher report measures are essential to assessing domains of functioning in different settings for school-age children with autism spectrum disorder (ASD). Investigating the relationship between parent and teacher observations offers a better understanding of impairing symptomatology potentially overlooked in school settings. Evidence from parent report measures suggests children with ASD are significantly more impaired than typically developing peers on all subscales of the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) with the exception of aggression, anxiety, and internalizing behaviors (Mahan & Matson, 2011). BASC-2 teacher rating scales have also indicated that children with ASD display significantly greater impairment than their typically developing peers on most of the clinical subscales (Hass, Brown, Brady & Johnson, 2012). However, evaluating the relationship between parent and teacher rated BASC-2 scores is warranted in order to assess inter-rater reliability, especially in relation to externalizing symptoms.

Objectives: To assess agreement between parent and teacher reports of children's adaptive and problem behaviors in the home and school settings.

Methods: 23 participants with ASD between the ages of 7 and 12 (*M* = 10.06 years, *SD* = 1.61), were enrolled in a study of the Resilience Builder Program®, a 14-week, manualized, group intervention for children with social competence deficits (RBP; Alvord, Zucker, & Grados, 2011) at a large, private practice. Prior to treatment, parents and teachers completed the BASC-2 to evaluate children's adaptive and problem behaviors in community and home settings. Bivariate correlations between all BASC-2 parent and teacher rated subscales were analyzed using SPSS, after which Bonferroni's correction was applied.

Results: There were statistically significant positive correlations between parent and teacher ratings of primarily externalizing behaviors including aggression ($r = .65$, $p = .001$) and externalizing problems ($r = .64$, $p = .001$). There was a lack of significant correlations between all other BASC-2 parent and teacher rated subscale scores, including measures of anxiety, depression, and overall internalizing problems.

Conclusions: The results suggest a strong agreement between parent and teacher assessment of externalizing behaviors, but a disconnect between parent and teacher's abilities to report similar levels of internalizing behaviors. Significant agreement on behavioral functioning may reflect the fact that this is easier to observe and therefore characterize. Interestingly, it also suggests that despite differences in the environment in which children are being assessed (i.e., home vs. school), youth with ASD are perhaps displaying comparable levels of behavioral difficulties. In contrast, the disagreement between parents and teachers on affective functioning may reflect the difficulty in observing these internalized deficits, or it is possible that children are exhibiting varying degrees of these problems depending on the setting. Data from the current study suggest that more targeted, objective measures may be needed to assess internalizing deficits that occur in the home vs. school settings. Finally, the results may also suggest that communication between parents and teachers is critical to ensure comprehensive awareness of mood related deficits, which may differ in presentation based on setting.

213 **169.213** Patterns of Visual Exploration of Complex Social Scenes Are Increasingly Deviant over Time in Preschoolers with ASD: A Longitudinal Eye-Tracking Study

N. Kojovic[1]*, M. Franchini*[2]*, Z. Daniela*[3]*, H. F. Sperdin*[4] *and M. Schaer*[5]*, (1)Developmental Imaging and Psychopathology Lab, UNIGE, Geneva, Switzerland, (2)Dalhousie University / IWK Health Centre, Halifax, NS, Canada, (3)Medical Image processing Laboratory, University of Geneva, Geneva, Switzerland, (4)Developmental Imaging and Psychopathology (DIP) Lab, Office Médico-Pédagogique, Department of Psychiatry, University of Geneva School of Medicine, Geneva, Switzerland, (5)Developmental Imaging and Psychopathology Lab, University of Geneva, Geneva, Switzerland*

Background: Numerous studies using eye tracking have highlighted atypical visual exploration patterns in individuals with ASD, e.g. less focus on eyes and faces compared to typically developing (TD) individuals. Little is known about the mechanisms driving the emergence of these atypical patterns and their change with age.

Objectives: We developed a method that defines age-appropriate dynamic "norms" of visual exploration of complex social scenes. This method allows definition of characteristic gaze behavior for both groups, and quantification of its change with age (i.e. change in group focus precision), thus discriminating normal and atypical developmental processes. It allows to, without any a priori, measure for each child with ASD the deviance in his gaze pattern from the "norm", based on a gaze of TD children.

Methods: A 3-minute cartoon was displayed on a Tobii eye-tracker device for 16 ASD males (aged 3.5±0.3) and 17 TD males (aged 3.3±0.3) and same procedure was repeated a year later. A measure of dispersion of gaze data was calculated for each frame of the video, in both groups. For each frame of the video we created "normative" gaze pattern distribution by employing kernel density distribution estimation on the raw gaze data of TD individuals. We then calculated the *Proximity index-PI* for each patient, and averaged these values for the duration of the video. Higher values indicate the visual exploration of the individual is being more similar to the one of TD subjects. The PI was further correlated with clinical behavioral data and a measure of the complexity of social plot (number of interacting characters).

Results: While TD gaze behavior showed increasing focus with age (less dispersion, $p < 0.0000$ $h^2= -0.47$), ASD children showed a more dispersed gaze pattern a year later ($p < 0.0001$, $h^2= -0.04$). We found positive correlation between the change in PI and change in measures of cognition ($R^2 = 0.57$, $p = 0.008$). In a group of males with ASD, higher PI characterized scene sequences with less social content (one character alone), while in sequences with two or three characters interacting this index was lower ($p = 0.004$).

Conclusions: Our results show that this data-driven method can be used to characterize change in visual exploration in typical and atypical development. In one year TD preschoolers showed increased attunement in visual exploration of complex social scenes. The opposite was observed in our group of males with ASD. This finding highlights the importance of intense early intervention to help preventing the derailment

214 **169.214** Pupil Dilation to Emotional Faces in Relation to Social Anxiety and Autistic Traits in Adolescents with Social Anxiety Disorder

J. L. Kleberg[1]*, T. Falck-Ytter*[2]*, S. Bolte*[3]*, E. Serlachius*[4,5]*, J. Högström*[4,6] *and M. Nordh*[4,6]*, (1)Uppsala University, Uppsala, Sweden, (2)Karolinska Institutet & Uppsala University, Uppsala, Sweden, (3)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden, (4)Department of Clinical Neuroscience, Karolinska Institutet, Solna, Sweden, (5)Stockholm Health Care Services, Stockholm County Council, Stockholm, Sweden, Stockholm, Sweden, (6)Stockholm Health Care Services, Stockholm County Council, Stockholm, Sweden*

Background:

Social anxiety and autistic traits are overlapping but distinguishable symptom dimensions, both in individuals with psychiatric conditions and in the general population. In social anxiety disorder (SAD), autistic traits may predict treatment response. Autistic traits may also be related to individual variation in attentional processes implicated in the development and maintenance of SAD. Both SAD and autism have been associated with atypical autonomic nervous system (ANS) arousal to emotional faces, although the literature is inconsistent. It is not known whether individual differences in autistic traits modulate ANS arousal to emotional faces in SAD. In the present study, we measured phasic pupil dilation, an index of ANS arousal that is modulated by the sympathetic and parasympathetic branches of the ANS.

Objectives:

To examine pupil responses in individuals with SAD as a function of autistic traits, controlling for self-rated level of social anxiety.

Methods:

Participants were treatment-seeking adolescents with a diagnosis of Social Anxiety Disorder (SAD; $N = 23$; 3 Male; Mean age = 15 years; $SD = 1$). Participants viewed images of 10 happy and 10 angry faces presented for 4 seconds while pupil size was recorded at a sample rate of 120 hertz. Stimuli were matched for luminance and low-level visual characteristics. Pupil response was defined as relative change in pupil size from baseline (1 second preceding the stimuli). Samples where the gaze was within the face were included in the analysis. Autistic traits were measured dimensionally with the Social Responsiveness Scale (SRS)[1]. Social anxiety was measured dimensionally using the Social Phobia and Anxiety Inventory – Child version (SPAI-C)[2]. We analyzed data using a linear mixed effects model (LME) with random intercepts for individual and trial, and fixed effects for emotion, autistic traits, and social anxiety level.

Results:

Significant effects were found for emotion (larger pupil responses to angry vs happy faces; $F = 14.66$; $p = .0002$), and autistic traits (higher level of autistic traits predicted smaller pupil responses; $F = 7.24$ $p = .008$), but not for social anxiety level, ($F = 2.31$; $p = .12$).

Conclusions:

Pupil dilation to emotional faces in individuals with SAD may be modulated by autistic traits. Our results suggest that this effect is independent of social anxiety level. This can inform theories about the overlap between autism and social anxiety.

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215 **169.215** Racial Disparities in an Inpatient Sample of Youth with ASD: Nonverbal IQ, Problem Behaviors, Verbal Ability, and Social Functioning

H. Nichols[1], *S. Dababnah*[1], *C. A. Mazefsky*[2], *B. Troen*[3], *R. Mahajan*[3] *and J. Vizzoli*[4], *(1)University of Maryland, Baltimore, Baltimore, MD, (2)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA, (3)Sheppard Pratt Health System, Towson, MD, (4)University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Research in atypically developing Black youth has found significant disparities in symptoms/behavioral profiles. However, there is limited research examining symptom profile differences between Black youth with ASD and youth with ASD from other racial groups. Furthermore, results have been inconsistent across the few studies that have looked at symptom profile differences by race and none of these studies have examined the inpatient population of youth with ASD.

Objectives: The current study evaluated differences between Black inpatient youth with ASD and inpatient youth with ASD from other racial groups, regarding: demographic & health-related characteristics; problem behaviors; communication; and, social functioning.

Methods: Participants were recruited as part of the Autism Inpatient Collection – a multi-site study enrolling youth diagnosed with ASD between the ages of 4 and 20 from six specialized inpatient psychiatry units in the US. Research-reliable Autism Diagnostic Observation Schedule (ADOS) testers administered the ADOS to confirm ASD diagnosis. Nonverbal IQ was assessed using the Leiter-3. Problem behaviors were measured using the Aberrant Behavior Checklist – Community; communication using the Vineland-II; and, social functioning using the ADOS-2 social affect summary score. Data were analyzed with chi-square difference tests, one-way ANOVAs, and basic descriptive statistical procedures using Stata.

Results: Of the 605 youth in the sample, the majority were male (78%) and the mean age was 13.1 years ($SD = 3.4$). Approximately 81% of youth were White, 9% were Black, and 10% identified as another race and/or multiple races. Black youth were admitted to psychiatric hospitals significantly more often over their lifetime than White youth ($p = .021$). Black youth were more likely to be non-verbal or minimally verbal (72%), compared to White youth (49%) and youth who identified as another race (52%; $p = .006$).

Black youth had significantly lower mean nonverbal IQ scores ($M = 61.0$, $SD = 24.7$) in comparison to White youth ($M = 73.6$, $SD = 28.7$; $p = .026$). Black youth with ASD had significantly lower written communication scores ($F(2, 485) = 3.66$, $p = .026$) in comparison to youth who identified as White or another race, but there was no difference between groups in parent-reported receptive and expressive communication skills. Black youth had significantly greater impairment regarding social functioning, compared to White youth ($F(2, 567) = 3.98$, $p = .019$).

Conclusions: This study highlighted significant racial disparities in psychiatric inpatient care among youth with ASD. Black psychiatric inpatient youth with ASD had overall lower functioning than inpatients of other races, as evidenced by lower nonverbal IQs and a higher proportion who are minimally verbal, as well as more impaired social functioning. The results pertaining to nonverbal IQ are consistent with previous research in other settings. However, few other differences in specific skill deficits or problem behaviors emerged between Black and non-Black inpatients. Given that all participants had marked problem behaviors that necessitated inpatient hospitalization, future research should investigate this association in a broader sample.

216 **169.216** Recognition of Music-Evoked Emotions Among Adolescents with Autism Spectrum Disorder: Examining the Effect of Musical Excerpt Duration and Relationship with Cognitive Skills.

T. Fernandes[1], *H. Dahary*[2], *S. Sivathasan*[1] *and E. M. Quintin*[1], *(1)Educational & Counselling Psychology, McGill University, Montreal, QC, Canada, (2)McGill University, Montreal, QC, Canada*

Background: Individuals with autism spectrum disorders (ASD) show impairments recognizing emotions conveyed in facial expressions and speech, but can recognize music-evoked emotions comparably to individuals with typical development, suggesting a strength within the musical domain. Music is a dynamic stimuli, which can convey different emotions over the course of minutes and even seconds. Yet, the potential confound of length of exposure to a melody on music-evoked emotion recognition has not been investigated within the context of ASD. We investigate this issue considering cognitive skills and ASD symptomology.

Objectives: We examined the effects of 1) stimuli (musical excerpt) exposure duration, 2) cognitive skills (verbal and visual spatial), and 3) ASD symptomology on the performance (accuracy and reaction time) of adolescents with ASD on music-evoked emotions recognition tasks.

Methods: Twenty-one participants with ASD (mean age = 14.14 years) completed two music-evoked emotions tasks of varying durations. The long music task (LMT) consisted of 15 excerpts with a mean duration of 37 seconds while the short music task (SMT) comprised of 18 excerpts with a duration of 4 seconds. In both tasks, the participants were asked to identify the emotion that best describes the music (happy, sad, or fearful). Participants completed the Verbal Comprehension Index (VCI) and Visual Spatial Index (VSI) of the WISC-V and their teachers completed the Social Responsiveness Scale (SRS-2). Participants were divided into groups based on a median split of Low and High WISC-V scores (VCI : 80; VSI : 95).

Results: An examination of emotion recognition accuracy revealed ceiling effects for the LMT (M=94%, SD=10%) and SMT (M=92%, SD=10%). A repeated-measures ANOVA with response time as an outcome variable, task and emotions as within subject repeated factors, and VCI group as a between subject factor revealed significant main effects of task (p <.01) and emotions (p = .03). Participants were faster in identifying emotions in the SMT compared to the LMT and in identifying happy vs. fearful music-evoked emotions. A significant interaction effect between task and group (p = .01) revealed that the Low VCI group was slower at identifying emotions in the LMT but were comparable to the High VCI group in the SMT. The same pattern of results was found with VSI group as a between subject factor. ASD symptomology did not have an effect on response times.

Conclusions: Results indicate that adolescents with ASD can accurately recognize music-evoked emotions irrespective of musical excerpt exposure duration. However, their speed at identifying emotions was differentially impacted by exposure duration and cognitive skills. These findings suggest that emotion processing and decision making among individuals with ASD and difficulty with verbal and visual-spatial skills may be facilitated by shorter exposure to emotions and potentially to other types of stimuli, which warrants further research.

217 **169.217** Seeing Eye to Eye? Discrepancies in Perceived Social Skill Competency and Motivation Among Adolescents with ASD and Their Parents

A. Osuna, *T. W. Vernon, A. R. Miller and J. A. Ko, University of California Santa Barbara, Santa Barbara, CA*

Background: Adolescents with autism spectrum disorder (ASD) may have limited insight regarding the quality of their interactions and perceived level of social competency (Lerner et al. 2012). As a result, they may over-estimate their level of social success and quality of relationships compared to third party observers, such as their parents. This trend may partially explain the reluctance that some individuals with ASD have to engage in social skill improvement efforts, as they already view themselves as socially competent with an established social network. Understanding this discrepancy may shed light onto the underlying vulnerabilities in social insight that could provide guidance towards removing barriers to treatment utilization and inform methods for promoting more accurate social perception.

Objectives: To examine differences in pre-intervention scores and resulting treatment gains on parent and adolescent socialization measures in the context of an RCT for the START intervention model.

Methods: A total of 35 adolescents, aged 12 to 17 (mean age: 13.46) with ASD participated in the 20-week Social Tools And Rules for Teens (START) Intervention Model. Individuals had an IQ over 70 and a confirmed diagnosis of ASD. Each family completed two socialization measures with corresponding parent and adolescent-report versions– the Social Skills Improvement System Rating Scale (SSIS-RS) and the Social Motivation & Competencies Scale (SMCS). The SSIS is a commonly-used measure of social skills, including communication, cooperation, assertion, responsibility, empathy, engagement, and self-control (Gresham & Elliott, 2008). The SMCS, developed for the purpose of this study, contains items pertaining to comfort in social interaction, conversation skill use, empathy, friendships, appropriate behavior, social contact, and social interest. SSIS-RS and SMCS data were collected before and after intervention. Pre-intervention scores and change scores were examined using paired sample t-tests.

Results: Prior to intervention, adolescents endorsed significantly higher levels of social skills proficiency based on self-report SSIS-RS total scores compared to corresponding parent-reported SSIS Scores, t(34) = 4.087, $p <.001$. They also endorsed significantly higher levels of social motivation and competencies based on self-report SMCS raw scores compared to corresponding parent-reported SMCS Raw Scores, t(34) = 8.568, $p <.001$. There was no significant differences in the pre-to post intervention change scores between groups.

Conclusions: The findings highlight noteworthy discrepancies regarding the adolescents' social skills, motivation, and competencies. These incongruences may be influenced by the adolescents' lack of awareness in self-perceived social competency (Morin, 2011) or possibly suggest that parents tend to be more critical raters of their own child's social competencies.. Furthermore, while there were increases in scores in reported social skill after treatment, the change scores were not significantly different from one another, suggesting that both parties perceived a comparable magnitude of change despite perceiving different baseline levels of social competence.

218 **169.218** Sequential Associations between Supported Joint Engagement and Parent Talk in Children with ASD and Typical Development

K. Bottema-Beutel[1], *B. P. Lloyd*[2], *L. R. Watson*[3] *and P. Yoder*[2], *(1)Lynch School of Education, Boston College, Chestnut Hill, MA, (2)Department of Special Education, Vanderbilt University, Nashville, TN, (3)Department of Allied Health Sciences, University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: Previous research indicates that caregiver talk that is tailored to the child's attentional focus (*follow-in utterances)* elicits child play, and more so for children with ASD than TD children (Bottema-Beutel et al., 2017). Further, *follow-in directives*, a subset of follow-in utterances, has been shown to be especially elicitative of high-level play in both children with ASD and TD children, as compared to follow-in comments. It is yet to be explored if particular types of caregiver talk elicit caregiver-child joint engagement. An important form of caregiver-child engagement is *supported joint engagement* (SJE), in which the caregiver influences the child's play, but the child does not visually reference the adult. SJE is a robust predictor of language development in TD children and children with ASD (Adamson et al., 2009).

Objectives: This project examines different combinations of SJE and caregiver talk sequences to explore temporal relationships between these constructs. Follow-in utterances, and especially follow-in directives, may be particularly suited to eliciting SJE in comparison to other types of caregiver talk. Further, SJE may elicit follow-in utterances, and potentially more so in dyads that include a child with ASD as compared to a TD child.

Methods: We compared sequential associations (SAs) between different types of caregiver talk and joint engagement sequences, and between children with ASD and typical development (TD). SAs quantify the extent to which one behavior is likely to follow another behavior, while controlling for each behavior's base rates (Yoder & Symons, 2010). SAs were calculated from a coded play session for each child. Mixed-effects models were used to determine effects of group and sequence on mean SAs.

Fifty children with ASD and 48 children with TD participated. Groups were matched on mental age (~13.5 months). Caregiver-child dyads engaged with toys during a 15-min, video recorded free-play procedure. Coding schemes for joint engagement and caregiver talk were applied to these videos, using a 5-s partial interval sampling method.

Results: Follow-in utterances were more likely to elicit SJE than utterances related to the caregiver's focus of attention (p =.05), and this association did not differ by group. Further, follow-in directives were more likely to elicit SJE than follow-in comments (p < .05), but this association did not differ by group. Finally, SJE was more likely to elicit follow-in utterances in the ASD group as compared to the TD group (p <

.05).

Conclusions: Providing talk that (a) is related to what the child is doing, and (b) provides suggestions about what the child might do with the toys (i.e., follow-in directives), elicits SJE to a greater extent than other forms of caregiver talk. Additionally, caregivers of children with ASD appear particularly attuned to providing talk at moments when their child is highly engaged, which may correspond to moments when the child is likely to be processing such talk (Bottema-Beutel et al., 2014). These findings can be used to improve intervention practices for children with ASD that seek to maximize joint engagement as a means to support development (e.g., Kasari et al., 2006/2008).

219 **169.219** Sex Differences in Social Cognition, Executive Functioning and Restricted and Repetitive Behaviours across Development in ASD

R. C. Leung[1,2]*, V. M. Vogan*[1,2]*, V. Yuk*[2,3] *and M. J. Taylor*[2,3]*, (1)Hospital for Sick Children, Toronto, ON, Canada, (2)University of Toronto, Toronto, ON, Canada, (3)The Hospital for Sick Children, Toronto, ON, Canada*

Background: One characteristic of Autism Spectrum Disorder (ASD) is a male preponderance, with a 4:1 male to female ratio frequently cited in current literature. However, recent research has indicated that this ratio may be influenced by biases towards males in terms of symptom presentation, diagnostic criteria and intellectual functioning. Relative to males with ASD, females with ASD have been shown to demonstrate increased social behaviour, greater language ability and reduced repetitive behaviours. These findings indicate that the current diagnostic criteria for ASD may not be sensitive for ASD in females and may be biased in favour of more disruptive and stereotypical behaviour. Thus, investigating differences in the presentation between males and females with ASD may lead to a better understanding and characterization of the female ASD phenotype, which in turn, has important clinical implications in terms of diagnosis and treatment.

Objectives: The present study characterized sex differences in everyday executive functioning, social cognition and restricted and repetitive behaviours across three age cohorts, children, adolescents and young adults, with ASD.

Methods: We recruited 187 children and adolescents with ASD (N=96, M=10.54+2.3 years, IQ=100.9+15.4; females only: N=14, M=11.07+2.2 years, IQ=99.3+15.4), typically developing children and adolescents (N=91, M=11.02+2.5 years, IQ=113.4+12.2; females only: N=23, M=10.39+2.2 years, IQ=114.0+14.7) and 16 adults with ASD (mean = 27.9+4.6; IQ = 112.4+19.7; 8 females). Informants filled out measures of executive functioning, social cognition and repetitive behaviour, as assessed by the Behavior Rating Inventory of Executive Function (BRIEF; Parent/Relative/Other Form), Social Responsiveness Scale (SRS; Parent Rating Scale), and Repetitive Behaviour Scale – Revised (RBS-R), respectively.

Results: To investigate overall group effects on executive functions, social responsiveness and repetitive behaviours, MANCOVAs were conducted with all BRIEF, SRS and z-scored RBS-R subscales, controlling for IQ. Informants rated males and females with ASD as having greater difficulty in executive functioning, social responsiveness and repetitive behaviours relative to their typically developing peers. Preliminary analyses further indicated that female children and adolescents with ASD had more difficulty with the ability to interpret social cues (p = 0.03) and stereotypical behaviours or highly restricted interests (p = 0.006).

Conclusions: Difficulty with the ability to interpret social cues carries profound implications in terms of the ability to successfully engage in social interactions. Our preliminary results suggest that impairment in social cognition, specifically the interpretation of social cues and stereotypical behaviours or highly restricted interests, is particularly heightened in female children and adolescents with ASD, relative to their male counterparts. Thus, females with ASD may exhibit greater impairment in social cognition to meet diagnostic criteria for ASD, particularly in terms of cognitive-interpretive aspects of reciprocal social behaviour. Furthermore, these differences are present in early childhood. Data analyses are ongoing to further explore sex differences in executive functioning, social skills and repetitive behaviours in children, adolescents and adults with and without ASD.

220 **169.220** Sibling Concordance for Viewing Social Dynamic Scenes in Children with ASD and Typical Development

A. Vinçon-Leite[1]*, E. Rechtman*[2]*, E. A. Douard*[3]*, A. Philippe*[4]*, N. Chabane*[5]*, N. Boddaert*[6]*, A. Saitovitch*[7] *and M. Zilbovicius*[8]*, (1)INSERM U1000, Paris, France, (2)INSERM U1000, Institut Imagine, Paris, France, (3)Research Center of UHC Sainte-Justine, Montreal, QC, Canada, (4)Necker Hospital, Paris, France, (5)CHUV, Lausanne, Switzerland, (6)Hospital Necker, Paris, France, (7)INSERM, Paris, France, (8)Inserm U1000, institut Imagine, Paris, France*

Background: Very recent findings in monozygotic and dizygotic twins toddlers show a concordance in the viewing of social scenes. This concordance is observed for levels of preferential attention and for time spent in the social stimuli (Constantino et al, 2017). Results of this study point to a high concordance in monozygotic twins, a lower concordance in dizygotic and non-concordance for non-siblings in the time spent looking at eyes or mouth, suggesting a strong genetic component influencing this type of behaviour.

Objectives: The objective of the present study was to measure such concordance in a non-twin but brotherhood sample using a paradigm of visual preference displaying at the same time biological and geometric motion.

Methods:

Twenty-eight siblings from 13 brotherhoods participated in the study: 4 brotherhoods of children with autism spectrum disorders (ASD) of which 1 brotherhood contain 3 siblings (so a total of 9 children with ASD) and 9 brotherhoods of typically developed (TD) children of which 1 brotherhood contain 3 siblings (so a total of 19 TD children) and thirty non-sibling children. Age characteristics are as follows: in the brotherhood group (mean=11.9, sd=5.7, range=2.7-25 years) and in the non- sibling group (mean= 9.9, sd = 3.2, range = 4.7- 17.4 years). ASD diagnosis was based on DSM IV-R and ADI-R criteria. Tobii T120 eye-tracker was used to measure looking behavior in a preferential viewing paradigm. Participants were presented with a movie consisting of dynamic geometric images (DGI) and dynamic social images (DSI) displayed simultaneously on the screen and percentage of time spent looking at DGI and DSI was measured for all participants.

Results: We found a significant positive correlation between the percentage of time spent looking at DSI in paired sibling (r =0.72; p=0.002), regardless of the diagnosis. This correlation was not observed among the singleton children, randomly paired.

Conclusions: These results highlight that visual engagement to biological motion could be viewed as a neurodevelopmental endophenotype of variation in social information gathering strategies, not only for autism but also for the typically developing population**.**

221 **169.221** Sleep, Cognition, and Autism Spectrum Disorder

A. Lausberg[1], *N. J. Minshew*[2] *and S. Eack*[1], *(1)University of Pittsburgh School of Social Work, Pittsburgh, PA, (2)University of Pittsburgh, Pittsburgh, PA*

Background: Problems with sleep are common in children with autism spectrum disorder (ASD). Family-reported sleep quality issues have become a growing concern in this population, but the specific areas of sleep that cause the most difficulties are understudied. Further evidence indicates that sleep disturbances significantly impact information processing, but little is known about the impact of sleep dysfunction on cognition in ASD. Objectives: The objective of this study was to examine the specific areas of sleep that are the most problematic in children with autism versus their typically developing peers, and the association between sleep and cognitive impairments in children with ASD.

Methods: The sample consisted of children with autism (n = 62) whose diagnosis was confirmed using the Autism Diagnostic Observation Schedule and the Autism Diagnostic Interview-Revised, and a demographically-matched typically-developing control group (n = 29). Parents or legal guardians completed the Child Sleep Habits Questionnaire, a well-validated measure of sleep quality and disturbance, and participants were assessed with a comprehensive battery of field standard neuropsychological and social-cognitive tests. General linear models and moderated multiple regression were used to examine group differences in domains of sleep quality, as well as the association between sleep quality and cognitive functioning within and across study groups.

Results: Children with autism were reported to have significantly more overall sleep problems as compared with their typically developing peers (t = 3.60, p = .0005), especially in sleep onset delay (t = 2.51, p = .014), sleep duration (t = 2.37, p = .0201), sleep anxiety (t = 3.56, p = .0006), and daytime sleepiness (t = 2.70, p = .0083). Furthermore, it was observed that greater sleep anxiety was related to poorer theory of mind performance (r = -0.27, p = .0142), and similar trend level effects were noted for total sleep problems and sleep-disordered breathing (all p < .090). Conversely sleep quality was not related to measures of neuropsychological impairment.

Conclusions: These results highlight the difficulties children with autism have in sleep onset delay, sleep duration, sleep anxiety, and daytime sleepiness, and also suggest that these challenges may be associated with core social-cognitive impairments in theory of mind. New treatment options that target the unique sleep challenges of children with ASD are needed, and may ultimately support improved social-cognitive functioning in this population.

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169.222 Social Cognition in Adults with Autism Spectrum Conditions: Validation of the Edinburgh Social Cognition Test (ESCoT)

A. Baksh[1], *S. Abrahams*[1], *S. Baron-Cohen*[2], *C. Allison*[2], *P. Smith*[3], *S. E. MacPherson*[4] *and* ***B. Auyeung***[1,2], *(1)University of Edinburgh, Edinburgh, United Kingdom, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (3)University of Cambridge, Cambridge, United Kingdom, (4)Department of Psychology, Human Cognitive Neuroscience, Edinburgh, United Kingdom*

Background:

Current tests of social cognition have limited use in clinical settings, do not assess the different aspects of social cognition within the same test and performance on these tests has shown associations with other cognitive abilities such as intelligence. We developed a new test called the Edinburgh Social Cognition Test (ESCoT) to address these limitations. The ESCoT uses animated interactions to assess cognitive and affective ToM and inter- and intra-personal understanding of social norms.

Objectives:

There were three main objectives of this study. First, we sought to investigate convergent validity of the ESCoT against established tests of social cognition. Second, we compared adults with Autism Spectrum Conditions (ASC) and neurotypical controls (NC) on the ESCoT and established tests of social cognition. Finally, we evaluated the psychometric properties of the ESCoT and compared these to traditional social cognition tests by examining the influence of intelligence, ASC traits, empathy and systemizing traits on performance.

Methods:

To support the development of the ESCoT as a clinical tool of social cognition, we derived cut-off scores from a neurotypical population (n=236) and sought to validate the ESCoT in a sample of nineteen adults aged 19-66 (12 males) with a diagnosis of Asperger's Syndrome or High-Functioning Autism according to established DSM-IV. These individuals were recruited from charities and support groups in Edinburgh, UK and from the Cambridge Autism Research Database (CARD), UK. A comparison group of thirty-eight NC (23 males) aged 19-67 years were recruited using online advertisement and through a research volunteer panel in Edinburgh.

The ESCoT was administered alongside established tests; Reading the Mind in the Eyes, Reading the Mind in Films and the Social Norms Questionnaire. Participants also completed the Autism Spectrum Quotient (AQ), the Empathy Quotient (EQ), the Systemizing Quotient (SQ) and the Wechsler Abbreviated Scale of Intelligence.

Results:

Performance on the subtests of the ESCoT and ESCoT total scores correlated with performance on traditional social cognition tests, demonstrating convergent validity. Adults with ASC performed poorer than NC on all measures of social cognition. Unlike the ESCoT, performance on the established tests was predicted by verbal comprehension. A ROC curve analysis demonstrated that the ESCoT was more effective than existing tests at differentiating adults with ASC from NC. Furthermore, a total of 42.11% of ASC adults were impaired on the ESCoT compared to 5.50% of NC adults.

Conclusions:

The results from this study demonstrate that the ESCoT is a valid and sensitive measure of social cognition, it shows better diagnostic accuracy than established tests and it may be a useful test to assess social cognition in clinical settings.

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169.223 Social Impairments Emerge in Infancy and Persist into Childhood in Fragile X Syndrome

J. E. Roberts[1], *A. L. Hogan*[2], *H. Crawford*[3,4], *A. Fairchild*[2], *B. Tonnsen*[5], *A. M. Brewe*[2], *S. L. O'Connor*[2], *C. Pappas*[6] *and D. Roberts*[7], *(1)Psychology, University of South Carolina, Columbia, SC, (2)Department of Psychology, University of South Carolina, Columbia, SC, (3)Faculty of Health and Life Sciences, Coventry University, Coventry, United Kingdom, (4)Cerebra Centre for Neurodevelopmental Disorders, University of Birmingham, Birmingham, United Kingdom, (5)Psychological Sciences, Purdue University, West Lafayette, IN, (6)University of North Carolina Charlotte, Charlotte, NC, (7)GA State University, Atlanta, GA*

Background: Fragile X syndrome (FXS) is the leading genetic cause of autism spectrum disorder (ASD) symptoms, with approximately 60% of individuals with FXS meeting diagnostic criteria for ASD (Lee, Martin, Berry-Kravis, & Losh, 2016). Social-communicative impairments in FXS are characterized in part by reduced and/or atypical social approach behaviors when interacting with unfamiliar adults. However, no studies to date have examined social approach behaviors longitudinally in young children with FXS, so the emergence and trajectories of atypical social approach in FXS are unknown.

Objectives: This study aimed to characterize the trajectory of social approach behaviors across infancy and early childhood in FXS and typical development (TD).

Methods:

The Social Approach Scale (SAS; Roberts et al., 2007) was used to longitudinally measure approach behaviors in children ranging from 4 to 72 months of age (FXS $n = 66$; TD $n = 59$). In total, 290 observations were included (FXS $n = 153$; TD $n = 137$). Physical Movement, Facial Expression, and Eye Contact were rated in the first minute (Rating 1 = R1) and last hour (Rating 2 = R2) of social interaction during a research assessment. Hierarchical generalized linear models (HGLMs) were employed to examine R1 and R2 scores on all three scales, with chronological age nested within participants. To assess whether children with FXS were more likely to "warm up" to examiners over the course of an assessment, the proportion of participants in each group that was rated better at R2 than R1 was compared using Chi-square analyses.

Results:

For Physical Movement, Facial Expression, and Eye Contact, the FXS group was less likely to exhibit normal approach behaviors at both R1 and R2 (bs > ± 1.49, ps < .05) with both the FXS and TD groups demonstrating reduced social approach with age at R1 (bs > ± .02, ps < .05) but not R2 (bs < ± .01, ps > .10) (Figure 1). Age by group interactions were non-significant (bs < ± .02, ps > .25). Similar proportions of participants in both groups exhibited improved Physical Movement ($X^2(1) = 0.17$, $p = .68$) over the course of the assessment, but that the FXS group had a larger proportion of participants exhibit a "warm-up" effect on Facial Expression ($X^2(1) = 5.22$, $p < .05$), and Eye Contact ($X^2(1) = 14.47$, $p < .001$).

Conclusions: As young children with FXS and TD children age, they are less likely to exhibit normal approach behaviors upon initial introduction to a stranger, with atypical approach behaviors more likely in the FXS group. Interestingly, age did not impact ratings at the end of the assessment, suggesting that approach behaviors once the child is familiar with an adult do not change with age. The lack of an age by group interaction suggests that atypical social approach is evident at infancy and persists across early childhood in those with FXS. Children with FXS were more likely to exhibit a "warm-up" effect for Facial Expression and Eye Contact over the course of the assessment.

224 **169.224** Social Information Processing and Victimization in Children with Autism Spectrum Disorders

M. Hooper[1]*, A. Porthukaran*[2]*, J. H. Schroeder*[3,4] *and J. M. Bebko*[3]*, (1)York University, Toronto, ON, CANADA, (2)Psychology, York University, Toronto, ON, Canada, (3)York University, Toronto, ON, Canada, (4)Durham District School Board, Oshawa, ON, Canada*

Background: Peer relationships in childhood and adolescence play a critical role in healthy development (Cairns & Cairns, 1994; Rubin, Bukowski, Parker, & Damon, 1998). Children with difficulties in social competence show a wide range of problems in development, including an increased risk of experiencing victimization through bullying (Schroeder, 2013). Researchers have also demonstrated that there are differences in how children process social information and that these differences can impact and are impacted by, children's experiences with aggression, both as a perpetrator and as a victim.

Objectives: The aim of this study was to examine victimization and social-information processing in children and adolescents with autism spectrum disorders relative to those with typical development. More specifically, it was posited that early social-information processing difficulties in those with ASD impact their ability to generate adaptive solutions to social problems, which increases their likelihood of becoming targets of bullying. This study uses eye-tracking technology to examine the association among variables of victimization. This study is also one of the few to explore multiple types of victimization across multiple raters.

Methods: Twenty-three children with ASD (83% male), and 24 in the TD comparison group (79% male) were matched based on age, IQ and PIQ as assessed by a brief measure of intelligence (WASI; Wechsler, 2011). Both the *Promoting Relationships and Eliminating Violence Network Assessment Tool-Parent and Child Versions* (PREVNet tool; PREVNet Assessment Working Group, 2008) were used to gather child and parent reports of victimization. Participants were shown videos filmed from a first-person perspective of children in various scenes depicting potential bullying and eye-tracking software was used to monitor gaze patterns. The children with ASD were then asked what their response would be in each of the scenes, and responses were categorized as passive, assertive or aggressive.

Results: Parent-reported victimization rates for children with ASD were higher than for typically developing children ($p = 0.001$), with approximately 70% of parents (ASD group) reporting some type of victimization within the past month.. The ASD group also had significantly fewer assertive responses to social scenes depicting bullying scenarios than the TD group ($p = 0.006$). Finally, children with ASD spent less time looking at faces during these social scenes than TD children ($p = 0.03$). For some videos, the amount of time looking at faces was negatively correlated with victimization rates ($r = -0.57$, $p = 0.01$) and passive responses ($r = -0.46$), and positively correlated with assertive responses ($r = 0.56$, $p = 0.02$).

Conclusions: The way in which children process their environment is associated with their everyday interactions. The results of this study can help us to understand the difficulties that children with ASD experience with bullying and victimization. Practically, this research can inform interventionists with specific information regarding areas to target when working on bullying prevention with children affected by ASD.

225 **169.225** Social Rhythmic Entrainment to Child-Directed Singing: The Role of Predictability

M. D. Lense[1]*, L. A. Edwards*[2] *and W. Jones*[2]*, (1)Vanderbilt University Medical Center, Nashville, TN, (2)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: Social communication makes use of predictable, rhythmic behaviors and typically developing (TD) individuals are sensitive to the timing of these behaviors beginning in infancy. In contrast, impairments in the timing of social coordination and reduced sensitivity to rhythmic social behaviors are widely reported in individuals with autism spectrum disorder (ASD). In the current study, we used child-directed singing, a universal form of rhythmic social behavior, to examine how rhythm scaffolds social attention in TD toddlers. Given the critical importance of looking at the eyes of others for understanding social information, we examined how attention to the eyes of a caregiver is modulated by the rhythmic structure of the interaction.

Objectives: Examine sensitivity to social rhythmic information in TD toddlers.

Methods: Sixteen TD toddlers (24 months) watched videos of actresses engaging them with child-directed singing while eye-tracking data were collected. The stimuli videos included natural rhythmic versions of the songs as well as experimentally manipulated, arrhythmic versions. For the rhythmic versions, we used original video recordings of the singing. For the arrhythmic versions, the rhythmic structure of the original videos was disrupted by pseudo-randomly jittering the interval timing between beats of the song. Two levels of jitter were used (moderate: 30%; severe: 50%) to create stimuli that varied in degree of rhythmic predictability. Beats of the singing were determined through vowel onsets and offsets of beat-aligned syllables. The original versions of the singing (coefficient of variation (CV) = 9.5%) were less variable than the 30% jitter versions (CV = 27%), which were less variable than the 50% jitter versions (CV = 43%). We measured whether changes in looking to the eyes of the singer were time-locked to the beats by constructing crosscorrelograms and comparing observed eye-looking with rates of eye-looking expected by chance using permutation testing.

Results: Rhythmic social behaviors in child-directed singing significantly increase attention to the singer's eyes in TD toddlers. When viewing the original, natural rhythmic condition, toddlers' looking to the eyes was significantly time-locked to the beat, with eye-looking increasing by 15.8% above mean levels (p<0.05). This time-locked eye-looking was substantially greater for the original versions of the singing than for the experimentally-manipulated arrhythmic versions. There was only a 9.0% increase in eye-looking at the beat for the 30% jittered version (p<0.05) and a non-significant 3.9% increase for the 50% version (see Figure). The overall proportion of time fixating on the eyes was not significantly different across conditions (p=0.72).

Conclusions: These findings show how the rhythmic structure of social communication impacts looking behavior in TD children, increasing TD children's looking to the eyes, time-locked with their communicative partner. When that rhythmic structure was disrupted, however, TD toddlers were less able to synchronize their looking to the eyes during important moments of social-communicative signaling. For children with ASD, the implication of these results is that children who struggle to perceive the rhythmic structure of social communication may consequently miss important social signals. Results for toddlers with ASD (data collection ongoing) will be discussed.

226 **169.226** Social Visual Preferences in Children with ASD: Preliminary Results from a Novel Dynamic Eye Tracking Task

M. C. Aubertine[1], *B. Li*[2], *M. Kim*[3], *E. Barney*[4], *Y. A. Ahn*[5], *J. C. Snider*[3], *A. Atyabi*[6], *T. Falck-Ytter*[7], *P. Nyström*[8] *and F. Shic*[4], *(1)Seattle Children's Hospital and Research Institute, Seattle, WA, (2)Computer Science and Engineering, University of Washington, Seattle, WA, (3)Seattle Children's Research Institute, Seattle, WA, (4)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (5)University of Miami, Miami, FL, (6)Seattle Children's Research institute University of Washington, Seattle, WA, (7)Karolinska Institutet & Uppsala University, Uppsala, Sweden, (8)Uppsala University, Uppsala, Sweden*

Background: Several eye-tracking studies have used social-nonsocial visual preference paradigms, i.e. side-by-side presentations of a social target versus a non-social distractor, to highlight atypical biases towards social information in individuals with autism spectrum disorder (ASD) (Pierce et al., 2011, 2015; Klin et al., 2009; Shaffer et al., 2017). In an ongoing study, we explore a modification of traditional social visual preference paradigms that incorporates uniform movement of targets and distractors, with the ultimate goal of increasing visual engagement to preference paradigms by participants while providing additional information for facilitating derivation of key eye tracking outcome measures.

Objectives:

- To examine the potential and limitations of a dynamic eye tracking social preference task in studying between-group differences in children with ASD and typically developing (TD) children.
- To examine relationships between social preferences in our task and clinically-relevant phenotypic variables in children with ASD.

Methods:

Twenty-nine children (N = 14 ASD, N = 15 TD) between the ages of 2 to 12 years watched three, 20 second trials. In each trial, two smaller videos were displayed: a social target video of a woman singing a song (Trials 1 and 3) or smiling (Trial 2), contrasted with distractor video of a nonsocial, dynamically evolving fractal. These videos began in the middle of the screen and moved horizontally in opposite directions, reversing towards the edge of the screen, and crossing over each other twice per trial. Videos were shown in the same order for every participant. Eye tracking was performed using an SR EyeLink 1000 Plus eye tracker.

Results:

An independent samples t-test showed that, across trials, the percentage of time TD children looked at the social stimuli (SocialLooking%) was greater than children with ASD (p =.042). However, when trials were examined individually, ASD and TD only significantly differed in Trial 1 (p = .046), not in Trials 2 and 3 (p = .082, 0.158). We subsequently performed a time course analysis, dividing comparable Trials 1 & 3 into four, equal time periods. A repeated measures ANOVA revealed TD children showed higher %SocialLooking only during time period one (p = .017). Phenotypically, relationships between ADOS and SocialLooking% in Trial 1 approached significance (r= -.480, p = .09). Age was negatively correlated with SocialLooking% in Trial 1 (r = .387, p = 0.035) and Trial 3 (p < .001).

Conclusions:

As predicted, children with ASD looked at the social stimuli less than TD children. Further exploration indicated these differences only occurred in the first portion of the first trial. It may be that TD and ASD differ only in initial, spontaneous preference for social stimuli, after which point familiarity effects wash away group differences. Results between social looking and autism symptoms are promising, but the current study may yet be underpowered to robustly detect these relationships. Relationship of age to social looking warrants caution, signalling the need to carefully consider developmental norms in this and potentially other preferential looking paradigms.

227 **169.227** Specificity of Social Visual Engagement Patterns in Toddlers with Autism Spectrum Disorder and Williams Syndrome

J. A. Olmstead[1,2,3], *A. L. Ford*[2,3,4], *W. Jones*[1], *A. Klin*[1], *M. D. Lense*[5], *S. Shultz*[1] *and S. K. Markert*[6], *(1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Department of Pediatrics, Emory University School of Medicine, Atlanta, GA, (3)Children's Healthcare of Atlanta, Atlanta, GA, (4)Marcus Autism Center, Atlanta, GA, (5)Vanderbilt University Medical Center, Nashville, TN, (6)Department of Pediatrics, Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine, Atlanta, GA*

Background: The social phenotypes of Autism Spectrum Disorder (ASD) and Williams Syndrome (WS) are often contrasted with one another (Bellugi, 2001): in general, individuals with ASD are characterized as possessing reduced social interest, whereas those with WS are characterized as atypically prosocial and initiating. The present study seeks to investigate patterns of social visual engagement in groups of toddlers with ASD or WS. By gathering information about where a young child looks, we also gather information about his or her cumulative social experience and interests. Contrasting groups of young children with ASD and WS—both affected by social disability, but in seemingly opposite ways—allows unique insight into distinct, possibly disorder-specific avenues of early social development. Thus, by quantifying patterns of social visual engagement, we can further broaden our understanding of the specificity of early social disability in individuals with ASD.
Objectives: To quantify profiles of social visual engagement in toddlers with distinct diagnoses (ASD, WS, or non-ASD developmental delays (DD)) relative to a comparison sample of typically developing (TD) toddlers.

Methods: Twenty-four-month-old children were eye-tracked while viewing video scenes of naturalistic caregiver interactions. Diagnoses were made by experienced clinicians blind to experimental eye-tracking data, with genetic testing to confirm the WS deletion. All participant groups were matched on chronological age. Percentage of fixation time to 4 regions of interest (eyes, mouth, body, and object) were calculated for each participant. Fixation patterns were compared between groups using two-tailed independent samples t-tests.

Results: Toddlers with WS fixated significantly more on eyes compared to the ASD, DD, and TD groups (all p's < 0.01, **Figure 1a**). By contrast, toddlers with ASD exhibited a trend toward less time spent looking at eyes compared to all other toddler groups (p=0.094, **Figure 1a**). Toddlers with WS also fixated significantly less on the mouth region relative to all other groups (all p's < 0.01, **Figure 1b**). Toddlers with ASD showed a trend towards increased fixation on the body region relative to TD toddlers (p=0.057, **Figure 1c**). Finally, both ASD and WS groups spent more time looking at objects relative to TD toddlers (both p's < 0.05, **Figure 1d**).

Conclusions: Data from ASD and WS toddlers reveal marked and group-specific deviations from the fixation patterns observed in typical development. Toddlers with WS display a striking preference for looking at the eyes of others, whereas toddlers with ASD trend towards less eye-looking. In short, although toddlers with ASD share aspects of social and intellectual disability with WS and DD cohorts, respectively (see clinical characterization scores in Table 1), our results reveal the *specificity* of reduced eye-looking to the social phenotype of ASD, as well as aspects of atypical social visual engagement—such as increased attention to objects—that may be *common* to developmental delays characterized by social disability. These results highlight distinct mechanisms by which developmental outcomes precipitate in ASD and may ultimately point toward different paradigms of treatment for young children with Autism Spectrum Disorder.

228 **169.228** Temperamental Differences between Autistic and Typical Children : A Meta-Analysis

E. L. Bussières[1]*, J. P. Lemelin*[2] *and M. Couture*[3]*, (1)Psychology, Université du Quebec à Trois-Rivières, Trois-Rivières, QC, Canada, (2)Psychoeducation, Université de Sherbrooke, Sherbrooke, QC, Canada, (3)Rehabilitation, Universite de Sherbrooke, Sherbrooke, QC, Canada*

Background:
Although autism is no longer considered a rare condition, challenges remain in the diagnosis process due to an important clinical heterogeneity in the phenotype. Some authors have suggested that temperament may be a useful construct for understanding early developmental differences in infants at risk for ASD.

Objectives: The present meta-analysis aimed to determine if ASD children differed from normative children on three temperamental factors (Negative Affectivity, Surgency and Effortful Control).

Methods:

A comprehensive literature search was conducted to identify published articles and unpublished dissertations using six electronic databases: ProQuest, Google Scholar, Medline, PsycInfo, Cinhal, Embase, using the following keywords : autis* OR ASD OR “autism spectrum disorder” OR Asperger OR TED OR PDD AND temperament*. Literature search covered a period of time from January 1st, 1970 to July1st, 2017. To be selected for this meta-analysis, a study had to (a) include a sample of autistic children aged between 2 and 16 years old, which was compared to a normative group ; (b) assess child temperament with validated temperament questionnaires. Studies also had to meet minimal criteria regarding participant ascertainment, such as having a confirmed diagnosis of autism spectrum disorder derived from a standard method (e.g. ADOS) or by a mental health professional. Studies including high-risk siblings (not diagnosed with ASD) were not retained, in order to limit potential bias and heterogeneity among studies. Analyses were performed using the Comprehensive Meta-analysis software 2.0 (Borenstein, Hedges, Higgins, & Rothstein, 2005). Based on Borenstein and colleagues (2009) recommendation, when original studies compare two groups and differences between their means are available, we used Cohen’s d to transform and combine every available statistics.

Results: Twenty-one studies were included in this meta-analysis. Results showed that autistic children and normative children differed significantly on the Negative Affectivity (d= -.36; k=19; 95%CI: -.57 to -.15; Q= 127.14; p < .001) and the Effortful Control factors (d= -.65; k=20; 95%CI: -.93 -.36; Q= 244.74; p < .001). No differences emerged for the Surgency factor (d = -.24; k=20; 95%CI: -.54 to .54; Q= 246.53; p < .001). Further analyses showed that these associations are moderated by age, country and publication year.

Conclusions:

This meta-analysis confirms that autistic children show both higher levels of Negative Affectivity (greater temperamental reactivity) and lower levels of Effortful Control (less capacities to regulate this reactivity), in comparison to normative children. Temperament could thus be an important variable to consider and document to help identify children who are at a higher risk of having ASD.

229 **169.229** The Adaptive Value of Attending to Social Stimuli Differs for Toddlers with Autism Spectrum Disorder and Williams Syndrome

S. K. Markert[1]*, J. A. Olmstead*[2]*, A. L. Ford*[3]*, A. Klin*[2]*, C. Klaiman*[2]*, M. D. Lense*[4]*, W. Jones*[2] *and S. Shultz*[2]*, (1)Department of Pediatrics, Marcus Autism Center, Children's Healthcare of Atlanta & Emory School of Medicine, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Atlanta, GA, (4)Vanderbilt University Medical Center, Nashville, TN*

Background: Throughout the first years of life, infants filter environmental information by attending to what they find most important, creating a unique subjective experience that shapes their developing cognition. Both children with Autism Spectrum Disorder (ASD) and William’s Syndrome

(WS) exhibit intellectual, linguistic, and social disability, but with distinct phenotypic profiles emerging by the second year of life. Children with ASD exhibit reduced interest in the social world, manifested in both impaired social interaction and communication, as well as atypical patterns of visual attention to social stimuli. Contrariwise, children with WS appear to demonstrate a heightened interest in the social world, manifested in hyper-sociability, visual attentional preference to faces and eyes, and although delayed, linguistic aptitude to communicate with others. By identifying disorder-specific patterns of social visual engagement (i.e., the ways in which children actively seek information in the world and then use or fail to use that information as a route to social adaptation), this study aims to gain insight into the distinct developmental processes underlying each of these neurodevelopmental disorders.

Objectives: To investigate: (1) clinical profiles and patterns of visual fixation to social stimuli in children with ASD, WS, and control groups and (2) whether and to what extent fixation patterns are related to communicative competence.

Methods: Eye-tracking data were collected while 63 toddlers (20 ASD, 11 WS, 12 DD and 20 TD; refer to Table 1 for group characterization details) watched video scenes of an actress caregiver engaging in child-directed communication. Visual fixation was quantified as the percentage of time spent looking at 4 regions of interest (eyes, mouth, body, object). Between-group comparisons of assessment scores on the Autism Diagnostic Observation Schedule (ADOS) and the Mullen Scales of Early Learning were made, and within-group analyses tested for correlations between assessment scores and percentage of fixation time to each region of interest.

Results: Clinical profiles of toddler groups are presented in Table 1. For children with WS, percent fixation on the mouth was positively correlated with expressive ($p = .003$) and receptive ($p = .04$) language scores (Figure 1). The same significant positive correlations were found for both DD and TD control groups (all p's < .05). By contrast, mouth-looking was *not* correlated with either expressive or receptive language for children with ASD (all p's > 0.2).

Conclusions: This research reveals a disorder-specific developmental process that may contribute to the social and cognitive phenotype of ASD. Visual engagement with the mouths of others is positively associated with language competence for WS, DD, and TD groups alike. However, this type of visual engagement does not share the same adaptive value for children with ASD, who show no association between mouth-looking and language scores. This suggests that toddlers with ASD may seek and attend to the mouths of others for very different reasons than do TD, DD, and WS children. These very different goals likely yield different learning experiences and expertise that may contribute to the unique presentations of both neurodevelopmental disorders, and ASD in particular.

230 **169.230** The Effect of Exposure on Attitudes Towards Bullying and Autism in Schools

A. Cook[1]*, J. Ogden*[1]*, N. Winstone*[2] *and I. Dale*[3]*, (1)Psychology, University of Surrey, Guildford, United Kingdom, (2)Higher Education, University of Surrey, Guildford, United Kingdom, (3)The National Autistic Society, Sheffield, United Kingdom*

Background: Children with special educational needs are significantly more likely to be the victims of bullying. Many of the characteristics considered to be the prime causative factors of bullying are often typical of children with autism, for example, communication difficulties, inappropriate social behaviour, low social status and reduced social competence. 40% of children with autism are bullied at school (DfE, 2014) and 70% of children with autism are educated in mainstream schools. Little research, however, explores the impact of inclusion on the attitudes of young people *without* special educational needs towards their peers with autism in mainstream schools. School climate can influence the extent to which peers hold inclusive or exclusive peer-group norms and these in turn can influence reactions to bullying, moderate emotions and predict intended behaviours.

Objectives: This study aimed to explore whether there are differences in attitudes towards the bullying of different targets (autistic and neuro-typical) and different violations (verbal bullying and social exclusion) in contrasting school settings: high explicit exposure to autism (schools with centres for autism) and low explicit exposure to autism (no centre). It also aimed to explore cognitive attitudes towards people with autism according to school setting and level of personal exposure to people with autism.

Methods: Survey data were collected at the beginning and end of the school year from 775 children (384 male), aged 11-12, from six mainstream schools: three with high explicit exposure and three with low explicit exposure to autism. Participants read vignettes depicting bullying scenarios then completed measures of their judgements, emotions and intended behaviours in relation to the vignette and also their cognitive attitudes towards people with autism.

Results: Analysis indicated no significant differences by school (explicit) exposure, but did reveal a significant increase in prosocial attitudes towards people with autism with increased personal exposure.

Conclusions: The research question asked whether a particular model of inclusion can influence the attitudes of neuro-typical children towards their peers with autism. Studies of group identity have shown that exclusive peer in-group norms lead to an increased likelihood that children will engage in bullying towards out-group children whereas an inclusive normative climate can reduce intergroup bias. While this study found no difference in attitudes by school type, this particular model of inclusion was only recently established, and would benefit from a longitudinal research design to explore whether an inclusive normative climate can be developed to stimulate increases in prosocial attitudes over time. The difference in attitudes by personal exposure also highlights the importance of positive contact at a personal level, and has implications for future school interventions embracing the contact hypothesis to instil greater understanding and acceptance, and potentially make an impact on the lives of young people with autism.

231 **169.231** Theory of Mind and Intelligence: The Importance of Visual Stimulus in Autism.

D. Girard[1] *and* ***I. Garcia-Molina***[2]*, (1)Psychology, University of Quebec in Montreal, Montréal, QC, Canada, (2)Psychology, Universitat Jaume I., Castellón, Spain*

Background: Theory of mind (ToM) is the ability to attribute mental states to oneself or to others, as well as to understand that others may have different thoughts, affects and intentions than one's own. ToM is essential in our daily lives to understand human behavior and social interactions. It is well established that autistic individuals have difficulties judging others' intentions and emotions in complex social situations due to impairments in ToM. However, most studies that use complex ToM tasks to measure mental state understanding require participants to comprehend verbal stimuli. Although autistic children tend to perform better at non-verbal tasks in general, few studies have investigated the performance of these children on ToM tasks using only non-verbal stimuli.

Objectives: This project investigated (1) whether children with autism (ASD) perform differently than neurotypical (NT) children at a ToM task measuring both moral judgement and *faux pas*; (2) whether intellectual abilities are associated with the performance on this visual task.

Methods: A novel ToM task was used, based solely on visual stimuli (vignettes for the stories and images for the answers), relating to the comprehension of social relationships. Twenty-eight children (16NT; 12ASD) completed a ToM task by exploring visual stories about moral judgements and *faux pas*. The task consisted of six moral scenarios, which differed in the nature of the action portrayed by the characters: accidental or intentional. The scores were calculated by adding up the correct answers for each item of the moral judgements and *faux pas* separately, and together. IQ was measured using the Wechsler abbreviated scale of intelligence.

Results: Both groups were closely matched in age (p=.208) and IQ (p=.196) (Table 1). Autistic children performed as well as the NT children at the ToM task in general (t(26)=-1.048; p=.304). Furthermore, there was no difference between groups in their moral judgement (t(26)=-.517; p=609) and *faux pas* abilities (t(15.78)=-1.088; p=293). In the autistic group, the performance on the ToM task was not significantly associated with global IQ, verbal IQ, nor performance IQ, all ps > .05. However, in the NT group, task performance was positively and significantly correlated with global IQ (r=.586, p<.05) and performance IQ (r=.568, p<.05).

Conclusions: This study examined the performance differences on a ToM task using visual scenarios related to morality and *faux pas* between an autistic and NT group. This study also investigated the relationship between performance on the task and intellectual level. The results indicate that autistic and NT children performed equally well on the ToM task when presented visually (no verbal replies were required). Additionally, the intellectual level was associated with the performance on the task in the NT group, but not in the autistic group. These results support the idea that 1) individuals with autism are predominantly visual rather than verbal, and 2) due to this particular cognitive style, autistic children may benefit from having access to visual elements during problem-solving tasks about social situations, regardless of their intellectual level.

232 **169.232** Unique Social Cognitive Profiles in Autism and Fragile X Syndrome: Influences on Pragmatic Language

L. Bush[1], *G. E. Martin*[2] *and M. Losh*[3], *(1)Northwestern Feinberg School of Medicine, Chicago, IL, (2)Communication Sciences and Disorders, St. John's University, Staten Island, NY, (3)Communication Sciences and Disorders, Northwestern University, Evanston, IL*

Background: Social cognition refers to the ability to infer thoughts and emotions in others and includes skills such as intentionality, perspective-taking, and false belief understanding. Social cognition is impaired in ASD, and has been implicated in the pragmatic impairments that define ASD. Social cognitive impairments have also been documented in fragile X syndrome with co-occuring ASD (FXS-ASD), and similarly appear related to this group's pragmatic language deficits (Losh et al., 2012). Importantly, the majority of past work has tended to analyze summary scores or single instruments of social cognition, which do not capture different types of social cognitive skills and their discrete impact on pragmatic language.
Objectives: This study used a series of social cognitive tasks ranging in difficulty (appropriate for age ranges in typical development from ~18 months-5 years) to compare social cognitive profiles across groups and examine the impact of these differences on pragmatic language in ASD and FXS-ASD.

Methods: Participants included children with ASD (29 boys) and FXS-ASD (46 boys, 15 girls). To determine the specificity of social cognitive patterns to ASD (idiopathic and syndromic), children with FXS only (13 boys, 27 girls), Down syndrome (20 boys, 22 girls), and typical development (19 boys, 18 girls) were also included. Tasks of perspective-taking (Slaughter et al., 2007) and 1st order false belief (Matthews et al., 2003; Lewis and Mitchell, 1994) were administered. Pragmatic language was assessed from language samples obtained through the Autism Diagnostic Observation Schedule (ADOS; Lord, 2001) and analyzed with a detailed hand-coding system for contingent (on-topic) and perseverative (repetitive) language, which prior research has identified as areas of overlap between ASD and FXS-ASD (Martin et al., in prep; Roberts et al., 2007; Tager-Flusberg & Anderson, 1991).

Results: Individuals with ASD and FXS-ASD demonstrated a marked pattern of social cognitive performance in which they passed the 1st order false belief task but failed the perspective-taking task. This pattern was very rarely observed in any of the other groups, and differentiated ASD and FXS-ASD from all other groups with 98% specificity. Participants with ASD and FXS-ASD who showed this pattern were also more perseverative and noncontingent in conversation than those who did not (ps<.05). Less contingent language in ASD and FXS-ASD, as well as more perseveration in FXS-ASD, were observed in those who failed the perspective-taking task compared to those who passed (ps<.05). Boys with ASD and FXS-ASD who failed false belief were more perseverative and less contingent, respectively, than those who passed (ps<.05).

Conclusions: A distinct pattern of social cognitive impairment was observed in both idiopathic and syndromic ASD, where children passed more advanced false belief tasks while failing a more basic task of perspective-taking. This pattern was generally not observed in the three other groups. This unique pattern of social cognitive difficulty also predicted shared pragmatic language impairments in individuals with ASD and FXS-ASD. Together, these data may help to define the role of social cognition in pragmatic language in ASD.

233 **169.233** Using Eye-Tracking to Investigate Social Information Processing (SIP) in Autism Spectrum Disorders (ASD)

S. M. Francis[1], *D. Srishyla*[1], *D. Back*[2], *K. Dalrymple*[3], *M. Manner*[4], *J. T. Elison*[5] *and S. Jacob*[1], *(1)Department of Psychiatry, University of Minnesota, Minneapolis, MN, (2)Medical School, University of Minnesota, Minneapolis, MN, (3)Institute of Child Development, University of Minnesota, Minneapolis, MN, (4)Department of Computer Science and Engineering, University of Minnesota, Minneapolis, MN, (5)University of Minnesota, Minneapolis, MN*

Background: A common characteristic of autism spectrum disorder (ASD) is deficits in social information processing. For effective interactions and communication, it is crucial to assess socio-emotional information from faces and to correctly interpret facial expressions in real-time. Tracking an individual's eye movements as they view a facial expression can offer insight into how an individual is processing relevant information. Using eye-tracking, we can measure location and duration of gaze, which allows us to assess subcomponents of social information processing in individuals.
Objectives: This study investigated differences in accuracy of emotion identification and eye-tracking metrics (locations and durations) during the Dynamic Affect Recognition Evaluation task (DARE; Bal et al, 2010; affects: happy, sad, anger, fear, surprise, disgust) in both individuals with and without ASD.

Methods: Two groups of participants were recruited to perform DARE. Fifteen individuals (mean age: 13.64±2.33y; IQ>70) diagnosed with ASD (ADOS and most had ADI-R) and 19 individuals (mean age: 12.74±1.97y) without diagnoses. To examine differences in accuracy, trial duration, and fixation between and within groups, different size ANOVAs (5x2, 1x6, and 3x2) followed by post hoc analysis with corrections were performed. Kendall's tau-b was used to note correlations between accuracy and eye metrics.

Results: Preliminary results suggest that ASD versus control differences (between group analysis) in accuracy of emotion recognition during adolescence are not significant. Significant differences in trial duration between the groups were observed. Individuals with ASD had longer trial durations for happy, surprise, fear, and anger (all: $p<0.001$) as compared to controls. Examining the eye-tracking data, we noted that controls on average had longer fixation durations on areas of interest (AOIs) in comparison to the ASD group across all emotions (all: $p<0.001$).

Within group analysis noted a negative correlation between accuracy on disgust and fixation duration on the mouth ($\tau b= -0.579$, $p=0.009$) in the ASD group. Analysis also yielded significant differences in accuracy between: happy > anger ($p=0.005$), happy > disgust ($p=0.002$), surprise > anger ($p=0.038$), and surprise > disgust ($p=0.014$). Within the group, trial duration was significantly shorter for happy versus anger ($p=0.009$). This group also had a longer mean fixation duration on the eyes in disgust versus happy ($p=0.029$). Analysis within the control group yielded a significant difference in accuracy, happy > fear ($p=0.016$). Trial duration did not significantly differ between emotions in the control group.

Conclusions: While there were no significant differences between groups in the accuracy of identifying emotion, there were differences in the strategies between the groups – where individuals looked (location) and for how long (duration). This suggests that by adolescence individuals with ASD establish a strategy that may be different from non-ASD individuals, but still allows for accurate emotion recognition. Going forward, we will increase sample size to ensure that the results are robust, examine eye movements between AOIs by analyzing frequency of saccades, and investigate the effect of age on task strategy.

234 **169.234** Viewing of Social and Non-Social Information in Natural Scenes in High-Functioning Adults with ASD

S. Skripkauskaite[1]*, J. Mayer*[2] *and L. Slade*[3]*, (1)University of Roehampton, London, United Kingdom of Great Britain and Northern Ireland, (2)University of Roehampton, London, United Kingdom, (3)Canterbury Christ Church University, Canterbury, United Kingdom*

Background: Research has suggested that individuals with autism spectrum disorders (ASD) exhibit less attentional engagement with social information than typical (e.g. Klin, Jones, Schultz, Volkmar, & Cohen, 2002), yet not consistently so. Thus, it remains unclear what the underlying mechanisms determining the presence of atypical social viewing in ASD are. Recently, it has been proposed that the content of the scene and the nature of the competing non-social information may moderate the reduced attention to social information seen in individuals with ASD (e.g. Chita-Tegmark, 2016).

Objectives: The primary aim of the current study was to evaluate whether high-functioning adults with ASD exhibited atypical attentional engagement with social and non-social information in naturalistic scenes. Secondly, the current study aimed to examine whether social content (i.e. number of people depicted) of the scene and/or subjective relevance (high and low) of the information within the scene as classified by independent judges may be explaining atypical social attention in ASD.

Methods: The sample consisted of 24 high-functioning adults with ASD and 26 age and IQ matched typically developed (TD) adults. Photographs of 24 naturalistic scenes depicting either low (1 - 4 people) or high (6 - 12 people) social content were used. Participants' gaze behaviour (i.e. visit durations) data was collected using eye-tracking and analysed using multi-level modelling.

Results: Participants with ASD viewed social information and subjectively relevant areas of the scene less than TD adults. However, increased social content affected adults with ASD similarly to TD adults by reducing their attention to the scene overall, to the subjectively more relevant areas, and to the social information in particular.

Conclusions: These findings suggest that the reduced social attention in ASD occurs due to the lack of social bias seen in TD adults rather than the non-social bias. Furthermore, it provides empirical support for the atypical prioritisation of perceived information in ASD by showing that adults with ASD pay less attention to the information judged as relevant by TD adults.

235 **169.235** Visual Attention to Cute Stimuli in Children with Autism Spectrum Disorder (ASD): An Eye-Tracking Study

A. Zaharia[1]*, M. Schaer*[2]*, T. Rojanawisut*[1]*, N. Kojovic*[3]*, D. Sander*[1] *and A. C. Samson*[1,4]*, (1)Swiss Center for Affective Sciences, University of Geneva, Geneva, Switzerland, (2)Developmental Imaging and Psychopathology Lab, University of Geneva, Geneva, Switzerland, (3)Developmental Imaging and Psychopathology Lab, UNIGE, Geneva, Switzerland, (4)Department of Psychiatry and Behavioral Science, Stanford University School of Medicine, Stanford, CA*

Background: Previously, research showed that individuals with ASD present an atypical pattern of positive emotional experience, as for instance: lower levels and a smaller range of positive emotions, as well as less positive facial expressions. A strong trigger to induce positive emotions in typical development (TD) is the baby schema, which consists of infantile physical features perceived as cute (e.g., big eyes, small mouth). These features also activate caretaking behavior, affiliation and social interaction.

Objectives: Our study aimed at investigating the sensitivity towards the baby schema in children with ASD and TD children. We explored the eye gaze responses to stimuli with strong (infants, animals) and less strong (adults) cute features in individuals with ASD compared to TD individuals. We also expected that sensitivity towards the baby schema would be linked to social impairments.

Methods: Fifteen children with ASD (M_{age}=5.47, SD_{age} = 1.96, 14 males) and 12 TD children (M_{age}=5.42, SD_{age} = 1.43, 7 males) participated in the study. Using eye-tracking technology (Tobii TX300), we compared the eye gaze patterns (time spent and number of fixations on areas of interest) during a visual exploration task in two conditions: frames that portrayed (1) infants, animals, and neutral objects, or (2) adults, animals, and neutral objects. Stimuli depicting animals and infants obtained similar cuteness ratings and were rated cuter than stimuli depicting adults during stimuli validation stage. Additionally, we assessed social impairment severity using Social Responsiveness Scale-2 (SRS-2).

Results: Repeated-measures ANOVAs revealed that participants with ASD show fewer fixations on animals compared to TD participants in both conditions. In addition, they showed a different eye gaze pattern in exploring frame (2): children with ASD spend less time on animals, but more time on adults compared to TD participants. Moreover, we computed a Cuteness Sensitivity Index (CSI) as a measure of sensitivity to focusing on infants versus adults, for which a low value indicates more time spent on infants and a high value indicates more time spent on adults. A positive correlation between the CSI and severity of social impairments was only found in the TD group.

Conclusions: These preliminary results suggest a decreased sensitivity towards the cute features in participants with ASD compared to TD.

Specifically, children with ASD compared to TD participants, seem to be less attracted to cute stimuli representing animals and more attracted to less cute stimuli representing adults during a visual exploration task. Moreover, our results showed that TD participants who spend more time on infants show less social impairments. This may suggest that sensitivity to cuteness has the potential to facilitate social interactions and predict better social outcomes. Future studies should test the relevancy of these findings in longitudinal studies to examine the predictive value of the sensitivity towards cuteness for socio-emotional development in individuals with ASD.

236 **169.236** “Thin-Slicing” Everyday Conversations: A Quick, Low-Cost Way to Add New Dimensionality to ASD Conceptualization

L. Bateman[1]*, E. F. Ferguson*[1]*, M. Cola*[2]*, S. Uh*[2]*, S. Plate*[2]*, Z. M. Dravis*[2]*, A. Pomykacz*[3]*, K. Bassanello*[2]*, A. Zoltowski*[4]*, J. D. Herrington*[5]*, K. Bartley*[5]*, E. S. Kim*[2]*, A. de Marchena*[6]*, J. Pandey*[2]*, R. T. Schultz*[2] *and J. Parish-Morris*[2]*, (1)The Center for Autism Research/CHOP, Philadelphia, PA, (2)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (3)Children's Hospital of Philadelphia- Center for Autism Research, Philadelphia, PA, (4)Vanderbilt University, Nashville, TN, (5)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)University of the Sciences, Philadelphia, PA*

Background: Individuals with autism spectrum disorder (ASD) are characterized by social communication challenges and repetitive behaviors that may be perceived differently by new acquaintances than by parents or expert clinicians. Intriguingly, recent research suggests that even naïve non-experts are capable of forming accurate impressions about a variety of human dimensions using only narrow windows of experience called “thin-slices” (Slepian, Bogart, & Ambady, 2014). In this study, we explore “thin-slice” ratings of interaction quality in ASD and typical controls after a 5-minute conversation.

Objectives: First, compare “thin-slice” ratings between participants with ASD and typical development (TD). Second, compare “thin-slice” ratings of participants with ASD to scores from a parent questionnaire (SCQ) and expert clinical observation (ADOS). We hypothesized that since parent questionnaire scores are based on a lifetime of experience, and ADOS scores are based on a shorter (~1 hour) interaction, that 5-minute “thin-slice” ratings would more closely resemble ADOS scores than SCQ scores, despite the non-expert status of the rater.

Methods: Forty-five participants with ASD (N=28; 8 female) or typical development (TD; N=17; 13 female) completed a ~5 minute unstructured “get-to-know-you” session with a novel conversational partner (N=14, 11 female). Participant groups did not differ significantly on age (11.75 years) or IQ (106), but the TD group had more female participants than the ASD group (imbalance will be corrected by May, 2018). After each conversation, conversational partners completed a modified version of the Conversation Rating Scale (CRS; Ratto et al., 2011). The original CRS included 5 questions indexing conversational interest, warmth, flow, boredom, and distance on a 1 (strongly agree) to 7 (strongly disagree) Likert scale. A sixth question about appropriate eye contact was added for the purposes of this study.

Results: Linear mixed effects regression models with conversational partner as a random effect revealed that the ASD group received lower overall CRS scores than the TD group, and were perceived as significantly less warm and more distant, with less appropriate eye contact (*p*s<.01, Fig.1). There were no significant group differences in perceived boredom, interest, or conversational flow. Warmth, distance, and eye contact scores were combined into a 3-item CRS composite that was found to correlate with ADOS severity scores in the ASD group ($r=-.62$, $p<.001$), but not with SCQ scores (Fig.2).

Conclusions: “Thin-slice” ratings of naturalistic conversations hold promise as a low-cost metric to gauge the impression that individuals with ASD make on naïve communication partners in everyday life. In this study, we identified three questions about a 5-minute conversation with a naïve interlocutor that differentiated diagnostic groups, and accounted for nearly 40% of the variance in ADOS scores of participants with ASD. The CRS 3-item did not correlate with SCQ scores, suggesting that “thin-slice” ratings capture variance that is orthogonal to parent perceptions of autism symptoms. We propose that non-expert “thin-slice” ratings provide a more complete and nuanced picture of ASD in daily contexts, adding new dimensionality to our conceptualization of the disorder.

237 **169.237** "I Wish I'd Know That When I Was Younger" - a Qualitative Exploration of the Change over Time in the Relationships of Autistic Girls and Women from Multiple Perspectives

F. R. Sedgewick[1]*, E. Pellicano*[2] *and V. C. Hill*[3]*, (1)Centre for Research in Autism and Education (CRAE), London, United Kingdom of Great Britain and Northern Ireland, (2)Macquarie University, Sydney, Australia, (3)Psychology and Human Development, UCL Institute of Education, London, United Kingdom*

Background:

While there is growing interest in the experiences of girls and women on the autism spectrum, no published work has yet examined how their relationships change between two key developmental stages, adolescence and early to mid-adulthood – both of which are characterised by significant changes in social experiences and expectations.

Objectives:

This cross-sectional study sought to examine the friendship and romantic experiences of two distinct cohorts of autistic females, adolescent girls and adult women, to elucidate potential similarities and differences across these distinct stages of development. Parental views were also sought to provide multi-informant perspectives on girl’s experiences.

Methods:

We conducted semi-structured interviews with 27 autistic girls (M age:14 years 5 months) and 19 autistic women (M age:30 years 2 months) about their relationships and conflict experiences. 20 of 27 parents of autistic girls were also interviewed about their daughter’s relationships and their thoughts about the future.

Results: Interviews were transcribed verbatim and analysed using thematic analysis. Almost all autistic girls and women discussed having one or more secure relationships, although some described difficulties with maintaining relationships. There were two key commonalities across autistic girls and women’s interviews. First, both autistic girls and women discussed having a few, intense relationships, both as their preference and because they found it “hard work” to maintain more. For autistic girls, this generally took the form of one or two best-friends, without wider social groups. For autistic women, their romantic partner had often taken on this role. Second, both autistic girls and women faced the same type of conflict regardless of life-stage, which was almost exclusively relational in nature. We also identified two key differences between the groups. First, there were notable differences in how autistic girls and women managed conflict they experienced. Autistic girls took a ‘black-and-white’ approach, either entirely assuming blame or seeing an insurmountable problem. In contrast, autistic women had learned to negotiate resolutions, but were also happy to walk away from situations which were too difficult. Second, these changes to conflict management, along with better self-knowledge through the diagnostic process, meant that autistic women were more satisfied with, less anxious about, and more self-assured in their relationships than autistic girls. Finally, one major concern identified from the accounts of autistic women and parents related to vulnerability. Adult women discussed experiencing physical and sexual violence, along with mental health issues. Parents were also concerned about their daughter's vulnerabilities, often actively trying to pre-empt them. Autistic women described how this input would have been useful when they were younger.

Conclusions:

Many of the social experiences reported by adolescent autistic girls were also reported by adult autistic women, including the patterns of their friendships and relationships, and the conflict they face with their peers. There are also apparent improvements in their relationships over time – in conflict management and social satisfaction – despite a range of challenges also present in adulthood. Future work should seek to examine which factors support these relationship improvements, and how these skills could be taught to autistic girls.

238 **169.238** Alexithymia Mediates Facial Muscle Mimicry of Observed Pain in Autism

ABSTRACT WITHDRAWN

Background: Poor empathy and deficits in mimicry of others' emotions have been reported in autism spectrum disorder (ASD). However, studies have either examined only cognitive aspects of empathy or only measured self-reported empathy. Furthermore, most studies have not adequately controlled for cognitive factors influencing empathy expression such as alexithymia; that is, the inability to express or understand one's own emotions.

Objectives: This study was the first to measure involuntary facial mimicry of painful expressions as an indicator of empathy in ASD. Muscle reactivity was examined in individuals with varying levels of autism traits. We hypothesised that muscle mimicry and subjective affective empathy are strongly correlated with alexithymia, but are not impaired in ASD once alexithymia has been controlled for. We further hypothesised that the ability to understand others' emotions, i.e. cognitive empathy, would enhance affective responses.

Methods: The relationship of cognitive empathy and alexithymia to muscle reactivity and subjective affective responses to pain were examined. In total, 98 individuals participated (27 ASD; 79 Male; ages 14 – 46). Participants were shown videos of painful facial expressions lasting 5s each, during which activity in the facial muscles associated with pain (verum; M. orbicularis oculi, M. zygomaticus major) and surprise (control; M. medial frontalis) were recorded using bipolar surface electromyography. Affective state and perceived pain was rated on a 7-point scale after completion of the videos. Autism traits were calculated from observed and self-reported autism behaviours using the Autism Diagnostic Observation Schedule 2 and the Autism Spectrum Quotient. Alexithymia was measured on the Toronto Alexithymia Scale (TAS-20) and cognitive empathy was measured using the Faux Pas task. Affective states, perceived pain and muscle reactivity were predicted from autism traits, alexithymia and cognitive empathy in separate mixed effect models.

Results: Muscle activity increased significantly from the start of the video to the time of greatest pain and was greater in muscles associated with pain than muscles associated with surprise. High trait autism was correlated with lower muscle amplitude, reduced perceived pain intensity and lower subjective affective ratings while observing pain. However, once alexithymia was controlled for, autism traits were no longer correlated with muscle amplitude or affective states. Furthermore, there were no differences in habituation or speed of muscle response between low and high autism trait participants. Cognitive empathy did not predict muscle reactivity or affective responses.

Conclusions: Alexithymia mediates the relationship between autism traits and affective empathy and muscle mimicry. Interestingly, though affective responses to perceived pain are unimpaired in those without alexithymia, participants with high autism traits may report perceived pain as less intense than those with low autism traits. Of note, complex cognitive empathy does not seem necessary for an affective empathic response to perceiving another's pain. These results support theories of separate cognitive and affective neural pathways for empathy.

239 **169.239** Do Children with Autism Spectrum Disorder Share Fairly and Reciprocally?

C. Hartley *and S. G. Fisher, Lancaster University, Lancaster, United Kingdom*

Background:

Sharing is a crucial foundation of human evolution. The conflict between retaining valued commodities and sharing with others is conventionally assessed via resource-exchange tasks, such as the Ultimatum Game (UG) and Dictator Game (DG). In these tasks, typically developing (TD) children and adults demonstrate preferences for equality and reciprocity, and reject incoming offers they perceive to be unfair. As these behaviours are driven by sensitivity to social norms and awareness of others' perspectives, there may be significant differences in how children with autism spectrum disorder (ASD) share with others. Importantly, failure to share fairly and reciprocally could impact children's ability to build friendships and increase their risk of bullying.

Objectives:

The objective of this study was to explore how children with ASD and TD children share stickers in age-appropriate versions of the UG and DG. In the ASD group, we expected to observe a weaker preference for equality, reduced reciprocity, and fewer verbal references to fairness.

Methods:

Participants were 15 children with ASD (*M* age: 9.2 years) and 18 TD children (*M* age: 4.3 years) matched on language comprehension (ASD *M* age: 5.1 years; TD *M* age: 4.83 years). On different days, children played the UG and DG with a puppet. Each game involved two roles: proposer and recipient (players alternated roles for 4 turns). The proposer received 8 stickers and decided how many to offer the recipient. In the UG, the recipient could accept or reject the proposer's offer. In the DG, the recipient always accepted the proposer's offer. In each game, the puppet made one fair offer (4 stickers) and one unfair offer (1 sticker) in a random order, and their responses were randomised in the UG.

Results:

Both groups indicated a preference for equality over self-interest in the UG (ASD *M* offer: 3.31; TD *M* offer: 3.39), offered significantly fewer stickers in the less socially-strategic DG (ASD *M* offer: 2.77; TD *M* offer: 2.75; $p = .006$), and explicitly referred to fairness at similar rates when making and receiving offers (*p*s = .17-.64). However, children with ASD were more likely to accept unfair offers than TD children (40% vs 11%; $\chi^2 = 3.77$, $p = .05$) and were less likely to reciprocate the puppet's offers in both games ($p = .04$-07). Strikingly, children with ASD reciprocated fair offers at much lower rates in both the UG (ASD: 56%; TD: 93%) and DG (ASD: 50%; TD: 75%).

Conclusions:

Although both groups exercised an explicit notion of fairness (as indicated by their offers and comments), ASD impacted children's ability to evaluate the fairness of others' offers and to reciprocate accordingly. Crucially, reduced reciprocation of others' fair behaviour by children with ASD could elicit negative affect in peers and lead to marginalisation, while increased tolerance of unfair behaviour could increase their susceptibility to bullying. Due to deficits in social-cognition and interaction, children with ASD might be increasingly motivated by material outcomes (irrespective of whether they are personally disadvantaged), and less concerned about defending norms associated with positive social-relational outcomes.

Oral Session -
Invited, Keynote Speakers, Awards
175 - Welcome Address & Sponsor Update
8:45 AM - 9:00 AM - Grote Zaal

8:45 Welcome Address & Sponsor Update.

Oral Session -
Invited, Keynote Speakers, Awards
176 - Keynote Address - Mark H. Johnson, FBA
9:00 AM - 10:00 AM - Grote Zaal

Professor Mark H. Johnson, FBA is Professor of Experimental Psychology (1931) and Head of the Department of Psychology, Cambridge University, UK. After obtaining a degree in Biology and Psychology from the University of Edinburgh (UK), and a PhD in neuroscience from Cambridge, he held academic and research positions at the MRC Cognitive Development Unit, London (1985-89 and 1994-98), University of Oregon, Eugene (1988-89), and Carnegie Mellon University, Pittsburgh (1990-95), before he moved to become MRC Director of the Centre for Brain & Cognitive Development at Birkbeck, University of London in 1998. He has published over 350 papers and 10 books on brain and cognitive development in humans and other species, including the textbook "Developmental Cognitive Neuroscience" now in its 4th Edition. Currently his laboratory focuses on typical, at-risk and atypical functional brain development in human infants and toddlers using a variety of different neuroimaging, cognitive, behavioural, and genetic methods. Johnson coordinates several national and international collaborative scientific networks, and is a named fellow of the APS, BPS, Cognitive Science Society and British Academy (FBA).

9:00 Babies At-risk for Autism: Assumptions, Progress and Prospects

M. H. Johnson, *Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

For over a decade a number of research groups world-wide have studied infants at-risk of autism in order to reveal the early developmental pathway that results in diagnosis. I will discuss the key assumptions that underpin this body of research, and the general approach taken of prospective longitudinal studies. Key conclusions from research so far will be illustrated by selected studies from our group in the UK (BASIS) and a European network (Eurosibs). Despite many findings, however, a number of fundamental issues about the early emergence of autism remain unresolved. I will argue that some of these issues may be resolved if autism is seen as being the result of a common alternative trajectory of human brain development. By this view autism is not a disorder of development, but rather an ordered developmental response to a different starting state.

Panel Session
Social Cognition and Social Behavior
177 - The Autism Biomarkers Consortium for Clinical Trials: Overview and Presentation of Interim Analyses
10:30 AM - 12:30 PM - Grote Zaal

Panel Chair: James McPartland, *Child Study Center, Yale University School of Medicine, New Haven, CT*

Discussant: Declan Murphy, *Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

The Autism Biomarkers Consortium for Clinical Trials (ABC-CT) is a US-based network designed to develop objective measures to more sensitively and validly quantify ASD symptomatology and its change in clinical trials and to stratify ASD into meaningful subgroups. This symposium will present results from ABC-CT interim analyses, when half of the total sample has been evaluated at the second of three time points. This panel brings together six autism research centers, with panelists spanning early career faculty to senior leaders in the field. The first lecture will provide an overview of study design, with focus on progress to date and unique elements of the approach to biomarker development. The second lecture will present clinical data from the interim sample, and the third and fourth lectures will provide preliminary biomarker results obtained from EEG and eye-tracking studies, respectively. The discussion, provided by leadership from EU-AIMS, a collaborating European biomarker consortium, will focus on unique concerns for biomarkers that can facilitate prediction of outcome and diagnostic stratification and on development of large-scale consortia and clinical networks for study of biomarkers in ASD.

10:30 **177.001** The Autism Biomarkers Consortium for Clinical Trials: Study Design and Progress to Interim Analysis

J. McPartland[1]*, S. J. Webb*[2]*, F. Shic*[3]*, A. Naples*[1]*, C. Sugar*[4]*, M. Murias*[5]*, J. Dziura*[6]*, C. Brandt*[6]*, R. Bernier*[2]*, K. Chawarska*[1]*, G. Dawson*[7]*, S. Faja*[8]*, S. Jeste*[4] *and C. A. Nelson*[8]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (4)University of California, Los Angeles, Los Angeles, CA, (5)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (6)Yale University, New Haven, CT, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (8)Boston Children's Hospital, Boston, MA*

Background:
Recent scientific advances offer promise for the development of targeted treatment methods to improve social-communication in autism spectrum disorder (ASD). The promise of targeted treatments is hindered by a lack of reliable and sensitive objective measures to identify subgroups likely to respond to specific treatments, to rapidly assess response to treatment, and to evaluate whether a treatment has affected the intended target. The Autism Biomarkers Consortium for Clinical Trials is a multisite biomarker development study designed to advance these objectives.

Objectives:

The goals of the ABC-CT are to: (1) establish sensitive and reliable objective EEG, eye-tracking (ET), and lab-based behavioral assays of social communication in ASD for predicting and quantifying response to treatment, reducing heterogeneity of samples via stratification, indicating early efficacy, and demonstrating target engagement; (2) create a publicly accessible repository spanning genetics, biomarkers, and clinical and behavioral information; and (3) establish an infrastructure optimized for the conduct of future clinical trials.

Methods:

Prior to commencing full-scale data collection, a feasibility study assessed 51 subjects (25 ASD, 26 TD) to ensure: standardization and viability of data collection across sites; valid and reliable implementation of experimental measures; effectiveness of data processing, extraction, and quality control procedures; and reliability of data management, upload, and sharing systems. The main study commenced in October 2016 and will include 200 rigorously characterized children with ASD (6-11 years; IQ 60-150) and 75 typically developing (TD) control subjects at three time points (Baseline, 6 weeks, 24 weeks). Detailed manuals of procedures (MOPs) and identical biomarker acquisition hardware and software are intended to minimize variance in ascertainment across sites, and clinical characterization is standardized with a clinical MOP and regular teleconferences to ensure reliability. A unique study governance brings together diverse expertise to facilitate progress from discovery to biomarker qualification. To provide opportunity for confirming biomarker results in independent samples, several EEG and ET paradigms are harmonized with those utilized in EU-AIMS.

Results:

As of October 2017, 203 participants have been enrolled in the main study, with 181 having reached 6 week visits and 116 having reached 24 week visits. Data acquisition procedures have been highly successful, with valid data acquisition rates above 96% across biomarker data modalities, and longitudinal attrition has been minimal (N=15). Panels in this symposium will report data from the interim analysis sample, at which point approximately half of the main study sample will have completed a 6 week visit. Interim analyses will focus on preliminary evaluation of biomarkers for clinical trials, in terms of acquisition and psychometric properties, as well as utility for stratification, discrimination, and indicating clinical status.

Conclusions:

The ABC-CT, and other consortia like it, are advancing the goal of clinically practicable biomarkers by investigating well-evidenced biomarkers in large, well-characterized cohorts in the context of a longitudinal design. Progress in these studies is laying groundwork for more sensitive and reliable measurement in clinical trials, and the use of economical and scalable biomarker technologies holds promise for eventual deployment in a broader range of clinical and research contexts.

10:55 **177.002** The Autism Biomarkers Consortium for Clinical Trials: Clinical Characteristics and Interim Evaluation of Clinical Measures Commonly Used in Clinical Trials

S. Faja[1]*, R. Bernier*[2]*, G. Dawson*[3]*, K. Chawarska*[4]*, S. Jeste*[5]*, C. A. Nelson*[1]*, S. J. Webb*[2]*, F. Shic*[6]*, A. Naples*[4]*, C. Sugar*[5]*, M. Murias*[7]*, J. Dziura*[8]*, C. Brandt*[8] *and J. McPartland*[4]*, (1)Boston Children's Hospital, Boston, MA, (2)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (3)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (4)Child Study Center, Yale University School of Medicine, New Haven, CT, (5)University of California, Los Angeles, Los Angeles, CA, (6)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (7)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (8)Yale University, New Haven, CT*

Background: The investigation of social interventions for ASD has traditionally relied on clinician rating scales and parent surveys, raising concerns about their relation to underlying mechanisms targeted by treatment, sensitivity to treatment-related changes, and potential for bias when used to measure interventions that are difficult to mask from clinicians and families. The ABC-CT provides an opportunity to examine the utility of these measures with respect to construct test-retest reliability, discriminant and convergent validity. The project also provides an opportunity to examine the feasibility of collecting clinical data in a reliable and precise manner across a five-site consortium.

Objectives: To examine the interim characteristics of a large sample, including possible site-specific differences. To examine convergent validity of the clinical battery, particularly for social communication symptoms of ASD. To explore whether standardized lab-based measures of face and emotion recognition discriminate groups and relate to traditional measures of clinical function. To examine interim data for test-retest validity of commonly used clinical measures.

Methods: To date, data are available from the Feasibility phase of the project, which included 25 children with ASD and 26 typically developing controls (4-11 years, FSIQ = 53-133). The presentation will include data from approximately 205 children across two time points at ABC-CT interim analysis.

Results: There were site specific differences in age, but not gender or clinician rating measures: ADOS-2 calibrated severity scores, ADI-R, Vineland-3, or CGI. In terms of convergent validity within the social domain, clinician ratings of social symptom severity (CGI) related to ADOS-2 social affect calibrated severity scores, Vineland-3 socialization, PDDBI Social Pragmatic, and SRS-2 Social Communication ($ps < .05$), suggesting excellent convergent validity for the CGI with other measures of current social communication symptoms within the group with ASD. The ADI-R social domain, which emphasizes historical symptoms; PDDBI Social Approach; SRS-2 Social Awareness, Social Cognition, Social Motivation; and CASI Autism and Asperger scales were not related to CGI. In contrast, the ADOS-2 social affect calibrated severity score was unrelated to ADI-R social, PDDBI, SRS-2 or CASI scales related to social communication symptoms. Likewise, the ADI-R Social scale was related to only the SRS-2 Social Cognition and Social Motivation and CASI Autism/Asperger's scales. The Vineland-3 Socialization scale related to all CASI, SRS-2 and PDDBI social and autism scales (*ps* <.06), and all SRS-2 and PDDBI social scales were related to each other (*ps* <.05). A standardized lab-based measure of face and emotion recognition (NEPSY-2) discriminated groups (face: $t(40)=5.03$, $p<.001$; emotion: $t(40)=2.75$, $p=.009$) and face memory related the ADOS-2 social affect scores.

Conclusions: Initial findings from ABC-CT feasibility provide information to guide selection of social measures for clinical trials confirming that traditional measures are feasible in a multisite clinical trial, have varying convergent validity, and are relatively independent from performance-based measures, such as the NEPSY-II. The replication of these findings among a larger sample (N=200), including test-retest reliability over a 6-week period will also be presented.

11:20 **177.003** The Autism Biomarkers Consortium for Clinical Trials: EEG Interim Analyses

S. J. Webb[1], *A. Naples*[2], *A. R. Levin*[3], *G. Hellemann*[4], *C. Sugar*[5], *D. Senturk*[4], *M. Santhosh*[6], *H. M. Borland*[7], *T. McAllister*[2], *S. Hasselmo*[2], *F. Shic*[7], *M. Murias*[8], *J. Dziura*[9], *C. Brandt*[9], *R. Bernier*[1], *K. Chawarska*[2], *G. Dawson*[10], *S. Faja*[11], *S. Jeste*[5], *C. A. Nelson*[11] *and J. McPartland*[2], *(1)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Neurology, Boston Children's Hospital, Boston, MA, (4)UCLA, Los Angeles, CA, (5)University of California, Los Angeles, Los Angeles, CA, (6)Seattle Children's Research Institute, Seattle, WA, (7)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (8)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (9)Yale University, New Haven, CT, (10)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (11)Boston Children's Hospital, Boston, MA*

Background: Autism Biomarkers Consortium for Clinical Trials (ABC-CT) electroencephalography (EEG) paradigms aim to identify social-communicative brain biomarkers relevant to autism spectrum disorder (ASD), using measures of signal strength (i.e., modulation of EEG spectral power and event-related potential latency/amplitude). Prior to commencing the full scale "main" study data collection (ongoing), a feasibility study was conducted to ensure standardization and viability of data collection across sites and effectiveness of data processing, extraction, and quality control procedures. This is particularly vital for EEG, as there have been few multisite data collection studies or test-retest evaluations, specifically in this age range and including the full functional variability in ASD.
Objectives: To investigate the acquisition validity, test-retest reliability; discriminant validity, and relation to clinical status of EEG measures of social communication in ASD.

Methods: EEG was collected across 51 participants (25 with ASD, 26 typically developing (TD), ages 4-11) over two days counterbalanced by day and within-day experiment order: (A) Resting (or calm viewing), visual evoked potential (VEP; checkerboard), and EU-AIMS Faces (based on the EU-AIMS face experiment), (B) Resting, Biomotion (point light displays of walkers), Dynamic social/nonsocial videos, and Emotion Faces. Equipment (EGI 128-channel EEG system), experimental control, and recording parameters were standardized across sites. Data processing and analyses were conducted via NetStation and Matlab, utilizing automated artifact detection and custom-made programs for component abstraction. Primary dependent variables, selected based on literature review, included slope of the power spectrum (Resting, Dynamic social/nonsocial), which is thought to be a marker of signal:noise ratio within the brain, as well as amplitude and latency of the P1 (VEP) and N170 (Biomotion, Faces, Emotion Faces) components. Validity was defined as valid acquisition (e.g., participant protocol compliance) and artifact free data for >40 seconds or 30% of trials.

Results: During feasibility, validity rates were >90% for Resting, Dynamic, VEP, and EU-AIMS Faces, and >80% for Biomotion and Emotion Faces. Significant differences (ps<.05) were found for Group for Resting slope (t=9.4). Effects of age were identified in Resting slope (t=4.1), Emotion Faces N170 latency (t=5.2), and VEP P1 amplitude (t=2.9). Interactions were found for diagnosis by age for Faces N170 amplitude (t=1.7), and diagnosis by verbal IQ for Emotion N170 amplitude (t=5.2) and VEP P1 amplitude (t=2.7). This symposium will present updated data from interim analyses, which includes Ns>175 of the main study sample and includes Resting, VEP, Faces (modified from feasibility), and Biomotion. Current Main Study (baseline) rates of acquisition are 97.5% valid session acquisition with valid derived results between 81% and 94% by experiment.

Conclusions: EEG measures showed high levels of data retention across site, age, and diagnostic categories. Biomarkers were highly sensitive to age and showed high levels of construct validity. Interim analyses data will provide additional information regarding EEG biomarker performance in feasibility and main study, test-retest stability, and implications for identifying an EEG biomarker with suitable psychometric performance, relation to clinical status, and potential for stratification in future clinical trials.

11:45 **177.004** The Autism Biomarkers Consortium for Clinical Trials: Eye Tracking Interim Analyses

F. Shic[1], *A. Naples*[2], *E. Barney*[1], *C. Sugar*[3], *M. Murias*[4], *J. Dziura*[5], *C. Brandt*[5], *R. Bernier*[6], *K. Chawarska*[2], *G. Dawson*[7], *S. Faja*[8], *S. Jeste*[3], *C. A. Nelson*[8], *S. J. Webb*[6] *and J. McPartland*[2], *(1)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (2)Child Study Center, Yale University School of Medicine, New Haven, CT, (3)University of California, Los Angeles, Los Angeles, CA, (4)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (5)Yale University, New Haven, CT, (6)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (7)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (8)Boston Children's Hospital, Boston, MA*

Background:
Eye tracking (ET) provides indices of cognitive processes via overt attention. ET measures robustly capture differences in social information processing in ASD, as well as associations with clinically-relevant phenotype. However, many prior studies have focused on theoretical mechanisms, relied on small samples, or have not been replicated.

Objectives:
To examine the suitability of several prominent ET paradigms for use as autism biomarkers.

Methods:

ET data were acquired from 4-11 year-old (average: 7.2±2.2 years) children with ASD (*n*=24) and typical development (TD, *n*=26) with EyeLink 1000 Plus 500hz eye trackers during the following experiments: activity monitoring (AM: actresses engaged in shared activities), social interactive (SI: play interaction between children), biological motion (BM: side-by-side presentations of human motion point-light versus scrambled/rotating points), dynamic naturalistic scenes (DNS: social/emotional movies), visual search (VS: array of social/non-social objects), gap overlap (GO: orienting to a peripheral target from a central cue), pupillary light reflex (PLR: pupil size changes after bright flash), static scenes (SS: naturalistic social scenes), and spontaneous social orienting (SSO: actress looking and speaking to the camera). IQ was added as a covariate in group comparisons. Trial-level quality control (QC) requirements included: valid data acquired for more than 50% of stimulus presentation (%Valid), calibration uncertainty/error less than 2.5 degrees; experiment-level QC included 25% of trials being valid; subject-level QC included 1 or more valid experiments. Primary and secondary variables varied per experiment. Phenotypic associations were examined in the ASD group using Spearman's rank correlation.

Results:

Valid experiment acquisition was >90% in both groups for all experiments except GO (88%). 96% of the ASD group and 100% of TD provided at least one valid experiment. Lower %Valid was noted in ASD (p<.05) for DNS, PLR, SS, but also in sub-conditions of specific experiments (e.g. static images in AM). No between-group calibration differences emerged for any experiment. Primary variable differences (ASD<TD, *p<.05, ~p<.10) were noted in AM (%Heads*), SI (%Social~), VS (%Face*), SS (%Face*), and SSO (%Face*, Dyadic Bid and Joint Attention phases); secondary differences in DNS (%Eyes*), GO (overall reaction time*); no differences in BM and PLR. Positive associations in ASD were seen between %Valid and Overall IQ (AM~, SI*, VS*), Vineland Social standard scores and SI %Head~, ADOS overall severity and PLR latency~, and age and PLR constriction*; negative associations between IQ and calibration error (AM*,BM*,VS~), ADOS SA severity and %Valid (SS~,VS*), and SRS Social Awareness T and %Heads/%Face (AM*,SI~,SS*). The presentation will include updated data from the larger interim analysis sample.

Conclusions:

ET paradigms generated valid data for nearly all participants. Paradigms with support for validation were mainly drawn from those with primary predictions of diminished face/head looking in ASD. Over multiple paradigms, decreased valid data collection in ASD was associated with lower IQ and increased symptom severity, suggesting QC variables may index pervasive characteristics of atypical attention in ASD. Complex patterns of phenotypic association point to nuances relating to selection of ET paradigms with ideal biomarker characteristics. In summary, these results highlight the promise of ET biomarkers for ASD.

Panel Session
Social Cognition and Social Behavior

178 - Fluctuations over Time in Parenting and Parent-Child Interactions in Families with a Child with Autism Spectrum Disorder

10:30 AM - 12:30 PM - Willem Burger Zaal

Panel Chair: Herbert Roeyers, *Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Discussant: Ilse Noens, *Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium, Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium*

Parent-child interactions influence the emotional, behavioural and cognitive development of children. There is increasing evidence that parent-child interactions and parenting practices are atypical in families with a child with autism spectrum disorder (ASD), but many of the findings lack consistency. This is partly due to the cross-sectional nature of the majority of studies that do not take into account bidirectional and transactional processes occuring in these families. The current panel presents four studies that used different methods to study changes in parenting behaviour and parent-child interactions in infancy, toddlerhood and middle childhood. The first presentation reports findings of a study on dyadic visual attention during parent-child interactions in high-risk (HR) and low-risk (LR) infants at 10 and 14 months. The next presentation focuses on changes in parent-child interactions between 5 and 10 months in a European cohort of HR and LR dyads. The third presentation highlights the changes in parent-child interaction in HR and LR children at five time points between 5 and 36 months. The last presentation reports on a 7-day diary study which analyzed daily parenting fluctuations in mothers of children with ASD. Together the four contributions reflect the dynamic, rather than the fixed, nature of parent-child interactions.

10:30 **178.001** Dyadic Visual Attention during Interactions of Infant Siblings and Their Parents in Relation to the Child's Attention Disengagement and Clinical Symptoms

A. Radkowska[1], *A. Niedzwiecka*[2], *S. Ramotowska*[3], *A. Malinowska*[3], *R. Kawa*[3], *E. Pisula*[3] *and P. Tomalski*[4], *(1)University of Warsaw, Faculty of Psychology, Warsaw, Poland, (2)Health and Rehabilitation Psychology Unit, University of Warsaw, Faculty of Psychology, Warsaw, Poland, (3)University of Warsaw, Warsaw, Poland, (4)Psychology, University of Warsaw, Warsaw, Poland*

Background:

Recently, efforts have been made to investigate the early precursors of autism spectrum disorder (ASD) by studying infants at familial risk for autism (HR). Studying early parent-infant interactions may give insight into the development of this disorder (Wallace & Rogers, 2010). Studies of global characteristics of parent-infant interactions of infant siblings showed that the quality of early dyadic interactions is associated with later diagnostic outcomes in ASD (Wan et al. 2012,2013).

Early development of infant visual attention during social interactions is associated with a range of developmental outcomes in typical and atypical populations. In typical development, dyadic infant-mother mutual attention during free play predicts later efficiency of attention disengagement (Niedźwiecka et al. 2015). HR Infants at 14 months of age differ from low-risk (LR) controls in attention disengagement skills, which predicts subsequent ASD diagnosis at 36 months (Elsabbagh et al., 2013).

Objectives:

This study examined the changes between individual and dyadic visual attention behavior during parent-infant interaction in HR and LR groups, when infants were 10, 14 and 24 months. The following analyses investigated the associations between dyadic states of attention at 10, 14 and 24 months and both concurrent and subsequent attention disengagement and clinical symptoms.

Methods:

As a part of a longitudinal Polish Autism Study of Infant Siblings we analyzed 6-min-long episodes of free parent-infant interactions when infants were 10, 14 and 24 months and coded them in terms of visual attention distribution, (32 HR siblings, 22 LR siblings). We measured the efficiency of attention disengagement using the gap-and-overlap-task and autism symptoms with ADOS-2 at 14, 24 and 36 months. At the conference, we will present the complete dataset including the analysis of visual attention during interactions at 24 months and clinical outcomes at 36 months.

Results:

Although we expected a decrease in the infant attentiveness to the parent in the HR group between 10 and 14 months (Wan et al., 2013), we did not find it in our sample. At both visits at 10 and 14 months HR infants spent more time looking at the parent manipulating an object and less time looking at the parent and at objects alone in comparison to LR siblings. Parents of HR infants spent less time looking at them than parents of LR children at both time points.

Looking at dyadic level of behaviors, we did not find significant group differences in dyadic attention at 10 and 14 months of age. However, dyadic mutual as well as parallel attention during interactions at 10 months were negatively correlated with ADOS-2 scores at 24 months. Additionally, in the HR group, the time spent in mutual attention during interaction at 10 months correlated negatively with results in attention disengagement task at 14 months.

Conclusions:

Dyadic measures of visual attention during infant-parent interactions already at 10 months may constitute an early predictor of later outcomes in HR siblings. Our results suggest the crucial role of the early social interactive environment for visual attention development in atypically developing children.

10:55 **178.002** A Behavioural Profile of Parent-Child Interaction Characteristics during the First Year of Life in High- and Low-Risk Infants

M. K. J. Pijl[1,2], *C. Bontinck*[3], *N. N. J. Rommelse*[4], *S. Kalwarowsky*[5], *E. Cauvet*[6], *A. Niedzwiecka*[7], *T. Falck-Ytter*[8], *E. J. Jones*[9], *T. Charman*[10], *P. Warreyn*[11], *H. Roeyers*[11], *J. K. Buitelaar*[12,13], *I. J. Oosterling*[2] *and &. the Eurosibs team*[14], *(1)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Centre Nijmegen, Nijmegen, Netherlands, (2)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (3)Department of Experimental-Clinical and Health Psychology, Ghent University, Gent, Belgium, (4)Department of Psychiatry, Donders Institute for Brain, Cognition and Behaviour, Radboud university medical center, Nijmegen, Netherlands, (5)Centre for Brain and Cognitive Development, Birkbeck University of London, London, United Kingdom, (6)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (7)Health and Rehabilitation Psychology Unit, University of Warsaw, Faculty of Psychology, Warsaw, Poland, (8)Karolinska Institutet & Uppsala University, Uppsala, Sweden, (9)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (10)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (11)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (12)Department of Cognitive Neuroscience, Donders Institute for Brain, Cognition and Behaviour, Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (13)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (14)The European Babysibs Autism Research Network, London, United Kingdom*

Background: During the first year of life the interaction between parent and child forms a key aspect of child's social environment. Previous studies found that parent-child interaction (PCI) in children at high risk (HR) of autism spectrum disorder (ASD) is disrupted. This may be due to either parent or child behaviors that in an interaction between the child's risk status and the social environment leads to an increasingly atypical development. More knowledge is needed about how early PCI differences arise in ASD and how they change over time. Answering these questions may help to strengthen PCI as a promising avenue for early intervention.

Objectives: (1) Investigating the inter-rater reliability of a newly developed coding scheme to rate PCI at 5 and 10 months of age; (2) Obtaining a detailed behavioural profile of the interaction between HR and LR infants and their caregiver, and to investigate differences between these groups.

Methods: As part of the Eurosibs Autism Research network (www.eurosibs.eu), the Parent-Infant/Toddler Coding of Interaction (PInTCI) was developed, including characteristics of PCI that predicted subsequent child development in ASD research. This global coding scheme consists of 5 child constructs (attentiveness – initiations – sharing of affect – positive affect – negative affect), 5 parent constructs (sensitive responsiveness – negative control – scaffolding – positive affect – negative affect) and 1 dyadic construct (dyadic reciprocity), rated on a 1-7 scale. Videotaped parent-child dyads were observed at 5 months (63 HR, 47 LR) and 10 months (93 HR, 73 LR). Coders were blind to risk status.

Results: (1) Intra-class correlations (ICC) showed excellent inter-rater reliability for all PCI constructs at 10 months (ICCs ranged from 0.79 to 0.96, all $p \leq 0.001$). At 5 months, reliability ranged from good to excellent reliability (ICCs ranged from 0.68 to 0.95, all $p < 0.05$), except for a poor to fair reliability for infant initiations (ICC=0.47, $p > 0.05$) and parental negative affect (ICC=0.23, $p > 0.05$) (which were removed from further analyses). (2) Analyses adjusted for age, sex and site showed no differences at 5 months between HR and LR dyads (all $p > 0.05$). At 10 months, results revealed that HR siblings showed less initiations towards their parents as compared to LR siblings ($p < 0.01$). Differences in parent or dyadic behaviors were not found at 10 months (all $p > 0.05$). Examination of PCI characteristics across 5 and 10 months showed no significant effects of time (all $p > 0.05$).

Conclusions: Our results indicate that the PInTCI, based on its inter-rater reliability, seems to be a promising coding measure of PCI that can be used during the first year of life. Application of the PInTCI showed that HR and LR dyads did not differ at 5 months of age, but by the end of the first year dyads started to differ based on the child's behaviour. Consistent with previous literature, our findings suggest that atypicalities start to emerge around the first birthday. Explanations for findings and recommendations for future research will be discussed.

11:20 **178.003** Mother-Child Interaction of High-Risk Siblings throughout the First Three Years of Life

E. Demurie[1], *E. Bruyneel*[2], *J. Vermeirsch*[1], *C. Bontinck*[2], *P. Warreyn*[1] *and H. Roeyers*[1], *(1)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Gent, Belgium*

Background: In families with a child with autism spectrum disorder (ASD), parent-child interactions (PCI) can be more challenging compared to families with only typically developing children. Within the transactional model of development this difference is explained by bidirectional influences of both interaction partners during PCI: parents might try to compensate for their child's social-communicative difficulties by using more directive interaction strategies. Given that siblings of children with ASD have a higher risk of developing (characteristics of) ASD themselves, PCI research has also focused on those high-risk (HR) siblings. These studies have shown that HR siblings are less lively during PCI and that the ASD-specific (directive) parental interaction style seems to be (at least partly) generalized to the younger siblings. Given the positive association of PCI characteristics with later development, it is important to investigate developmental pathways of PCI characteristics and its possible impact on the development of HR siblings.

Objectives: The current study observed PCI in HR and low-risk (LR) siblings at five time points throughout the first three years of life. Maternal, infant and dyadic PCI characteristics were compared between groups and the link with later cognitive and social-communicative functioning was explored.

Methods: Unstructured play interactions of 76 mother-infant dyads (38 HR, 38 LR) were observed at 5, 10, 14, 24 and 36 months and coded with the Coding Interactive Behavior scheme (Feldman, 1998). Mullen Scales of Early Learning (MSEL) and ADOS-2 were administered at 10 (only MSEL), 14, 24 and 36 months.

Results: HR dyads were rated lower for dyadic reciprocity at 10 months, maternal limit setting and dyadic reciprocity at 24 months and infant involvement at 36 months.

Within the whole sample, the predictive value of PCI characteristics at 5 and 14 months for later social-communicative, cognitive and PCI characteristics was rather limited.

At 10 months PCI characteristics were predictive of ADOS scores at 14 and 24 months, MSEL subscale scores at 14 and 36 months, and PCI characteristics at 24 and 36 months. Finally, at 24 months infant negative emotionality during PCI was predictive of higher ADOS scores and lower MSEL scores at 36 months; and infant involvement was predictive of higher MSEL language scores at 36 months.

On the other hand, higher ADOS scores at 14 months predicted less maternal limit setting and infant involvement at 24 months and less infant involvement at 36 months. ADOS scores at 24 months predicted all PCI characteristics at 36 months.

Conclusions: Throughout the first three years of life PCI of HR siblings is characterized by lower levels of dyadic reciprocity, and a lower level of infant involvement at the age of three. Predictive value of PCI characteristics for later functioning is strongest at the ages of 10 and 24 months. On the other hand social-communicative functioning also predicts PCI characteristics at later ages. These bidirectional associations are in line with the transactional model of development. At the conference, the relationship between PCI characteristics and diagnostic outcome at 36 months and implications of the findings will be discussed.

11:45 **178.004** Daily Sources of Autonomy-Support and Control in Mothers of Children with ASD: The Role of Child Behavior and Mothers' Psychological Needs

L. M. Dieleman[1]*, S. S. De Pauw*[2]*, M. Vansteenkiste*[1]*, P. Prinzie*[3] *and B. Soenens*[1]*, (1)Department of Developmental, Personality, and Social Psychology, Ghent University, Ghent, Belgium, (2)Department of Special Needs Education, Ghent University, Ghent, Belgium, (3)Erasmus University Rotterdam, Rotterdam, Netherlands*

Background: Many parents would probably agree that, when it comes down to rearing children, one day is not the other. On some days, parents can be patient and sensitive towards their children without any effort, whereas on other days parents can experience difficulties to be attuned to their children's perspective and even inclined to interact with their children in a more pressuring fashion (Dix, 1991). Dairy studies in community samples have confirmed that controlling and autonomy supportive parenting behaviors vary considerably on a daily basis (e.g., Mabbe et al., in press). In parents of children with autism spectrum disorders (ASD), however, the short-term variability in parenting remains unexamined. Given that the specific symptoms and behaviors of children with ASD confront parents almost on a daily basis with unique challenges (e.g., Pottie, Cohen, & Ingram, 2009), it is important to advance the understanding of the daily dynamics in raising a child with ASD.

Objectives: To gain more insight in the sources of daily parenting among parents of children with ASD, this study aims to investigate whether daily variation in both child behavior and in mothers' own psychological needs (Deci & Ryan, 2000) relates to daily variation in controlling and autonomy-supportive parenting. In addition, this study aims to offer more insight into the mechanisms underlying these daily relations by examining the mediating role of daily parental vitality and stress.

Methods: Data will be presented from a 7-day diary study examining the daily associations between child behavior (i.e., externalizing and internalizing problems, prosocial behavior), mothers' psychological needs (i.e., autonomy, competence, and relatedness), parenting behavior (i.e., autonomy-support and controllingness), stress and vitality. In total 42 mothers (M_{age} = 41.60) of children with ASD (M_{age} = 10.94, range 7-15) participated.

Results: Analyses revealed that both daily child behavior and mothers' psychological needs relate to day-to-day variation in parenting behavior. Moreover, the majority of these relations could be accounted for by daily stress and vitality in the mother-child interaction. More specifically, the results revealed a maladaptive and an adaptive pathway: stress accounted for the associations of externalizing child problems and maternal need frustration with controlling parenting, whereas vitality accounted for the association between need satisfaction and autonomy support.

Conclusions: This study highlights (1) that parenting is a dynamic phenomenon among mothers of children with ASS, (2) the importance of both daily child behavior and mothers' own psychological functioning in parenting a child with ASD, and (3) the key role of daily stress and vitality in effects of daily antecedents on daily maternal parenting.

Panel Session
Sensory, Motor, and Repetitive Behaviors and Interests
179 - Brain-Behavior Mechanisms of the Sensory and Motor Features of Autism
10:30 AM - 12:30 PM - Willem Burger Hal

Panel Chair: Robin Shafer, *Vanderbilt Brain Institute, Vanderbilt University, Nashville, TN*

Sensory and motor features are highly prevalent in autism spectrum disorder (ASD) and contribute to individual differences across the spectrum. They are often associated with “core” social-communication deficits and repetitive behaviors in ASD. However, these sensory and motor features remain understudied. Consequently, we lack rigorous methods for measuring them, and have limited understanding of their underlying brain-behavioral mechanisms and the contribution of sensory and motor processing differences to core aspects of ASD. Symposium speakers from several labs will present studies using various neural and behavioral measurement approaches to better understand sensory and motor symptoms in ASD. Ms. Zoltowski (Vanderbilt University) will present fMRI data demonstrating differences in neural processing of tactile stimuli in ASD. Ms. Shafer (Vanderbilt University) will present EEG and motor performance data demonstrating the role of sensorimotor integration in neural and behavioral adaptability and its relation to core characteristics of ASD. Dr. Ewen (Johns Hopkins University) will present data illustrating how individuals with ASD acquire the skills involved in visuomotor imitation. Dr. Mosconi (University of Kansas) will discuss the functional neural circuitry involved in translating sensory feedback into precise motor output in ASD. Together, these papers represent novel approaches for exploring this under-represented area of autism research.

10:30 **179.001** Differences in Temporal Profile of Brain Responses By Pleasantness of Somatosensory Stimulation in Individuals with ASD

A. Zoltowski[1], *M. D. Failla*[2], *E. J. Moana-Filho*[3], *G. Essick*[4], *G. Baranek*[5], *B. P. Rogers*[6,7] *and C. J. Cascio*[8], *(1)Vanderbilt University, Nashville, TN, (2)Psychiatry, Vanderbilt University, Nashville, TN, (3)Division of TMD and Orofacial Pain, School of Dentistry, University of Minnesota, Minneapolis, MN, (4)Department of Prosthodontics, School of Dentistry, University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (6)Radiology and Radiological Sciences, Vanderbilt University, Nashville, TN, (7)Institute of Imaging Science, Vanderbilt University, Nashville, TN, (8)Vanderbilt University School of Medicine, Nashville, TN*

Background: Individuals with autism spectrum disorders (ASD) show varied behavioral responses to somatosensory stimuli, including hyper-reactivity to light touch and hypo-reactivity to pain. Investigation of the neural processing underlying these differences can be informed by previous fMRI studies of sustained painful stimuli. These studies have isolated three distinct phases of pain processing, including a late phase encompassing stimulus offset and reflecting cognitive-affective evaluation of pain (Moulton et al., 2012). Individuals with ASD show diminished response in the two later phases of this triphasic pattern (Failla et al., 2017), suggesting differences in pain evaluation but not sensation or perception. It is not known whether this is unique to painful stimulation or if this pattern extends to non-painful stimuli, either pleasant or aversive.

Objectives: Our objective was to investigate the temporal profile of brain responses to non-painful somatosensory stimulation in individuals with ASD.

Methods: 28 Adults (ASD=14, typically developing (TD)=14) underwent functional magnetic resonance imaging (fMRI) in a block design using 3 textures with previously normed pleasantness ratings in the general population (Essick et al., 2010): soft brush (pleasant), burlap (neutral), and plastic mesh (unpleasant). On each trial, a texture was stroked along the right forearm with moderate speed and pressure for 30 seconds. Changes in blood oxygenation level-dependent (BOLD) signal were analyzed during early, intermediate, and late phases, consistent with prior studies. Results were cluster-corrected, thresholding at $Z>2.3$ and $p< .05$.

Results: Between groups, we found significant differences (TD>ASD) in BOLD signal change for pleasant (brush) and neutral (burlap) textures. For the brush, the TD group had greater response in left postcentral gyrus and right superior parietal lobule during the early and intermediate phases (all peak Zs> 4.0, all $p_{corr} < .0001$). For the burlap, group differences were only significant during the early phase and occurred in the paracingulate gyrus ($Z_{peak}=4.16$, $p_{corr}<.005$) and right angular gyrus ($Z_{peak}=4.01$, $p_{corr}<.05$). There were no group differences for the plastic mesh texture.

Within groups, the TD group showed significant early and intermediate phase responses to all stimuli. The ASD group had a more limited pattern of response, with increased BOLD signal during the late phase for the burlap texture (Left Central Operculum/Insular Cortex, $Z_{peak}=3.62$, $p_{corr}<.005$) and during the early phase for the mesh texture (Right Parietal Operculum, $Z_{peak}=3.64$, $p_{corr}<.0001$ and Left Insula, $Z_{peak}=3.87$, $p_{corr}<.0001$).

Conclusions: Group differences for the more pleasant textures seemed driven by limited responding in the ASD group, who showed more reliable responses to more aversive stimuli. As cognitive-affective evaluation may be less critical for non-painful stimuli, the TD group did not show late phase responses; however, the late phase response to the neutral burlap in the ASD group may reflect difficulty evaluating ambiguous, neutral sensory stimuli. The finding of an intact early but not intermediate and late phase response by the ASD group to the mildly aversive mesh texture extends the finding by Failla et al. (2017) in pain processing, suggesting a continuum of aversive sensation for which cognitive-affective evaluative processes may be affected in ASD.

10:55 **179.002** Neural and Behavioral Mechanisms of Behavior Change and Adaptability: Examining the Role of Sensorimotor Integration in Autism

R. L. Shafer[1], *E. Solomon*[2], *K. M. Newell*[3], *M. Lewis*[4] *and J. W. Bodfish*[1,5,6], *(1)Vanderbilt Brain Institute, Vanderbilt University, Nashville, TN, (2)Wesleyan University, Middletown, CT, (3)College of Education, University of Georgia, Athens, GA, (4)University of Florida, Gainesville, FL, (5)Department of Hearing and Speech Sciences, Vanderbilt University Medical Center, Nashville, TN, (6)Vanderbilt Kennedy Center, Vanderbilt University, Nashville, TN*

Background: Unusual sensory symptoms and motor deficits are highly prevalent in autism spectrum disorder (ASD). They can emerge early in the development of ASD, before the core social deficits and repetitive behaviors emerge, and their prevalence suggests that deficits in sensorimotor integration may contribute to characteristic features of ASD. Sensorimotor integration is the process through which the brain uses continuous sensory information to produce flexible patterns of behavior that support adaptation to one’s surroundings. Thus, impairments in sensorimotor integration may contribute to the development of inflexible patterns of social and nonsocial behavior that characterize ASD. We currently lack techniques to precisely measure sensorimotor integration in ASD and so lack an understanding of the role it may play in ASD.

Objectives: Our study aimed to (1) develop a method to simultaneously assess neural and behavioral function during a sensorimotor task, (2) develop measures of the adaptability of neural and behavioral output during the sensorimotor task, and (3) examine differences in neural and behavioral adaptability in persons with ASD.

Methods: We designed a stimulus-tracking task with simultaneous recording of high density EEG. Participants used a computer mouse to control an on-screen cursor. They were instructed to keep the cursor inside of a target that moved across the screen in a series of unpredictable patterns. The task consisted of two sensory conditions: (1) Visual Feedback: target and cursor were visible on the screen for the duration of the trial, (2) No Visual Feedback: target and cursor were visible at the beginning of the trial, but disappeared mid-trial, and participants were instructed to continue moving the mouse as if the target and cursor were still visible. Participants included young, right-handed adults with ASD (N=20) and an age- and gender-matched typically developing group (N=18). We analyzed group and visual feedback effects on motor performance (root mean squared error of cursor position), motor complexity (sample entropy), and neural complexity (multi-scale sample entropy).

Results: Participants show significantly greater error in task performance when visual feedback is not available (t=10.39, p<0.001). Consistent with this finding, motor complexity is significantly reduced in the absence of visual feedback (t=23.59, p<0.001), indicating more stereotyped patterns of movement when feedback is not available compared to when it is. Participants also demonstrate lower neural complexity in task-relevant scalp regions when feedback is withheld (Frontal: t=3.29, p=0.006; Occipital: t=3.07, p=0.009), paralleling the patterns of motor complexity.

Conclusions: Our results indicate that reliable sensorimotor integration and the availability of sensory feedback provide the brain with rich information with which to generate complex, adaptive motor output. In the absence of sensory feedback, the neural signal contains less information and correspondingly, the motor signal is more stereotyped and inflexible, thus this task provides a standardized, objective measure of inflexible, stereotyped behavior. Sensorimotor integration is likely disrupted in individuals with ASD resulting in less complex neural signals and consequently less complex, less adaptive behavior. Our ongoing work involves adapting our sensorimotor task into a “game-like” virtual reality environment, which allows assessment at earlier periods of development.

11:20 **179.003** Capacity Limits and Learning: Two Views of Altered Visuo-Motor Imitation in ASD

J. B. Ewen[1,2]*, S. H. Mostofsky*[3]*, A. S. Pillai*[1,2] *and D. McAuliffe*[1]*, (1)Kennedy Krieger Institute, Baltimore, MD, (2)School of Medicine, Johns Hopkins University, Baltimore, MD, (3)Center for Neurodevelopmental and Imaging Research, Kennedy Krieger Institute, Baltimore, MD*

Background: Impairments in visuo-motor imitation have been recorded in ASD since the 1970's, and are believed by some to have a fundamental, causal role in the development of the disorder. What is less well understood is how these imitation deficits come about. Based on clinical experience, we have developed two hypotheses regarding the basis for these imitation deficits. The first centers around capacity limitations. Specifically, we have noted that children with ASD have a challenge imitating gestures when they are required to do two components simultaneously. On the other hand, we also suggest a framework for impaired gesture imitation in which children with ASD may have trouble building up representations of the novel gestures through impaired learning mechanisms.

Objectives: We tested these two hypotheses regarding the basis for altered imitation in ASD independently.

Methods: Study 1A: High-functioning children with ASD aged 8-12 years and age- and IQ-matched controls (n = 25+25) were asked to imitate 9 novel, meaningless gestures with their right hand in which movement elements (e.g., supinate the forearm, flex fingers 1 and 2) were all serial, and 7 gestures in which these elements were overlapping (simultaneous). Performance was recorded as correct or incorrect. Study 1B: 15 pairs of gestures were constructed in which there was a serial version and an simultaneous version. 7 children with ASD and 7 controls participated. Study 2A: 4 children with high-functioning ASD and 5 controls participated in a novel gesture learning task, in which they watched videos of a model performing a meaningless gestures. At a Go cue, they copied that gesture and were scored as performing it correctly or incorrectly. They repeated this cycle 5 more times with the same gesture. 12 gestures were tested. Study 2B: Similar to 2A, but with four repetitions of each gesture. 16 children with ASD and 17 controls participated.

Results: Study 1A: Main effects were seen for diagnosis (ASD had more errors than TD) and for gesture type (simultaneous gestures evoked more errors than serial). The central finding was the interaction effect: children with ASD had greater performance cost for simultaneous (over serial) gestures than controls. Partial eta squared: 0.21, p=0.001. This effect size stayed constant even when controlling for the total number of elements in each gesture. Study 1B: When the serial and simultaneous gestures were paired (i.e., the only difference was the relative timing of the two elements), there were no group differences in serial gesture error rates. The group x gesture-type interaction effect size was 0.42 (partial eta squared), p = 0.017. Study 2A: Children with ASD took an average of 4.0+/-2.3 trials to perform a gesture correctly; TD, 2.7+/-2.1 (p=0.013). Study 2B: Children with ASD took an average of 3.3+/-2.3 trials to perform a gesture correctly; TD, 2.3+/-1.7 (p=0.01).

Conclusions: There is independent evidence for both accounts of impaired imitation in ASD--a more restrictive capacity limitation, and impaired learning of the motor representation. Work using EEG to establish neural correlates is ongoing.

11:45 **179.004** The Functional Neuroanatomy of Visuomotor Impairments in ASD

M. W. Mosconi[1]*, K. E. Unruh*[1]*, R. J. Lepping*[2]*, Y. Wang*[3]*, L. M. Schmitt*[4]*, Z. Wang*[5]*, S. Lui*[3]*, D. E. Vaillancourt*[6] *and J. A. Sweeney*[7]*, (1)Kansas Center for Autism Research and Training (K-CART), University of Kansas, Lawrence, KS, (2)Hoglund Brain Imaging Center, University of Kansas, Kansas City, KS, (3)Huaxi MR Research Center (HMRRC), Department of Radiology, West China Hospital of Sichuan University, Chengdu, China, (4)Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (5)Department of Occupational Therapy, University of Florida, Gainesville, FL, (6)Applied Physiology and Kinesiology, University of Florida, Gainesville, FL, (7)Division of Developmental Behavioral and Pediatrics, Cincinnati Children’s Hospital Medical Center, Cincinnati, OH*

Background: Sensorimotor impairments are common in ASD and associated with worse functional outcomes. We previously documented increased force variability during continuous visuomotor behavior in ASD. Patients’ visuomotor deficits were more severe when the force required or the precision of visual feedback were increased implicating both motor and sensory feedback processes. Characterizing the neural processes associated with visuomotor deficits in ASD will help determine mechanisms of sensorimotor issues and related daily living skills.

Objectives: We will describe new results on neural processes associated with sensory feedback and motor control processes during visuomotor behavior in ASD.

Methods: Individuals with ASD aged 11-30 years and age-matched controls completed three functional MRI (fMRI) studies. For studies 1 and 2, participants completed visuomotor tasks in which they pressed with their thumb and index finger on a force transducer while viewing a white FORCE bar on a screen that moved upwards with increased force toward a fixed green TARGET bar. Participants were instructed to maintain the FORCE bar at the level of the TARGET bar for 26 seconds. For study 1, 20 participants with ASD and 15 controls pressed at 20 and 60% of their maximum force. For study 2, a separate 25 individuals with ASD and 22 controls pressed at 15% of their maximum force across three different visual feedback gain levels. At higher visual gains, the white FORCE bar moved a greater distance per change in Newtons of force relative to lower gains. For study 3, the same participants who performed study 1 completed a resting functional scan.

Results: During study 1, individuals with ASD showed reduced activation of contralateral motor cortex (M1), superior parietal lobule (SPL), and ipsilateral cerebellar lobules V-VI compared to controls. These hypoactivations were more severe at higher force levels. Individuals with ASD also showed greater activation than controls in middle frontal gyrus, supplementary motor area (SMA) and striatum at both force levels. During study 2, reduced M1, SPL and ipsilateral cerebellar activation was seen in ASD relative to controls at low visual gain. At high gain, individuals with ASD showed greater activation than controls in SPL. During rest, reduced SMA and cerebellar ALFF and reduced striatal-cortical and cerebellar-cortical connectivity each were associated with visuomotor deficits in ASD (r's>.6; p's<.05 corrected).

Conclusions: These studies indicate that elevated motor variability in ASD is associated with intrinsic alterations of frontal, parietal, striatal and cerebellar function and connectivity. We found that parietal-cerebellar-M1 circuits involved in reactively adjusting motor output in response to visual feedback are underactive and less able to support precise motor behavior in ASD. Elevated frontostriatal activation in ASD suggests that brain systems typically involved in higher-level cognitive control may compensate for visuomotor network underactivity. Greater parietal activation in ASD at high visual gain suggests that deficient motor control during conditions of increased sensory load reflects hyper-reactivity of visual processing brain circuits. Together, these results indicate that atypical neural processes involved in translating sensory feedback into precision behavioral output represents a significant component of the neurodevelopmental processes that cause ASD.

Panel Session
Diagnostic, Behavioral & Intellectual Assessment

180 - Leveraging the Strengths of People with ASD: A Strengths-Based Approach to Intervention

10:30 AM - 12:30 PM - Jurriaanse Zaal

Panel Chair: Sven Bolte, *Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

While the abilities and strengths of people with autism spectrum disorder (ASD) are increasingly recognized, developing strengths-based interventions is hampered by a lack of consensus in regard to their commonly occurring skills and abilities, failure to articulate strengths-based frameworks, and the absence of multiple perspectives in identifying the mechanisms of strengths-based approaches, including those of people with ASD themselves. In this symposium we present findings from four projects adopting a strengths-based approach: The development of ICF core sets for ASD; a scoping review of the literature relating to strengths-based programs underpinning a provisional strengths-based framework; a realist evaluation of computer coding groups for adolescents with ASD employing multiple ethnographic methods defining the context, mechanisms and outcomes of the program; and, the self-reported viewpoints of adolescents diagnosed with ASD, their parents and coding mentors in relation to their participation ASD specific computer coding clubs.

10:30 **180.001** Abilities and Strengths of Individuals on the Autism Spectrum from a Global Perspective: Findings from the ICF Core Sets for Autism Development

__S. Mahdi__[1] and S. Bolte[2], (1)Karolinska Institutet Center of Neurodevelopmental Disorders (KIND), Karolinska Institute Center of Neurodevelopmental Disorders, Stockholm, Sweden, (2)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden

Background: Autism Spectrum Disorder (ASD) is associated with a wide range of social, occupational and educational challenges, but also strengths. To date, no standardized, internationally accepted tools exist to assess ASD-related strengths. The WHO's International Classification of Functioning, Disability and Health (ICF) can serve this need The ICF is based on a bio-psycho-social model of functioning, comprising of over 1600 categories related to various components of health: body functions, body structures, activities, participation and environmental factors. Not all are, however, applicable to a certain condition, which is why the process has been initiated to develop ICF Core Sets for Autism Spectrum Disorder (ASD); lists of generally-agreed-upon ICF categories pertinent to individuals with a certain health condition.

Objectives: We present the results of ASD-related strengths that were identified in our efforts to develop ICF Core Sets for ASD. The efforts included more specifically three cross-cultural and trans-disciplinary studies: an expert survey, a qualitative study and a clinical study.

Methods: The expert survey included 225 international experts representing 11 different disciplines and 43 countries across all six WHO-regions. The survey contained 7 questions related to functioning, of which one inquired about ASD-related strengths. The qualitative study involved focus group discussions and semi-structured interviews with individuals with ASD, family members and professional caregivers from 19 stakeholder groups in 5 countries from 5 WHO-regions. Qualitative content analysis was performed to extract meaningful concepts from survey responses and transcripts. These were then linked to ICF codes (if applicable) following specific linking rules. The ICF linking was not necessary in the clinical study. Instead, an extended version of ICF checklist (containing ICF categories) was used by clinicians to gather data from 122 individuals with ASD recruited at 11 clinical sites in 10 countries in 4 different WHO-regions. Frequency analysis was conducted in all studies to identify most common reported ASD-related strengths

Results: A large majority of experts (n = 207, 92%) indicated at least one ASD-related strength. The most common ones were b126 temperament and personality functions (n = 68, 30%; e.g. strong sense of morality), b140 attention functions (n = 67, 30%; e.g. attention to detail, intense focus) and specific expertise in a field (n = 52; 23%; e.g. video games, geographical facts). All stakeholder groups in the qualitative study identified at least one ASD-related strength, which included b126 temperament and personality functions (n = 8, 42%; e.g. honesty), b140 attention functions (n = 6, 32%; e.g. attention to detail) and b144 memory functions (n = 5, 26% e.g. memory for specific events). The clinical study yielded two ICF categories, namely b140 attention functions (n = 27, 21%) and b144 memory functions (n = 20, 16%).

Conclusions: Irrespective of study methodology and perspective, certain ASD-related strengths (e.g. memory, attention) were found to be recurring and important to functioning. The information on strengths can be meaningful for a variety of purposes. It can serve as basis for developing resource-oriented interventions in clinical settings to matching job assignments with individual strengths in employment services

10:55 **180.002** Strengths-Based Computer Coding Groups for Adolescents with ASD: A Realist Evaluation

__M. Jones__[1] and S. J. Girdler[2], (1)School of Occupational Therapy and Social Work, Curtin University, Bentley, Australia, (2)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia

Background: While research suggests that there has been much progress in improving outcomes for children and adolescents with Autism Spectrum Disorder (ASD) adult outcomes continue to be less than optimal. Specifically, the employment rate of individuals with ASD internationally remain poor. Strengths-based programs leverage individual strengths, potentially building skills that could assist in preparing adolescents with ASD for work and adult life, ultimately improving outcomes. Strengths-based programs focus on pathways for the future rather than trying to 'fix' impairments. However, little is known as to what constitutes a 'strengths-based program' and few studies document the active ingredients or the essential components of programs that result in a positive change in participants.

Objectives: To synthesise literature describing strengths-based programs for individuals with ASD and define their active ingredients.

Methods: A scoping review of strengths-based programs for individuals with ASD was undertaken. Database searches of AMED, CINAHL, MEDLINE, PsychINFO, EMBASE, Cochrane Library, Scopus and ERIC were undertaken for studies published between 1990 and 2017. Studies recruiting participants of any age with a diagnosis of ASD and claiming to describe a 'strengths-based program' were included. Descriptive data such as author, publication date, country, sample characteristics, aim, methodology, intervention type, outcome measures and results were extracted. The methodological quality of the studies was assessed via the quality assessment tool developed by Kmet, Lee and Cook. Thematic analysis identified the active ingredients of the strengths-based programs described in the studies which were linked to the International Classification of Functioning, Disability and Health (ICF) Core Sets for ASD. Consultation with stakeholders occurred in interpreting the results.

Results: Searches of relevant databases identified a total of 27 articles. Twenty articles evaluated strengths-based programs for individuals with ASD, including 9 qualitative and 11 quantitative studies, which ranged in methodological quality from limited (k=3) to very strong (k=11). The remaining articles (k=7) consisted of published feature or discussion articles and did not include or report any research methods. All articles were published between 2003 and 2017, with the majority of undertaken in the United States of America (k=20). Thematic analysis revealed ten major themes representing the active ingredients of strength-based programs for individuals with ASD; interests, family involvement, skill development, visual instruction, reframing weaknesses, autonomy, peer mentoring, routine, adult mentors and talents. Linking to the ICF Core sets for ASD highlighted the importance of environmental factors including *Chapter 1 Products and technology* and *Chapter 3 Support and relationships* in underpinning strengths-based programs.

Conclusions: While there is a paucity of research evaluating the efficacy of strengths-based programs for individuals with ASD and what constitutes a 'strengths-based program' is poorly defined in the literature, this review articulates for the first time a framework with the potential to underpin future programs. Future research is needed to evaluate the effectiveness of programs underpinned by these active ingredients in improving outcomes for people with ASD.

11:20 **180.003** Strengths-Based Programs for Individuals with Autism Spectrum Disorder: A Scoping Review Defining the Active Ingredients

M. Jones[1] *and S. J. Girdler*[2]*, (1)School of Occupational Therapy and Social Work, Curtin University, Bentley, Australia, (2)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia*

Background: While it is widely recognized that many individuals with Autism Spectrum Disorder (ASD) have abilities and strengths well suited to employment in the Information Communication Technology (ICT) industry, they continue to be under represented in this industry and their overall employment rate remains less than optimal. It has been proposed that employment outcomes in adulthood for people with ASD could be improved through strengths-based programs that leverage strengths, capitalize on existing skills and prepare adolescence with ASD for work. The Autism Academy of Software Quality Assurance (AASQA) and Autism West in Western Australia both deliver strength-based programs targeted at adolescents with ASD with interests in Science, Technology, Engineering, Arts and Mathematics (STEAM). A significant focus of these programs is computer coding clubs which draw from the CoderDojo approach which aims to provide a fun, free and social open learning environment where young people can meet others with similar interests to themselves, develop 21st century skills and build creative projects of their own choice using digital technology.

Objectives: To define the context, mechanisms and outcomes of strengths-based computer coding groups for adolescents with ASD.

Methods: A realist evaluation was employed triangulating ethnographic data collection methods (participant observations and focus groups) and investigators (two observers). Observations were undertaken during eight sessions of computer coding groups for 17 adolescents with ASD and five program mentors or facilitators. Focus groups were conducted with seven adolescents with ASD who had attended the computer coding groups, nine of their parents, and nine mentors or facilitators. Field notes and focus group discussions were transcribed verbatim and coded using the context, mechanism and outcome framework. Context refers to anything that was present prior to the intervention program, inclusive of personal factors. Mechanisms include program components that lead to change. Outcomes refer to changes that occur as a result of the strength-based program.

Results: Themes within the context category were personal factors of students with ASD, personal factors of facilitators and expectations of parents. Themes within the mechanism category were adaptable environment, facilitator-student interaction, student-student interaction, match between facilitators and mentors technical computer skills and student interests, shared interests, autonomy and goal setting. Themes in the outcome category included social engagement, skill development, goal achievement, confidence and motivation.

Conclusions: This study highlights the mechanisms of a strengths-based computer coding group, the context in which mechanisms occur and the outcomes for adolescents with ASD. The main findings emphasized the importance of matching the technical skills of facilitators with student interests, providing an adaptable environment and achieving social and technical skill outcomes. These findings, combined with those of previous strengths-based research in ASD, could potentially inform the development of a strengths-based framework to underpin future Science, Technology, Engineering, the Arts and Mathematics (STEAM) programs for young people with ASD. Future research should evaluate the effectiveness of STEAM programs underpinned by this framework in improving outcomes for people with ASD.

11:45 **180.004** Social Coding: The Viewpoints of Adolescents with ASD, Their Parents and Mentors on Participation in Social Coding Clubs

K. Catto[1]*, M. Falkmer*[2]*, S. J. Girdler*[3] *and M. Jones*[4]*, (1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (3)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia, (4)School of Occupational Therapy and Social Work, Curtin University, Bentley, Australia*

Background: While it is clear that people living with ASD experience challenges in social communication and interaction, there is increasing evidence that social functioning can be improved by providing opportunities to socialise in supported and structured environments. Parallel to this research there is emerging appreciation that many individuals with ASD possess abilities and strengths, including attention to detail and an affinity for rule based activities such as computer coding. It is likely that programs combining a group approach with an activity focus, such as computer coding, will be particularly engaging for adolescents with ASD. However, little is known of the experience of young people with ASD attending such programs, or the viewpoints of their parents or mentors on these programs.
Objectives: This study explored the viewpoints of adolescents diagnosed with ASD, their parents and coding mentors in relation to their participation in community computer coding clubs specifically targeted at adolescents with ASD.

Methods: Q methodology, which enables viewpoints to be obtained without an interview, was employed facilitating an in-depth understanding of attitudes and beliefs of participants regarding their experience of computer coding group. The Q methodology in this study followed the five stage procedure of: 1) Developing the concourse to gain insight into broad attitudes and beliefs of people involved in ASD-specific coding groups; 2) Identifying Q Sort statements guided by the concourse and the 'Five C's model' of Positive Youth Development; 3) Administering the Q Sort electronically or via a physical Q Sort grid and statement cards; 4) Factor Analysis using PQ method software; and, 5) Interpretation of factors. A total of 54 participants completed the Q Sort: 16 adolescents with ASD, 10 parents and 28 mentors.

Results: Two viewpoints were identified by adolescent participants and a total of three viewpoints were identified by parent and mentor participants. All adolescent participants loaded significantly onto either *Viewpoint 1) "Social coding is cool"*, or *Viewpoint 2) "Community coding is cool"*. In contrast, 11 parent/mentor participants loaded significantly onto either *Viewpoint 1) "Social coding is a pathway to the future", Viewpoint 2) "Social coding is challenging"*, or *Viewpoint 3) "Mentored coding is cool"*.

Conclusions: Findings highlighted that adolescents with ASD highly valued the social aspects of the computer coding clubs, while parents saw the coding clubs as a pathway to future job opportunities and as an opportunity for skill development. These divergent viewpoints underline the importance of consulting both adolescents with ASD and their parents in developing engaging and effective group interventions. Mentors also played a central role in facilitating the development of coding skills and social interaction. This study suggests that computer coding clubs are an approach which provides an opportunity to both practice and develop social skills and to learn technical coding skills, both of which are beneficial in the pathway to adult roles including employment.

Panel Session
Service Delivery/Systems of Care
181 - Developing ASD Interventions for End-Users: Examining the Process and Impacts of Training Providers in Multiple Community Service Systems
10:30 AM - 12:30 PM - Arcadis Zaal

Panel Chair: Lauren Brookman-Frazee, *Psychiatry, University of California, San Diego, San Diego, CA*

Discussant: David Mandell, *Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

The purpose of this panel is to describe community-partnered research aimed to develop and test clinical and service interventions for delivery in community services caring for children with ASD: early intervention, education, mental health, and primary care. These studies share a common focus on developing feasible and effective provider training models to enhance child outcomes in routine care. The first presentation describes the impact of a train-the-trainer implementation model for a naturalistic developmental behavioral intervention for infants and toddlers delivered in early intervention services on agency leader training outcomes. The second presentation reports results from a large-scale effectiveness trial including teacher and students outcomes when teachers were trained to deliver a behavioral classroom intervention. The third presentation reports results from a large-scale effectiveness trial of a behavioral intervention in publicly-funded mental health services including the impacts of training therapists on therapist practice and child symptoms. The final presentation reports initial qualitative themes from a new program of research aimed to enhance primary care provider training in integrated care for children with ASD. Dr. David Mandell, will highlight themes across studies and propose recommendations for developing interventions and training models for the targeted community services caring for children with ASD.

10:30 **181.001** Building Community Capacity for Evidence-Based, Parent-Mediated Early Intervention: Effectiveness of a Train-the-Trainer Approach

A. C. Stahmer[1], *S. R. Rieth*[2,3], *K. S. Dickson*[3], *K. L. Searcy*[4], *J. Feder*[5] *and L. Brookman-Frazee*[6], *(1)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (2)San Diego State University, San Diego, CA, (3)Child and Adolescent Services Research Center, San Diego, CA, (4)Speech & Language, San Diego State University, San Diego, CA, (5)Child and Family Psychiatrist Tertiary Outpatient and Neurobehavioral Medicine Private Practice, Solana Beach, CA, (6)Psychiatry, University of California, San Diego, San Diego, CA*

Background: Parent-mediated naturalistic developmental behavioral interventions (NDBI) have demonstrated positive child and family outcomes for young children with ASD (Zwaigenbaum et al., 2015; Burrell & Borrego, 2012). Despite demonstrated benefits, however, there has been little dissemination of parent-mediated NDBI into community settings, where the majority of children receive services (Stahmer et al., 2016). Community providers with expertise in both the NDBI strategy use and partnering with parents are needed to effectively deliver NDBIs. However, based on the range of mechanisms and avenues through which children with ASD may receive services, community providers have variable educational backgrounds and ASD specific experience. As communities struggle to serve the growing number of young children with ASD with appropriate intervention, more information is needed on effective provider training that adequately equips interventionists to work effectively with families and meet the specialized needs of children with ASD.
Objectives: The objective of this presentation is to demonstrate training outcomes from a train-the-trainer study of an evidence-based, parent-mediated NDBI for community early interventionists (Project ImPACT for Toddlers or PI for T; Ingersoll & Dvortscak, 2010).

Methods: A multiple probe design was used to examine effectiveness of the training model. Fourteen leaders from 12 publicly-funded community agencies participated. Agencies included school-based early intervention (N=2), infant and early childhood services (N=6), speech language (N=1), ASD specific agencies (N=1) and a Children's Hospital ASD clinic (N=1), and family health programs (N=1). Agency leaders received 12 weeks of training in PI for T from the research team. Leaders were trained in groups of 4-5, per the multiple probe design. After agency leader training was complete, each leader returned to their individual agency to deliver training to 2-3 interventionists (45 providers total). Intervention fidelity in PI for T was measured across the training period (before, during and after) at multiple time points. A total of nineteen fidelity criteria were rated on a 1-5 scale, where 1 = does not implement and 5 = implements competently and consistently.

Results: Agency leaders (n=14, 100%) were successfully delivered training at their agencies, utilizing both online (n=3) and in-person approaches (n=11). Intervention fidelity data are variable but demonstrate growth for strategies that providers were not implementing at baseline. On average, providers were using 21% of strategies correctly at baseline strategies (M=3.5 or above), including limiting distractions in the environment (baseline M = 4.1) and adjusting animation (baseline M=3.6). After training, on average, providers were using 74% of strategies correctly; waiting for a child response (baseline M=3.2, post-training M=3.8) and making comments/avoiding questions (baseline M=3.3, post-training M=4) demonstrated the most change. Specific support for sustainment beyond the training period (e.g., assistance securing public funding) facilitated agencies' continued use of the approach. Differences in post-training fidelity based on provider and agency characteristics will also be explored.

Conclusions: A train the trainer model is an effective method to build community capacity for evidence-based early intervention across a range of service settings. It may be possible to deliver training more efficiently by tailoring training to gaps in provider knowledge.

10:55 **181.002** Examining Effectiveness of Classroom Pivotal Response Teaching in Public Schools

__J. Suhrheinrich__[1], S. R. Rieth[1,2], S. Roesch[1] and A. C. Stahmer[3], (1)San Diego State University, San Diego, CA, (2)Child and Adolescent Services Research Center, San Diego, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA

Background: Autism interventions that are shown to be efficacious in controlled research settings are often not well integrated into schools, demonstrating the need for translation or adaptation for classroom use. These practices can be systematically adapted to ensure a fit with student and classroom characteristics while maintaining the active ingredients of the intervention. Such adaptations should improve teachers' fidelity of implementation of the intervention (FI; the degree to which the intervention is being applied as specified in the treatment manual) and thus facilitate better outcomes for students (e.g., Durlak & DuPre, 2008; O'Donnell, 2008; Sanetti & Kratochwill, 2009; Stahmer & Gist, 2001). Classroom Pivotal Response Teaching (CPRT) is a behavioral intervention for children with ASD adapted from Pivotal Response Training through an iterative process in collaboration with researchers, teachers, and school administrators (Stahmer, Suhrheinrich, & Rieth, 2017).
Objectives: This presentation will provide teacher outcomes from a large-scale community effectiveness trail of CPRT in schools including teacher and preliminary student outcomes.

Methods: The study used a randomized waitlist-control design with 108 classrooms (including the lead teacher and paraprofessional educators) over three years. Teachers (n=109) and students (n=256) from 17 school districts participated. Training procedures included 12 hours of small group didactic instruction, including goal setting, supervised exercises and role-playing. Individual coaching followed at weekly, then monthly intervals upon completion of didactic training. During coaching, teachers worked with their own students during regular classroom activities. Teacher measures included the Professional Development Assessment (PDA), fidelity of CPRT use and satisfaction surveys. Child measures included the ADOS, cognitive assessment, Vineland Adaptive Behavior Scales (VABS) and Pervasive Developmental Disability Behavioral Index (PDDBI).

Results: On average, trained teachers reported using CPRT for 50 min/day, and 3 days per week, with 37% of teachers using CPRT at least 4 days/week. Multilevel models indicated significantly higher fidelity of CPRT (as coded by naïve observers) for teachers who completed training as compared to control teachers (B=0.27, p=.001). Seventy-three percent of teachers met fidelity criteria (trainer coded) for CPRT after an average of 7.6 coaching sessions. Preliminary student data indicate significantly greater change on PDDBI during the training compared to control year. Scores on some scales were moderated by student age, teacher experience and classroom quality.

Conclusions: Results indicate CPRT is feasible in classroom settings and classroom teachers can be trained. Preliminary student outcomes are promising. Findings suggest collaborative adaptation of evidence-based practices may facilitate fidelity of the intervention in community settings. Considerations for sustainment and improving community outcomes will be discussed.

11:20 **181.003** Training Community Mental Health Providers to Deliver an Intervention for Children with ASD: Impacts on Therapist Practice and Child Behaviors

__L. Brookman-Frazee__[1], C. Chlebowski[2] and S. Roesch[3], (1)Psychiatry, University of California, San Diego, San Diego, CA, (2)National Institute of Mental Health, Bethesda, MD, (3)San Diego State University, San Diego, CA

Background:Publicly-funded mental health (MH) services play an important role in caring for school-age children with ASD. AIM HI ("An Individualized Mental Health Intervention for ASD", Brookman-Frazee and Drahota, 2010) was developed based on a systematic needs assessment and in collaboration with community stakeholders in response to the need for a scalable intervention for delivery in MH programs. AIM HI is a package of well-established parent mediated and child-focused behavioral strategies designed to reduce challenging behaviors, the most common presenting problem for children with ASD in MH services. The current study examined the impact of training community therapists to deliver AIM HI. Data were drawn from a completed large-scale randomized community effectiveness trial of AIM HI conducted in publicly-funded outpatient and school-based MH programs.
Objectives: The purpose of this study was to examine the impact of training community MH therapists to delivery AIM HI to their clients on observed therapist practice and child behavior problems and to identify therapist perceptions and child factors associated with these outcomes.

Methods: A waitlist controlled design was used in which 29 MH programs were randomized to either immediate AIM HI training or Usual Care/Delayed AIM HI training conditions. Therapist and client dyads were recruited from with enrolled programs. A total of 202 client/therapist dyads were included. Therapists were 86% female and 33% Latino and children (*M* age = 9.1 years) were 82% male and 56% Latino. Session-level therapist fidelity was collected over the 6 month training period during which the therapist delivered AIM HI to their client while receiving performance feedback from an AIM HI trainer. Specifically, video recordings of 1,153 psychotherapy sessions were coded for adherence to active teaching strategies (e.g., modeling, behavioral rehearsal) directed to children and parents. Therapists reported on their confidence using active teaching strategies at baseline. The Eyberg Child Behavior Inventory (ECBI) was completed by parents at baseline, 6 months (post), and 12 and 18 month follow up.
Results: AIM HI adherence was significantly higher for therapists who received AIM HI training compared to Usual Care therapists (B=1.40, p<.001).

Therapist self-reported pre-training confidence was associated with adherence directed to children (B=.17, p=.05). Results from three-level (time nested within child within program site) mixed effects modeling controlling for ASD severity and program setting (school, clinic) revealed a significant group by time interaction for ECBI Intensity scores (B=-0.38, p.015). Follow-up tests showed a significantly greater decline across the four time-points in the AIM HI training group (B=-1.36, p<.001) relative to the Usual Care group (B=-0.98, p<.001). Therapist AIM HI adherence and child behaviors in session significantly moderated this effect.

Conclusions: These results provide empirical support for the effectiveness of AIM HI on a key targeted outcome when delivered by community mental health providers and highlight the importance of therapist fidelity on outcomes. Next steps in the research include a recently-initiated, large scale implementation trial examining training and implementation leadership strategies to improve therapist fidelity.

11:45 **181.004** Enhancing Provider Training in Integrated Mental Health Care for ASD: Perspectives from Primary Care Providers and Leaders

N. A. Stadnick[1] *and S. broder-Fingert*[2]*, (1)University of California San Diego, La Jolla, CA, (2)Pediatrics, Boston University, Boston, MA*

Background: Children with autism spectrum disorder (ASD) have high rates of co-occurring psychiatric symptoms or diagnoses (e.g., Joshi et al., 2010) that necessitate mental health care. However, there are often challenges in timely identification of mental health comorbidities and linkage to services, resulting in high rates of unmet mental health needs (Farmer et al., 2014). Pediatric primary care is well-positioned to screen for and link children with ASD to needed mental health services earlier (Asarnow et al., 2015). However, these integrated care procedures need to be tailored for children with ASD to facilitate access to and receipt of mental health care. Detailed information from pediatric primary care stakeholders related to mental health screening and referral practices and perceived training needs to improve this process are needed for successful tailoring and implementation of integrated care for children with ASD.

Objectives: In this qualitative study, the perspectives of primary care providers and organizational leaders regarding the current infrastructure and needs of primary care providers to enhance integrated mental health care for ASD were examined.

Methods: Data were drawn from the first phase of a larger implementation study that will adapt and implement an integrated care model for children with ASD and co-occurring mental health concerns. Focus groups and key informant interviews were conducted with 12 pediatric primary care leaders and providers from two large health care organizations in Southern California that provide primary care to children with ASD. Participants were asked about current mental health screening and linkage procedures and how they modify these procedures for their patients with ASD.

Results: Discovery-oriented qualitative analyses revealed preliminary themes about provider experiences in mental health screening and referral with children with ASD. Primary care providers confirmed that the majority of their school-age patients with ASD exhibit symptoms of co-occurring psychiatric conditions, notably disruptive behaviors and anxiety. However, there is a paucity of standard mental health screeners administered to school-age children, placing the burden on caregivers or providers to identify and express psychiatric concerns about the child. Primary care providers often spend significantly more time (compared to patients without ASD) supporting caregivers to follow through on a mental health referral. The reasons for this are multifactorial but due, in part, to provider perception that caregivers may not view mental health care as a top priority or distinct from other recommended or ongoing treatment services (e.g., applied behavior analysis, educational supports).

Conclusions: These initial findings confirm the need for tailored integrated mental health care procedures for children with ASD. Further, findings highlight potential targets for provider training including selecting and using efficient and effective mental health screening tools and strategies to engage and empower caregivers to facilitate access to mental health services. Qualitative data from an additional 40 primary care providers and leaders will be analyzed and integrated. Further implications for integrated care provider training and research will be discussed.

Poster Session
182 - Brain Function (fMRI, fcMRI, MRS, EEG, ERP, MEG)
11:30 AM - 1:30 PM - Hall Grote Zaal

1 **182.001** Accurate Prediction of Individual Subject Identity and Task -- but Not ASD Diagnosis -- from Functional Connectomes

L. Byrge *and D. P. Kennedy, Psychological and Brain Sciences, Indiana University, Bloomington, IN*

Background: There is currently much interest in using functional connectivity (FC) MRI to identify neural biomarkers of ASD. However, for FC-based biomarkers to be useful, we need to know whether FC measurements are reliable in individuals with ASD and whether FC can robustly differentiate diagnostic groups (ASD vs. controls). Progress toward addressing these issues should also provide insights into the biological bases of ASD, including the neural heterogeneity or homogeneity of the condition.

Objectives: To evaluate FC reliability and predict diagnosis group in a sample of adults with ASD and controls using extensively and densely sampled fMRI data from each subject.

Methods: We acquired multiband resting-state and video-watching scans (813ms TR) from 29 adult controls and 22 matched individuals with ASD across multiple scan sessions, comprising over 2 hours of functional data per individual. Preprocessing, denoising, parcellation, and censoring are described in Byrge & Kennedy (in revision; see also Burgess et al., 2016). We computed correlations between each pair of FC matrices to assess similarity of FC. We used general linear mixed models to assess group differences in reliability and in similarity to NT scans while controlling for noise covariates. We used “connectome fingerprinting” (Finn et al., 2015) to predict identity, diagnosis, and scan type (rest/video) from maximal pairwise similarity. We also trained a classifier on the most informative FC edges to predict diagnosis and scan type while also controlling for noise covariates, extending the method of Shen et al. (2017). For visualization, we conducted multi-dimensional scaling.

Results: Within-individual consistency of functional connectomes did not differ across groups (rest/video, *p*=.14/.33, n.s.), indicating equivalent reliability across scans. Individual connectomes were highly distinct from other individuals, such that we could predict subject identity with 98% accuracy (see also Fig. 1, with subject scans generally clustering together). Using the same fingerprinting method, however, we could not predict subject diagnosis (56.8% accuracy, see also Fig. 2a), even though scans from the ASD group were reduced in similarity to NT scans (rest/video, *p*=0.026/.017). In contrast, this same method could be used to predict scan type (rest/video) with 97.6% accuracy (see also clear clusters in Fig. 2b), indicating that scan type elicited a stronger common FC pattern than diagnosis. Similar results were obtained using classifiers trained on only the most informative FC edges (60% accuracy for diagnosis; 96.8% accuracy for scan type). MDS results (Fig. 2a) depict scans from individuals with ASD spread farther apart from NT scans (i.e., more dissimilar) in all directions, without forming a common cluster, suggesting heterogeneous presentations of functional connectivity in ASD.

Conclusions: Our findings indicate that, at the spatial and temporal scale analyzed, functional connectomes in individuals with ASD present heterogeneously (consistent with our previous work; Byrge, Dubois, et al., 2015), rather than sharing a common pattern of FC abnormality. In other words, when connectomes from individuals with ASD differ from those of controls, they differ idiosyncratically. This suggests that successful biomarkers will require employing and developing analytic techniques sensitive to idiosyncratic (but stable) neural presentations.

2 **182.002** Action Observation Modulates Mirror Neuron System in Toddlers and Preschoolers with and without Autism Spectrum Disorders

***M. A. Krol**, J. Leano, H. Tager-Flusberg and D. Plesa-Skwerer, Psychological and Brain Sciences, Boston University, Boston, MA*

Background:
Action execution and observation lead to activation of the mirror neuron system (MNS). This system is hypothesized to be fundamental to social cognition. However, little is known about the development of the MNS, especially the functioning of this system in toddlers and preschoolers, the stage when communication skills are rapidly developing. Given that children with autism spectrum disorders (ASD) start to show clear signs of social deficits in this period, an important question is whether ASD is linked to impairments in the MNS that can be detected at this age.
Objectives:
The aim of the study was to compare neurophysiological activation during action observation and execution in the MNS between young children with and without ASD. Furthermore, we investigated whether observation of an action that is more relevant in social contexts (i.e. pointing) modulates the MNS activity differently than a direct action (i.e. grasping).

Methods:
Participants
15 typically-developed (TD) young children (M = 42.3 months; range 25-59) and 6 young children with ASD (M = 37.0 months; range 24-48) participated and provided quality data. ASD diagnoses were confirmed on the ADOS-2 Toddler module or Module 1.

Stimuli and procedure
To measure activation of the MNS, electroencephalography (EEG) recordings were obtained using the EGI system during action execution and observation. Power in the 7-10 Hz frequency band at the sensorimotor areas (C3 and C4 in the 10/20 system), the mu rhythm, was used as an index for MNS activity. This was measured when the toddlers and preschoolers performed a right-handed grasping action and when they observed video clips of the same grasping action and a pointing action performed by an actor. Data were included if children provided a minimum of 10 trials for each of the three conditions, execute grasp, observe grasp and observe point.

Results:
As expected, both the TD and ASD groups demonstrated activation in left sensorimotor area when grasping an object. In the TD group, modulations of power in the mu rhythm were stronger when observing grasping actions than pointing actions. Responses were bilateral with stronger effects in the left hemisphere during the observation of a grasping action. In contrast, the young children with ASD exclusively demonstrated a significant effect in the right hemisphere during the observation of pointing but not for grasping.

Conclusions:
The findings of the present study show that toddlers and preschoolers with ASD appear to have a different activation pattern in the MNS during action observation. Since this system has been proposed to play a crucial role in social development, impairments in the MNS could explain some of the deficits in social and communication abilities. The current study shows that this relation is already present at an early age, which could lead to new approaches in early intervention designed to improve the functioning of the MNS.

3 **182.003** Adolescents and Young Adults with Autism Spectrum Disorder Show Differences in Dynamics and Recruitment of Cognitive Control Networks

***M. Solomon**[1,2,3], M. K. Krug[4], C. C. Coleman[4], M. V. Elliott[5], J. Hogeveen[6], T. A. Niendam[7], J. D. Ragland[7] and C. S. Carter[8], (1)MIND Institute, Sacramento, CA, (2)Imaging Research Center, UC Davis, Sacramento, CA, (3)Department of Psychiatry & Behavioral Sciences, UC Davis MIND Institute, Sacramento, CA, (4)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA, (5)Department of Psychology, University of California, Berkeley, Berkeley, CA, (6)Department of Psychiatry & Behavioral Sciences, UC Davis, Sacramento, CA, (7)Imaging Research Center, Sacramento, CA, (8)Department of Psychiatry and Behavioral Sciences, University of California Davis, Sacramento, CA*

Background:
Individuals with Autism Spectrum Disorder (ASD) exhibit cognitive control (CC) deficits that appear to persist into adolescence and adulthood (Ozonoff et al, 1991, Solomon et al, 2017). CC deficits may be associated with the difficulties in social functioning, adaptive functioning and restricted and repetitive behaviors that are characteristic of individuals with ASD. Previous fMRI studies with slow event-related versions of the preparing to overcome prepotency (POP) task found evidence that typically developing (TYP) individuals develop a mature LPFC/parietal network in adolescence; however, individuals with ASD may continue to rely more heavily on a less mature dACC/LPFC network when presented with a situation that requires the implementation of CC (Solomon et al, 2009, Solomon et at, 2014).

Objectives:

(1) Investigate potential group differences in CC by looking at behavioral performance in a rapid event-related version of the POP task in participants aged 12-22 years old. (2) Associate behavioral measures with recruitment of brain regions known to play a role in implementation of CC. (3) Examine age-related changes in CC network recruitment and connectivity.

Methods:

Participants included 46 ASD (mean age=17.2 years; mean IQ=103) diagnosed using gold standard measures and 46 TYP (mean age=16.7 years; mean IQ=109). They completed four 28 trial runs of the Rapid Preparing to Overcome Prepotency (rPOP) task in the fMRI environment. For each trial of rPOP, a color cue was presented, followed by an arrow probe. For green cues, participants were instructed to press a button on the same side as the arrow probe. For red cues, participants were instructed to press a button on the opposite side of the arrow. Data was acquired using a 3 Tesla Siemens Tim Trio with a 32 channel head coil. Data were preprocessed and analyzed using SPM12. Functional connectivity analyses used CONN toolbox (http://www.nitrc.org /projects/conn).

Results:

Behavioral performance was assessed by calculating inverse efficiency score (IES; RT(ms)/accuracy; larger values indicate inefficient performance).There was a main effect of both cue type and diagnosis and a significant cue type X diagnosis interaction (F=10.17,p<.005), indicating that the ASD group was less efficient at the task. Whole brain analysis indicated that recruitment of BA 32 was greater for red cue trials compared to green cue in both groups (p-FDR<.05). In the ASD versus the TYP group, there was significantly stronger functional connectivity between the dACC and the DLPFC at the cue phase (Figure 1), which was negatively associated with task performance (Figure 2). This connectivity pattern negatively correlated with age in TYP, but there was no relationship in ASD.

Conclusions:

Our findings suggest a possible neural mechanism underlying the CC impairment evidenced by poor behavioral performance in ASD on the rPOP task. The developmental dissociation between TYP and ASD in this consequential network is also of great interest, and may provide an explanation for the persistence of CC deficits into young adulthood in ASD. Future analyses will investigate how these CC networks develop longitudinally, and their relationships to relevant clinical and adaptive functioning outcomes in young adults with ASD.

4

182.004 Age-Related Differences in the Large-Scale Resting State Executive Network and Relationships with Social Communication Impairments in Autism Spectrum Disorder

M. Walsh[1]*, L. C. Baxter*[2]*, C. J. Smith*[3] *and B. B. Braden*[4]*, (1)Arizona State University, Tempe, AZ, (2)Radiology, Barrow Neurological Institute, Phoenix, AZ, (3)Southwest Autism Research & Resource Center, Phoenix, AZ, (4)College of Health Solutions, Arizona State University, Tempe, AZ*

Background: The first children diagnosed with autism spectrum disorder (ASD) are now elderly; yet, there is little research on aging in adults with ASD. Abnormalities observed in resting-state functional connectivity (rs-FC) of large-scale brain networks are thought to underlie ASD symptoms. The rs-FC of these networks also declines with normal aging, most strongly in the executive network (EN). This is concerning for aging adults with ASD, since executive functioning has been postulated as a compensatory domain responsible for ameliorating the core symptom, social communication impairments (SCI), in ASD.

Objectives: We aimed to determine age-related differences in EN rs-FC in adults with ASD versus neurotypical (NT) adults. Additionally, we aimed to determine age-related differences in SCI, and the relationship between EN rs-FC and SCI, in adults with ASD. We hypothesized adults with ASD would experience larger age-related changes in EN rs-FC than NT adults. Further, we hypothesized middle-age adults with ASD would have greater SCI and a stronger relationship between SCI and EN rs-FC, than young-adults with ASD.

Methods: Participants were 24 young adult (YA; 18-25 years) and 25 middle-aged (MA; 40-64 years) adult males with high-functioning ASD, and 15 YA-NT and 21 MA-NT adult males. Differences in SCI (measured by the Social Responsiveness Scale -2; SRS-2) between YA and MA adults with ASD were evaluated with a t-test (p<0.05, one-tailed). We used independent component analysis to generate whole-brain rs-FC maps of the EN for all participants. Whole-brain EN comparisons were made using a two-factorial design in Statistical Parametric Mapping-12 and small-volume correction (p<0.05, false discovery rate) using an EN mask (neurosynth.org). An exacerbated aging trajectory of rs-FC decline in ASD was probed with a contrast matrix modeling reduced rs-FC in ASD participants relative to NT participants, and a larger age-related decline between ASD age groups than NT age groups. Rs-FC of six neo-cortical EN nodes was extracted and correlations with SCI were investigated in MA-ASD and YA-ASD groups separately (p<0.05, family-wise error corrected). IQ was entered as a covariate in all analyses.

Results: Although MA-ASD participants demonstrated higher SCI than YA-ASD, this difference was non-significant (p=.13). The EN demonstrated exacerbated age declines in rs-FC of the bilateral dlPFC, with only the left hemisphere surviving statistical correction. Lastly, there was a significant negative correlation between rs-FC of the right dlPFC and SCI in MA-ASD but not YA-ASD participants.

Conclusions: In one of the first aging rs-FC investigations in adults with high-functioning ASD, our findings suggested exacerbating age-related hypoconnectivity in frontal regions of the EN, relative to NT adults. Further, EN hypoconnectivity was related to increased SCI in middle-age adults with ASD only. Findings provide some of the first insights of brain mechanisms underlying core symptoms in older adults with ASD.

5

182.005 Atypical Neural Response to Biological Motion in Children with ASD: A Preliminary Functional Near Infrared Spectroscopy Analysis

A. Atyabi[1]*, M. Kim*[2]*, B. Li*[3]*, E. Barney*[4]*, Y. A. Ahn*[2]*, M. C. Aubertine*[5]*, S. Corrigan*[2]*, E. Neuhaus*[6]*, K. Pelphrey*[7] *and F. Shic*[4]*, (1)Seattle Children's Research institute University of Washington, Seattle, WA, (2)Seattle Children's Research Institute, Seattle, WA, (3)Computer Science and Engineering, University of Washington, Seattle, WA, (4)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (5)Seattle Children's Hospital and Research Institute, Seattle, WA, (6)Seattle Children's Hospital, Seattle, WA, (7)Autism and Neurodevelopment Disorders Institute, George Washington University and Children's National Medical Center, Washington, DC*

Background:

Attentional bias towards biological motion (BM) is an evolutionarily-preserved early-developing skill considered a fundamental process of neurocognition (Krakowski, 2014). It is likely that perceptual sensitivities underlying preferences for social and biological information impact and underpin developmental trajectories of social cognition skill acquisition, an area of primary deficits in individuals with ASD. Recognition of and preference for BM is found to be impaired in ASD (e.g. Kaiser et al. 2009, 2010, Annaz et al. 2012), with oxytocin and social inclusion modulating perceptual and neurophysiological response to BM in typical individuals (Keri and Benedek 2009, Perry et al. 2010, Bolling et al. 2014). Bolling et al. (2014), in a dual fMRI-fNIRS (functional Near Infrared Spectroscopy) study of 12 healthy typically developing (TD) adults demonstrated that fNIRS can reliably measure brain responses to BM. However, there are few reported studies of BM using fNIRS in young children with ASD.

Objectives:

To explore the use of fNIRS to examine hemodynamic response differences in TD children and children with ASD as they viewed emotion-modulated BM stimuli.

Methods:

8-year-old children with ASD (n=40) and TD (n=25) sat in front of a computer monitor while wearing a cap embedded with optodes (Gowerlabs NTS) covering prefrontal cortex (PFC) and superior temporal sulcus (STS) areas. Emotional BM clips (fear, anger, joy, neutral) were presented alongside rotating control point light displays (PLDs). Changes in oxygenated hemoglobin (Oxy-Hb) during stimuli observation were analyzed by applying motion artifact removal, band pass filtering (0.010hz-0.50hz) and General Linear Modeling (for short separation and drift correction). Long distance channels were removed to reduce artifactual and noisy signal.

Results:

a) Trial-based analysis: using the median of the 90th percentile concentration from valid trials in each channel, statistical analyses revealed the following: **1) Biomotion:** Between-group differences in Oxy-Hb (t-test, α=0.05**)** over the *angular right gyrus* and deOxy-Hb(α=0.05) over *frontal_middle_left*, *frontal_inferior_triangularis_left,* and *angular_left* areas. **2) Rotation**: Only weakly significant differences (α=0.1) were observed between TD and ASD participants with Oxy-Hb over *frontal_supramarginal_left, frontal_middle_left,* and *parietal_inferior_right* and with deOxy-Hb over *frontal_supramarginal_left*.

b) Functional-Connectivity: the analysis of functional connectivity with 0.65 cross correlation cutoff indicated higher PFC connectivity in TD compared to ASD in Oxy-Hb, with TD participants demonstrating both inter- and intra-hemispheric connectivity in frontal regions both in rotation and biomotion stimuli. TD participants demonstrated higher level of intra-connectivity with the rotation paradigm compared to biomotion while a similar level of inter-connectivity in frontal regions was observed in this group in both biomotion and rotation paradigms. No intra-connectivity was observed in middle and posterior regions with either biological motion or rotation in either group.

Conclusions:

While analyses are ongoing, preliminary results suggest that between-group differences are evident in brain areas associated with biological motion perception in typical individuals and noted in previous research to be atypically activated in children with ASD. Functional connectivity results suggest that responses of children with ASD to biological motion are less expansively organized across brain regions than TD children, who demonstrated a wider breadth of activity and connectivity across the frontal areas.

6

182.006 Autism Symptom Severity Predicts Accuracy of Facial Emotion Recognition Under Conditions of Low Theta-Power Early in Visual Processing

C. Halpern[1]*, T. Clarkson*[2] *and M. D. Lerner*[3]*, (1)Psychology, Stony Brook University Dept. of Psychology, Stony Brook, NY, (2)Psychology, Temple University, Philadelphia, PA, (3)Psychology, Stony Brook University, Stony Brook, NY*

Background: Individuals with autism spectrum disorder (ASD) demonstrate deficits in facial emotion recognition (FER; Harms et al., 2010), which requires holistic visual processing (Duchaine et al., 2006). The weak central coherence model (WCC) predicts that individuals with ASD have deficits in holistic processing (Happé and Frith, 2006). While, the level of impairment on FER tasks generally relates to ASD symptom severity (SS) (Spencer & O'Brian, 2006; Humphreys et al., 2007), some individuals with high ASD SS can have intact performance on FER task, possibly through the engagement of compensatory neural processes that don't involve holistic processing (Harms et al, 2010). However, different neural processes that reflect cognitive compensation during FER task have yet to be identified in individuals with ASD. One possible neural correlate of holistic processing that might shed light on this question is early posterior theta activity. Early Posterior theta in visual processing task can be measured during the P100 event-related potential (ERP) and is associated with cognitive integration during visual working memory tasks (Sauseng et al., 2009), and abnormalities in theta are associated with deficits in object recognition and memory in individuals with ASD (Chan et al., 2011). The extent to which ASD SS relates to FER, as a function of early posterior theta, has yet to be examined. This interaction can clarify the possible compensatory neural processes utilized by individuals with ASD, and is important for understanding the heterogeneity in FER.
Objectives: We examine whether ASD SS predicted performance on a FER task and if this relation varied as a function of early theta-power during the P100 ERP window.

Methods: Fifty-three youth (M_{age}=11.60, SD_{age}=2.96; 38 male) with IQ≥70 (M_{IQ}=103.49, SD_{IQ}=15.40) and ADOS-2-confirmed ASD diagnosis and SS. Electroencephalography (EEG) data were recorded during a FER task (DANVA-2; Nowicki, 2004). Natural log transformed theta power at the P100 ERP was calculated using wavelet analysis for central frequencies 4-7.5Hz using 20 logarithmic steps at 4 cycles. Moderated linear regression analyses were used to test the relation of ASD SS and accuracy for identifying adult and child emotional faces at varying levels of the theta frequency during the P100.

Results: No correlations between ADOS SS and FER performance, theta-power and FER performance, or theta-power and SS (p's> 0.26) were found. However, a significant interaction was found between SS and P100 theta-power in predicting FER performance (*B*= 0.463 p = 0.026), such that at lower levels of theta-power and greater SS predicted *better* FER performance (Figure 1).

Conclusions: Our results suggest that greater SS predicts *better* FER performance, but only among those exhibiting lower occipital theta-power during the P100 ERP window. Heightened posterior theta is associated with holistic processing during FER tasks (Sauseng et al., 2009). These results suggest that, when such holistic processing is not engaged, individuals with greater symptoms of ASD may utilize alternate or compensatory strategies to decode faces, while those with fewer symptoms may rely on underdeveloped holistic processing abilities. Our results may help explain heterogeneity in relations between ASD SS and FER performance.

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182.007 Autism-Associated 16p11.2 Microdeletion Impairs Prefrontal Functional Connectivity in Mouse and Human

A. Bertero[1]*, A. Liska*[1,2]*, R. Parolisi*[3]*, M. Esteban Masferrer*[4]*,* ***M. Pagani***[1,2]*, M. Gritti*[5]*, M. Pedrazzoli*[6]*, A. Galbusera*[1]*, A. Sarica*[7]*, A. Cerasa*[7]*, M. Buffelli*[6]*, R. Tonini*[5]*, A. Buffo*[3]*, C. Gross*[4]*, M. Pasqualetti*[1] *and A. Gozzi*[1]*, (1)Istituto Italiano di Tecnologia, Functional Neuroimaging Lab, Centre for Neuroscience and Cognitive Systems, Rovereto, Italy, (2)University of Trento, CIMEC, Rovereto, Italy, (3)University of Turin, Neuroscience Institute Cavalieri Ottolenghi (NICO), Department of Neuroscience Rita Levi-Montalcini, Torino, Italy, (4)European Molecular Biology Laboratory (EMBL), Mouse Biology Unit, Monterotondo, Italy, (5)Istituto Italiano di Tecnologia, Neuroscience and Brain Technologies Department, Genova, Italy, (6)University of Verona, Department of Neurosciences, Biomedicine and Movement Sciences, Verona, Italy, (7)Consiglio Nazionale delle Ricerche, Catanzaro, Italy*

Background: Abnormal brain connectivity has been repeatedly observed in autism spectrum disorder (ASD) patients. However great heterogeneity exists in the manifestation of these aberrancies, and little is known on the role of specific ASD-associated mutations in affecting brain functional coupling. Human chromosome 16p11.2 microdeletion, a trait associated to mild intellectual disability, is one of the most common gene copy number variation (CNV) in autism, accounting for approximately 0.5-1% of all ASD cases.

Objectives: Here we sought to causally probe a role of 16p11.2 CNV in affecting brain connectivity. To this purpose, we mapped resting-state connectivity in children with 16p11.2 deletion and in a mouse carrying an orthologous 16p11.2 deletion (Horev et al., 2011). To mechanistically probe the observed connectional impairments, we also performed electrophysiological and viral tracing mapping in 16p11.2 mouse mutants.

Methods: Human resting-state fMRI (rsfMRI) imaging was performed on 3T Siemens scanner on a previously characterized sample of 16p11.2 del carriers and control subjects from the Simons VIP consortium. Control of motion artefacts was achieved via data scrubbing at a FWD=0.5 mm, regression of motion traces, and by retaining subjects with > 80% of initial fMRI frames. All mouse fMRI images were acquired on adult male 16p11.2$^{+/-}$ mutants and control littermates on a 7.0 Tesla MRI scanner (Bruker Biospin) under light halothane sedation, and images were analysed as described in Liska et al., 2017. *In-vivo* LFP were recorded by placing electrodes in anterior cingulate and retrosplenial regions. Quantification of retrogradely labelled cells was carried out with rabies virus injection as previously described (Liska et al., 2017).

Results: Inter-group connectivity mapping revealed reduced long-range prefrontal rsfMRI connectivity in human 16p11.2 del carriers (A-B), an effect robustly associated with increased social responsiveness scale (C-D). We also observed foci of reduced connectivity in temporal and parietal areas involved in sociocognitive functioning. To bolster a role of 16p11.2 CNV in affecting prefrontal connectivity, we used resting-state fMRI to map functional connectivity in a mouse line harbouring a deletion in orthologous regions to 16p11.2. In keeping with human findings, 16p11.2$^{+/-}$ mice exhibited reduced long-range prefrontal connectivity (E-F). 16p11.2 mutants also presented impaired long-range neural synchronization in the delta frequency range, corroborating a neural origin for the observed connectivity impairment (G-H). Retrograde axonal labelling in 16p11.2$^{+/-}$ mutants revealed altered neuronal density in prefrontal-projecting thalamic-nuclei, suggesting a possible contribution of thalamo-frontal miswiring to the observed connectivity impairment (I-L).

Conclusions: Our data document converging prefrontal connectivity impairments in human 16p11.2 del carriers and in a mouse with the same genetic deficit. We also show that 16p11.2 deletion in the mouse results in aberrant thalamo-frontal wiring and impaired long-range low-frequency neural synchronization. These findings establish a link between a common ASD-associated CNV and macroscale connectional aberrancies. They also suggest that 16p11.2 del can predispose to neurodevelopmental disorders and impaired socio-cognitive function via a dysregulation of long-range prefrontal connectivity.

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182.008 Children with Autism Show No Leftward Asymmetry of Neural Response to Native Vs. Nonnative Speech Distinction

L. Yu[1,2], *X. Wu*[3], *S. Wang*[2], *D. Huang*[3] *and Y. Zhang*[1,4], *(1)Department of Speech-Language-Hearing Sciences, University of Minnesota, MINNEAPOLIS, MN, (2)Psychology, South China Normal University, Guangzhou, China, (3)Guangzhou Rehabilitation & Research Center for Children with ASD (Guangzhou Cana School), Guangzhou, China, (4)University of Minnesota Center for Neurobehavioral Development, MINNEAPOLIS, MN*

Background: The left hemisphere plays a dominant role in linguistic processing (Zatorre & Gandour, 2008). Leftward lateralization has been found to develop in parallel with children's advance in linguistic competence (Mills et al., 2004). Similarly, native speakers of a specific language show greater neural sensitivity and efficiency in processing the auditory patterns found in that language (Kuhl, 2010; Zhang et al., 2005). However, such neural specialization appears to be significantly deviated in children with autism. Toddlers with autism failed to show leftward asymmetry when listening to natural speech (Eyler et al., 2012); children with autism show reduced neural sensitivity in discriminating phonological units in the native language but not so much in discriminating non-phonological units and nonspeech contrasts (Huang et al., 2017; Wang et al., 2017; Yu et al., 2015). These findings all point to an altered language-specific neural specialization in children with autism.

Objectives: The current study aimed at examining the neural coding of native vs. non-native phonological processing in children with autism. By comparing native vs. nonnative responses, we expected to investigate the functional specialization in detecting abstract word-level phonological structure of the native language.

Methods: EEG was recorded from 21 school-age (9~13 years) native Chinese-speaking children with autism and 25 age-matched TD controls. The participants were instructed to watch a self-chosen cartoon while ignore any sounds. The native condition consisted of a sequence of Chinese disyllabic nonsense words (e.g., /gu4bo1/), and the nonnative condition included a list of English disyllabic nonsense words (e.g., goober). The stimuli in the two conditions were matched by number of syllables, phonemic units (e.g., CVCV) and key acoustic features (i.e., duration, overall intensity). Mean ERP response amplitude was measured on the left side (F3/C3) and right side (F4/C4) of the scalp, within the time windows of 200-400, 400-600, and 600-800 ms.

Results: Regardless of stimulus and hemisphere, the autism group had smaller response amplitude than the TD group in the two later time windows but not the early window. Both groups showed larger ERP negativity to the native stimuli than to the nonnative stimuli. Specifically, In the 200-400 and 600-800 ms windows, the ERP difference in the TD group was restricted to channels on the left side, whereas the difference in the autism group was bilaterally distributed. In the 400-600 ms window, the ERP difference was mainly driven by the autism group with the effect only on the right side.

Conclusions: Both children with autism and TD children differentiate the abstract phonological structures of native vs. nonnative speech at the neural level. The ERP differences in the TD children show a clear leftward distribution, which coincides with existing adult data that linguistic information in native speech can engage specialized neural network for language (Perrachione et al., 2009). In comparison, the lack of leftward asymmetry in autism might represent a neural signature of impaired or delayed neural specialization for native language processing. Data from nonspeech stimuli are needed to examine the role of prosody in such language-specific neural specialization.

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182.009 Cortical Inhibitory Alterations in Autism Spectrum Disorders: A TMS Study

I. Bernardino[1,2], *A. Dionísio*[3], *R. Monteiro*[3], *I. Violante*[4] *and M. Castelo-Branco*[5,6], *(1)Institute for Nuclear Sciences Applied to Health (ICNAS), Coimbra, Portugal, (2)IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine – University of Coimbra, Portugal, Coimbra, Portugal, (3)Institute of Nuclear Sciences Applied to Health, University of Coimbra, Coimbra, Portugal, (4)School of Psychology, Faculty of Health and Medical Sciences, University of Surrey, London, United Kingdom, (5)CIBIT & IBILI - Institute for Biomedical Imaging and Life Sciences, Faculty of Medicine – University of Coimbra, Portugal, Coimbra, Portugal, (6)ICNAS - Produção Unipessoal Lda, Coimbra, Portugal*

Background: Autism spectrum disorder (ASD) is a pervasive neurodevelopmental condition of considerable relevance in cognitive and clinical neuroscience because of its intriguing combination of symptoms, including marked impairments in social interaction and communication in the presence of repetitive stereotyped behavior. Although several studies have characterized the ASD phenotype, the nature of its pathophysiology remains unclear. Emerging evidence suggests that inhibitory GABA neurotransmission represents an important dysfunctional pathway in ASD. This led us to investigate whether alterations in the push-pull mechanism between physiological excitation and inhibition may be present in ASD and likely conduct to altered motor cortical excitability.

Objectives: We aimed to probe whether there are alterations in cortical excitability, including inhibition and facilitation, in the primary motor cortex (M1) on ASD patients, via the use of transcranial magnetic stimulation (TMS) well stablished protocols: paired-pulse (pp-TMS), input/output curves (I/O) and cortical silent period (CSP).

Methods: Data were acquired from 8 high-functioning (mean full-scale IQ 105) ASD patients (mean age ± SE = 21.56 ± 1.27) and 5 chronological age and full-scale IQ-matched control participants (mean age ± SE = 24.83 ± 1.54).

In pp-TMS, two magnetic pulses are applied, separated by variable inter-stimulus intervals (ISI) which can be associated to either cortical excitation or inhibition. Three protocols were implemented: short-interval intracortical inhibition (SICI) measuring cortical inhibition putatively mediated by GABAA receptors (ISIs= 1, 3, 5ms); intracortical facilitation (ICF) reflecting a mixture of excitatory (NMDA glutamate) and inhibitory (GABAA) effects (ISIs=10, 15, 20ms); and long-interval intracortical inhibition (LICI) showing inhibition mediated by GABAB receptors (ISIs= 50, 100, 150ms).

In I-O curve, TMS intensities at 90, 100, 110, 120, 130 and 140% of RMT were used. Ten pulses at each intensity were delivered in a randomized order.

Regarding CSP, a suprathreshold TMS pulse is given during voluntary muscle contraction producing a motor-evoked potential (MEP) followed by a period of EMG silence. Measures were obtained while participant maintained contraction of 20% of the maximal force, measured with a dynamometer. Ten CSPs were recorded using an intensity of 130% of RMT.

Results: Our preliminary results showed significant differences between groups regarding both relative and absolute cortical silent period measures. ASD patients revealed longer relative (M=159.75, SE=8.60) and absolute periods (M=117.11, SE=8.22) than controls (relative: M=129.45, SE=9.61; absolute: M=87.60, SE=9.04) (t-test; p=.038 and p=.034, respectively). Concerning paired-pulse, no significant differences were yet found (while we predict power to increase when additional participants are added), although a trend for higher values in ASD was shown for the 5ms interval, in SICI (t-test, p=.089). In the IO protocol, participants did not differ regarding curve slope, maximum MEP and S50, i.e. the stimulus intensity that produces a MEP amplitude of 50% of the maximum.

Conclusions: In this study, we found preliminary evidence of altered motor cortical excitability in ASD which seems to involve intracortical inhibitory pathways. These results are in line with previous findings reporting altered GABA neurotransmission in this pathology and suggest altered GABA-mediated cortical inhibition which possible underlies cognitive impairments present in ASD.

10 **182.010** Decreased Rest Cerebral Blood Flow (CBF) in the Superior Temporal Sulcus (STS) in Children with Autism: An MRI-ASL Study

A. Saitovitch[1], *E. Rechtman*[2], *H. Lemaitre*[3], *J. M. Tacchella*[4], *N. Chabane*[5], *A. Philippe*[6], *E. A. Douard*[7], *H. Guemar*[4], *A. Vinçon-Leite*[8], *A. Cavalcanti Ferreira*[9], *R. Gobbo*[9], *R. Calmon*[4], *D. Grevent*[4], *F. Brunelle*[6], *N. Boddaert*[10] *and M. Zilbovicius*[4], *(1)INSERM, Paris, France, (2)INSERM U1000, Institut Imagine, Paris, France, (3)Inserm U1000, institut Imagine, Université Paris Sud, Paris, France, (4)Inserm U1000, institut Imagine, Paris, France, (5)CHUV, Lausanne, Switzerland, (6)Necker Hospital, Paris, France, (7)Research Center of UHC Sainte-Justine, Montreal, QC, Canada, (8)INSERM U1000, Paris, France, (9)Inserm U1000, institut Imagine, UNICAMP, Paris, France, (10)Hospital Necker, Paris, France*

Background: The first results on brain rest functional abnormalities in ASD using positons emission tomography (PET) have described decreased cerebral blood flow (CBF) in children with ASD compared to controls in the temporal regions and particularly in the superior temporal sulcus (STS) (Zilbovicius et al., 2000; Ohnishi et al., 2000). In addition, multivariate classification analysis has shown that STS hypoperfusion allows to correctly classify individual images of children with ASD at rates of 86% (sensitivity: 88%, specificity: 75%) (Duchesnay et al., NeuroImage, 2011). This suggests that the decrease in CBF at the STS level predicts the diagnosis of autism in 86% of cases and could therefore become a useful biomarker in autism. However, PET has significant limitations such as injecting radioisotope products, which makes it unsuitable to study children. Nowadays it is possible to measure rest CBF using arterial spin labeling (ASL) sequence in MRI, without contrast nor radioactivity injections. Thus, ASL could replace the PET method, which had important limitations.

Objectives: To reproduce the results described with PET using ASL-MRI in order to develop a possible biomarker in autism using a non-invasive brain imaging method.

Methods: Twelve children with ASD (age = 11.2 ± 3 years, 7-16 years) and 28 typically developing (TD) children (age = 10.1 ± 2.5 years) participated in this study. The ASD diagnosis was based on DSM-IV and the ADI-R. All participants underwent MRI at the Pediatric Radiology Department at Necker Hospital, in Paris, and rest CBF measures were performed with the ASL sequence, which allows rest CBF measures based on marking arterial water spin. Image processing was performed using Statistical Parametric Mapping 8 (SPM8) (http://www.fil.ion.ucl.ac.uk/spm). A voxel-to-voxel analysis on the whole brain and without a priori hypothesis was performed comparing the ASL images of children with ASD to the control group of children. Further region of interest (ROI) analyses was performed on the bilateral superior temporal regions.

Results: Whole brain voxel-by-voxel analysis showed a significant decrease in rest CBF ($p < 0.05$ FEW corrected for multiple comparisons) in the ASD group compared to the TD group in the left posterior STS. In addition, ROI analysis showed decreased rest CBF in children with ASD in left and right superior temporal regions.

Conclusions: The evidence of a decreased rest CBF within the STS by a non-invasive imaging MRI method could have a major impact on understanding the pathophysiological mechanisms underlying autistic behavior. In addition, if confirmed in a larger sample, STS hypoperfusion may become a biomarker in ASD for the evaluation of new therapeutic strategies.

11 **182.011** Differences in Frontal-Posterior Activity during Mental Rotation of Body-Related Stimuli in Autism Spectrum Disorders

J. A. Trapani[1], *H. M. Wadsworth*[2] *and R. Kana*[3], *(1)University of Alabama at Birmingham, Birmingham, AL, (2)UAB School of Medicine, Birmingham, AL, (3)University of Alabama, Birmingham, Birmingham, AL*

Background: Cognitive and behavioral studies in recent years have identified visuospatial processing as a generally intact area of functioning in individuals with autism spectrum disorders (ASD). Previous research suggests that this advantage may be reflected in tasks, such as mental rotation. However, mental rotation of body-related stimuli in ASD has received little attention relative to rotation of objects and shapes.
Objectives: This study investigates (a) the neural mechanisms underlying mental rotation of sensorimotor stimuli and (b) the extent to which autistic traits and symptomology play a role in processing mental rotation.

Methods: Thirteen children and adolescents with ASD and 15 age-and-IQ-matched typically developing (TD) control participants took part in this fMRI study. Participants completed a mental rotation task while fMRI data were acquired using a Siemens 3.0 Tesla Allegra head-only scanner. In this task, images of two hands appeared on a computer screen, one on the left and one on the right side of a crosshair. Participants were asked to press a button if the rotated hand on the right panel (rotated either 45° or 90°) was the same hand as the hand shown on the left panel. Imaging analysis included brain activation, change in percent signal intensity, and functional connectivity, along with correlation analyses involving these measures and behavioral assessment and self-report scores.

Results: Preliminary analyses indicate that the ASD group was significantly more accurate, relative to TD group, in mental rotation [$F(1,696) = 31.75$, $p<0.01$], although this effect was related to their spatial skills, measured by performance IQ. When 45° rotation was contrasted with that of 90° rotation, the ASD group showed greater activation, relative to TD group, in the right fusiform gyrus (FG), left and right middle occipital lobe, and right precuneus. The TD group, on the other hand, showed greater activation in left inferior frontal gyrus (LIFG), left medial prefrontal cortex (MPFC), left supplementary motor area (LSMA), and left anterior cingulate cortex (ACC) ($p<0.005$, k=144). ASD participants also showed intact functional connectivity during this mental rotation task.

Conclusions: While participants with autism performed the mental rotation task as well as or better than the TD controls, it was accompanied by differences in brain activity. The ASD participants seem to have relied more on visuospatial and body related areas (increased activity in FG, occipital, and precuneus), whereas TD participants recruited frontal areas (increased activity in MPFC, SMA, LIFG). It is possible that there is strategic difference between the groups in approaching this task, perhaps bottom-up versus top-down processing. This variation in approach may underlie difficulties observed in individuals with ASD when faced with more complex social stimuli requiring visual-perspective taking or full-body rotations and warrants continued and future investigations.

12 **182.012** Distinct Functional Network Connectivity in Children with ASD, ADHD, and OCD: Data from the Pond Network

M. M. Vandewouw[1]*, E. J. Choi*[2]*, J. P. Lerch*[3]*, M. J. Taylor*[4] *and E. Anagnostou*[2]*, (1)Diagnostic Imaging, Hospital for Sick Children, Toronto, ON, Canada, (2)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada, (4)The Hospital for Sick Children, Toronto, ON, Canada*

Background: Children with autism spectrum disorder (ASD) share genetic vulnerability and symptom domains with other neurodevelopmental disorders (NDs), such as attention-deficit/hyperactivity disorder (ADHD) and obsessive-compulsive disorder (OCD) despite distinct diagnostic criteria. A body of research of resting-state functional connectivity for each of the disorders shows that NDs exhibit some notable overlapping patterns of atypical functional connectivity in large-scale networks. However, the findings have been inconsistent across studies and there is no study to consider three different NDs within a single cohort. We compared large-scale whole brain fMRI networks directly across ASD, ADHD, OCD, and typically developing (TD) participants collected in a single cohort using graph theory to examine what the shared and disorder-specific functional organization abnormalities are in the three different NDs.
Objectives: We investigated a) if resting-state functional connectivity differs between NDs (including children with ASD, ADHD, and OCD) and TDs, and b) if the children with ASD show different functional connectivity profiles compared to children with ADHD or OCD.

Methods: The current study included 311 high-functioning children and adolescents (out of 354 subjects, excluding those with excessive motion), 156 with ASD, 68 with ASD, 43 with OCD, and 44 TDs (4-21 years of age, mean 12 years). T1-weighted and resting-state fMRI (5 minute duration) images were obtained on a Siemens 3T MRI using a 12-channel head coil. Subjects' T1-weighted images were parcellated into 82 cortical and subcortical ROIs, and subject-specific networks were constructed by correlating the mean resting-sate time-series for each ROI pair. Local (degree, strength, local efficiency, and betweenness centrality) and global (small-worldness and global efficiency) network measures were obtained for each network over a range of sparsity thresholds, and the area under the threshold curve (AUC) was calculated. An analysis of covariance was used to compare the network measure AUCs of NDs with TDs, as well as ASD with OCD and ADHD, with age and sex as covariates. Non-parametric permutation testing was used to determine significance ($p < 0.05$).

Results: Children with NDs showed an altered connectivity profile compared to the TDs, with increased degree and strength in ROIs including subcortical structures and the insula. These ROIs, as well as ROIs such as the pars opercularis and caudal anterior cingulate gyrus, also showed significantly increased local efficiency in NDs compared to TDs. Significant age and sex interactions were found between the two groups. Within the ND group, ASD exhibited significantly decreased degree and strength in ROIs including the paracentral gyrus compared to ADHD, while this effect was found in OCD in ROIs such as the fusiform gyrus. ASD also showed increased degree and strength in subcortical structures compared to OCD. Betweenness centrality also differed amongst the ND groups. Age and sex interactions differed significantly between the NDs; details will be presented.

Conclusions: The NDs show increased graph theoretic measures in subcortical structures compared to TDs. Within the NDs, we found evidence for distinct and shared areas functional connectivity in ASD, ADHD and OCD. These findings will help us understand the heterogeneity across NDs.

13 **182.013** EEG Abnormalities in Adolescents with ASD: A Power and Coherence Analysis

P. Wantzen[1]*, P. Clochon*[1]*, F. Doidy*[1]*, C. Piet*[1]*, C. Rebillard*[1]*, J. M. Guilé*[2]*, C. Mille*[2]*, F. Wallois*[2]*, F. Guénolé*[1,3]*, J. M. Baleyte*[1,3]*, F. Eustache*[1] *and B. Guillery-Girard*[1]*, (1)Normandie Univ, UNICAEN, PSL Research University, EPHE, INSERM, U1077, CHU de Caen, Neuropsychologie et Imagerie de la Mémoire Humaine, 14000 Caen, France, Caen, France, (2)Université de Picardie, INSERM, U 1105, CHU Amiens, groupe de recherches sur l'analyse multimodale de la fonction cérébrale, Amiens, France, (3)Service de Psychiatrie de l'Enfant et de l'Adolescent, CHU de Caen, Caen, France*

Background: Social and cognitive difficulties observed in autism could be partly explained by an atypical integration and perceptual processing associated with abnormalities in cerebral activity. Indeed, Resting-state electroencephalography (EEG) studies conducted in adults with Autism Spectrum Disorder (ASD) show a U-shaped model of power alteration with excessive power in low-frequency (delta and theta) and high-frequency bands (beta and gamma) contrasting with reduced alpha power. In addition, other EEG studies report altered brain connectivity with both hyper- and hypo-connectivity. In children with ASD, some results recently obtained do not fit with these models with for example and contrary to adults, reduced theta observed before 13 years old. Hence, modifications may occur after 13 years or during adolescence leading to adult models but there are too few studies conducted during this period to conclude.

Objectives: To specify cerebral particularities during resting state with high-density EEG, among adolescents with high functioning ASD aged from 10 to 18 years old compared to controls.

Methods: EEG was recorded in a sample of 17 adolescents with ASD compared to 27 age and IQ-matched typically developing adolescents. We examined eyes-closed and eyes-open EEG relative power and coherence in resting state for beta, theta, alpha and beta bands. Both short and long range functional connectivity was assessed with electroencephalographic coherence between pairs of electrodes in a high-density electrode array.

Results: We observed an important variability between participants for both relative power and coherence. We reported a U-shaped profile of relative power alterations in the ASD group compared to controls: delta, theta and beta relative power were increased and alpha relative power was reduced in adolescents with ASD. We also noticed long range hypo-connectivity from frontal to posterior regions for all band frequencies that contrasted with hyper-connectivity in posterior regions only for alpha band.

Conclusions: Our findings validate the U-shape profile in adolescents with ASD with increased power at low (delta, theta) and high (beta) frequencies and reduced alpha power. This profile of activity is associated with abnormal long range connectivity in all frequency bands that is consistent with difficulties in cognitive integration and regulation from anterior brain regions on posterior ones. In addition, we reported a posterior and short-range hyper-connectivity in alpha band. This excessive connectivity may participate to the atypical perceptual processing that characterizes ASD people. Further analysis combining EEG and behavioral data collected in this study will be crucial to identify EEG correlates of both perceptual and cognitive processing in adolescents with autism.

14 **182.014** EEG and Pupillary Response in Children with Autism: Results from the ABC-CT Feasibility Study

A. Naples[1], *F. Shic*[2], *A. R. Levin*[3], *R. Bernier*[4], *G. Dawson*[5], *M. Murias*[6], *S. Jeste*[7], *C. A. Nelson*[8], *S. Faja*[8], *K. Chawarska*[1], *C. Sugar*[7], *D. Senturk*[9], *G. Hellemann*[9], *J. Dziura*[10], *C. Brandt*[10], *S. J. Webb*[4] *and J. McPartland*[1], *(1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, (3)Neurology, Boston Children's Hospital, Boston, MA, (4)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (5)Department of Psychiatry and Behavioral Sciences, Duke Center for Autism and Brain Development, Durham, NC, (6)Duke Center for Autism and Brain Development, Department of Psychiatry and Behavioral Sciences, Duke University, Durham, NC, (7)University of California, Los Angeles, Los Angeles, CA, (8)Boston Children's Hospital, Boston, MA, (9)UCLA, Los Angeles, CA, (10)Yale University, New Haven, CT*

Background: Dysregulated attention and arousal are comorbid features of ASD. These symptoms are associated with differences in noradrenergic activity. Pupil diameter (PD) is a marker of locus coeruleus (LC) activity, the primary cortical source of norepinephrine. Prior work has established that individuals with ASD exhibit attenuated pupil response to light. Despite the broad neuromodulatory efferents from the LC to cortex, there have been no studies in humans linking the dynamics of the pupillary light reflex (PLR) to EEG features; this relationship may help to parse heterogeneity among individuals with ASD and between ASD and controls.

Objectives: We examine: (1) the relationship of the PLR and EEG; (2) The relationship between PLR and individual alpha frequency (IAF); (3) the relationship of the PLR and EEG to clinical characteristics.

Methods: Data were collected from 25 children with ASD and 26 typically developing controls (TD) across five sites. Ages ranged from 4-11 years and IQ ranged from 53-133. Analyses were conducted on subsets of participants contributing valid PLR (ASD=23, TD=26), EEG (ASD=23, TD=26), and IAF data (ASD=21, TD=24). EEG data were recorded at 1000hz and spectral power was calculated from one second epochs. IAF was calculated from occipital electrodes in the range from 6-12hz. The PLR was calculated in response to a 133ms white flash followed by a black screen. PLR dynamics included relative constriction, latency of constriction, and redilation and constriction velocities.

Results: PLR comparisons revealed marginal differences in constriction velocity (t=1.941, *p*=.058), such that constriction velocity, but not latency, was faster in individuals with ASD than in controls. EEG analyses revealed individuals with ASD exhibited an atypical power spectrum; a less steep slope (t = 2.184, *p*=.034), and higher power in theta (t=2.5, *p*=.017), beta (t=2.638, *p*=.011), and gamma (t=2.91, *p*=.005) bands compared to controls. PLR latency correlated with theta (r=.374, *p*=.009), beta (r=.473, *p*<.001), and gamma power (r=.312, *p*=.031), and IAF correlated with PLR constriction (r=.295, *p*=.051) and constriction velocity (r=.326, *p*=.031). Among children with ASD, the ADOS calibrated severity score correlated with theta (r=.473. *p*=.023) and PLR latency (r=.359, *p*=.093). PLR latency also correlated with the socialization domain of the Vineland (r=-.586, *p* =.005). The Social Responsiveness Scale Cognition Subscale correlated with PLR constriction (r=-.459, *p*=.003). For all correlations, attenuated PLR response predicted elevated symptomology.

Conclusions: These are the first data to examine relationships between EEG and PLR within individuals with ASD, revealing potential relationships between brainstem nuclei, cortical activity, and clinical symptomology**.** The directionality of effects suggests that increased LC activity, indicated by increased PLR latency and attenuated constriction, is related to an atypical EEG profile and increased symptomology. Further analyses will parse shared and unique variance between PLR and EEG contributions to ASD symptomology and measures of EEG coherence. These findings show promise for the potential of these biomarkers as indicators of treatment response and as potential targets for treatment development.

15 **182.015** EEG Correlates of Face Processing in a Large ASD Sample

L. Mason[1], *E. J. Jones*[1] *and M. H. Johnson*[2], *(1)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (2)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom*

Background: Social and communicative impairments are a core feature of ASD, and behavioural impairments in face processing are commonly reported (Dawson et al, 2005). In order to understand whether these impairments reflect atypicalities in the neural circuitry underlying face perception, some researchers have used the high temporal resolution of EEG to investigate individual stages of face processing in ASD. Latency and amplitude differences of face-sensitive event related potential (ERP) components have been reported in adults (e.g. McPartland et 2011) and children (e.g. Webb et al, 2005) with ASD. Here we describe the results from the Longitudinal European Autism Project (LEAP), a component of the

EU-AIMS study.
Objectives: To characterise the nature and extent of atypicalities in EEG correlates of face processing in a large sample of individuals with ASD and age- and IQ-matched neurotypical controls.

Methods: Participants aged from 6-30 years of age watched 168 trials in which interleaved upright or inverted faces were presented, whilst their EEG was recorded. Data was centrally pooled, harmonised and segmented by trial, and artefacts were rejected. Neural responses to upright and inverted faces were averaged separately. The final analyses contain data from 496 individuals (271 with ASD).

Results: ERP responses to upright faces had slower latencies in ASD, but overall did not differ in amplitude. The effect of inversion was absent in children with ASD; the inversion effect emerged in adolescence and adulthood, but with a reduced magnitude compared to neurotypical controls. Face-sensitive ERP components were lateralised to the right hemisphere in both groups.

Conclusions: Longer ERP peak latencies suggests slower and/or less efficient processing of faces in ASD, from childhood to adulthood. An absence of an inversion effect in children with ASD, and a reduction in its magnitude in adolescence and adulthood, is suggestive of reduced cortical specialisation for faces. This may result from a lack of motivation to attend to other people, leading to the slower development of expertise for faces across development in ASD.

16 **182.016** EEG Correlates of the Attentional Blink: Relationship to Autism Symptoms

E. A. Kaplan*, N. Russo, J. Kopec, E. P. McKernan, E. L. Koelmel and A. M. Prawl, Psychology, Syracuse University, Syracuse, NY*

Background:
In light of findings of superior temporal visual search abilities in individuals with autism spectrum disorders (ASD), we sought to understand neurophysiological mechanisms underlying single-target search and its relationship to the attentional blink (AB). The AB is a phenomenon whereby the second of two targets is frequently missed when it occurs within 200-500 milliseconds (ms) of the first.

Objectives:

There were three main objectives to this study. First, to examine characteristics of the AB in children with ASD and IQ- and age-matched comparison children. Second, to assess the relationship between electrophysiological responses to single color-bound targets and a color-binding AB task in both groups. Third, to assess the relationship between electrophysiological responses and diagnostic criteria for ASD.

Methods:

15 children with ASD (mean age = 11.8 years; mean IQ = 102.7) and 15 IQ- and age-matched comparison children completed an AB color-binding task in which they were asked to identify two purple targets amongst black distractors. Participants also completed a single-target version of this task while electrophysiological responses were recorded. Variables of interest included the accuracy of identifying the first target (T1), the accuracy of identifying the second target given that the first target was identified (T2|T1), the AB depth, and properties of the N2pc and P3 ERP components.

Results:

Analysis of the AB tasks revealed no group differences in target detection accuracy, or in the depth of the AB. ERP results from the single-target detection task revealed no significant differences between groups for the mean amplitudes of the N2pc and P3 components, or peak latency of the P3.

ASD and comparison groups differed in their relationship between the behavioral results on the AB color-binding task and ERP measures on the single-target detection task. For the ASD group, but not the comparison group, the AB depth was positively correlated with P3 peak latency in both the left ($r = .732$; $p < .01$) and right ($r = .637$; $p < .05$) hemispheres.

Exploratory analyses examining the relationship between ASD diagnostic measures and ERP results revealed a negative correlation between ADOS Social Affect scores and the amplitudes of the N2pc ($r = -.728$, $p < .01$) and left-lateralized P3 components ($r = -.638$, $p < .05$). Both verbal and nonverbal scores on the ADI were negatively correlated with the mean amplitudes of the N2pc and left-lateralized P3 components.

Conclusions:

Though no differences were found between ASD and comparison groups in any measures of the AB or the ERP components, the relationship between the AB and ERP components differed between the groups. For individuals with ASD, but not comparison individuals, AB depth was positively correlated with the P3 latency, indicating that individuals who are slower to process a single target also show a larger AB to dual-targets. Finally, exploratory analyses suggest that the size of the N2pc and left-lateralized P3 components might be related to social cognition impairments in ASD.

17 **182.017** EEG Neural Variability Distinguishes 16p11.2 Deletion and Duplication Carriers

R. Al-Jawahiri*, M. Jones and E. Milne, The University of Sheffield, Sheffield, United Kingdom*

Background:
Copy number variations (CNV) at the 16p11.2 chromosomal locus (~600 kb breakpoints 4–5 (BP4-BP5)) are associated with myriad clinical features including intellectual disability, autism spectrum disorder (ASD), epilepsy, and language and motor delays. Importantly, trends of reciprocal phenotypic differences between deletions (DEL) and duplications (DUP) have been consistently observed across multiple traits (e.g., brain volume and structures (Chang et al., 2016; Maillard et al., 2014), BMI (Jacquemont et al., 2011), EEG signals (LeBlanc and Nelson, 2016; Jenkins et al., 2016), etc.), which have been interpreted as indicating gene-dosage effects. However, as 16p11.2 CNVs are rare, there has been only four studies (LeBlanc and Nelson, 2016; Jenkins et al., 2016; Berman et al., 2016; Hudac et al., 2015) that phenotyped the EEG activity of carriers and no study examined reciprocal neural variability patterns.

Objectives:

The aim of this study is to determine whether 16p11.2 DEL and DUP carriers demonstrate a distinct and reciprocal pattern of EEG activity as represented by neural variability and signal-to-noise (SNR) measures.

Methods:

EEG data of the 16p11.2 CNV and typical groups were previously collected as part of the Simons Variation in Individuals Project (Simons VIP Consortium, 2012). Neural variability measures, as estimated by single trial ERP and spectral power analyses in the alpha and beta frequency bands, in addition to SNRs, were analysed in the CNV (n=28) and typical groups (n=11).

Results:

Intra-participant variability in ERP amplitude and absolute alpha power was significantly higher in DEL compared to controls (and compared to DUP for the latter measure). Relative alpha variability was significantly lower in DUP relative to both DEL and controls. SNRs did not differ between the groups. Patterns of EEG activity did not support indications of gene-dosage effects.

Conclusions:

The findings indicate that 16p11.2 CNV groups have a distinctly atypical pattern of EEG activity, as indexed by neural variability measures, that is gene-dosage independent. The overall neural variability patterns were conceptualised as relating to cognitive processing and neural plasticity.

18 **182.018** EEG Phenotype in Angelman Syndrome Differs between Genotypes

J. F. Hipp[1], *L. M. Bird*[2], *P. Garces*[3], *M. Hoener*[4], *S. Jeste*[5], *O. Khwaja*[6], *M. L. Krishnan*[7], *M. Miller*[8], *H. Purtell*[9], *A. Rotenberg*[9], *W. H. Tan*[10] *and J. Frohlich*[11], *(1)Neuroscience and Rare Diseases (NRD), Roche Pharma Research and Early Development, Roche Innovation Center, Basel, Switzerland, (2)Department of Psychiatry, UCSD, San Diego, CA, (3)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann-La Roche, Basel, Switzerland, (4)Roche Innovation Center, Basel, Switzerland, (5)University of California, Los Angeles, Los Angeles, CA, (6)F. Hoffmann - La Roche AG, Basel, Switzerland, (7)Research and Early Development, Roche Innovation Center, Basel, Switzerland, (8)Roche Pharmaceutical Research and Early Development - NORD, Basel, Switzerland, (9)Neurology, Harvard Medical School, Boston, MA, (10)Genetics, Harvard Medical School, Boston, MA, (11)University of California Los Angeles, Los Angeles, CA*

Background:: Angelman syndrome (AS) is a neurodevelopmental disorder characterized by a specific set of clinical features including intellectual disability, movement disorders, limited speech, and epilepsy [Angelman et al., 1965], and confers increased risk for autism spectrum disorder. Loss of function of *UBE3A* is necessary and sufficient for AS. This paternally imprinted (i.e., silenced) gene encodes ubiquitin-protein ligase and is critical for normal neuronal development. There are several AS genotypes that present with different clinical severity [Moncla et al., 1999]: 1) deletions of 15q11.2-q13.1 on the maternal allele, which includes *UBE3A* and several other genes, most notably three non-imprinted gamma-aminobutyric acid (GABA)-A receptor subunit genes *GABRA5*, *GABRB3*, *GABRG3*, and 2) mutations that affect the maternal copy of *UBE3A* (e.g., loss of function *UBE3A* mutations, unipaternal disomy, and imprinting mutations). Biomarkers reflecting the disease pathophysiology are crucial for the development of pharmacological treatments of AS. Electroencephalography (EEG) is a promising candidate biomarker and functional readout of neuronal activity in AS, characterized by excessive delta oscillations [Sidorov et al, 2017]. However, it remains unknown if this EEG phenotype differs between genotypes. Such knowledge is important for both understanding AS pathophysiology and informing the design of possible future intervention studies.

Objectives: To examine EEG characteristics of AS patients by genotype and, specifically, to compare spontaneous EEG spectral power between 1) AS genotype groups and 2) AS patients and typical developing (TD) controls.

Methods: Clinical EEG recordings were obtained from a National Institutes of Health (NIH) natural history study of AS. A total of 66 datasets, including longitudinal data, were obtained from 43 unique subjects (13 non-deletion, 30 deletion) ranging in age from infancy to adulthood. Age-matched control data were recorded with the same EEG system from 51 TD children. Data were recorded in the awake state and preprocessed to remove physiological artifacts. Power spectral densities (PSDs, 1-32 Hz) were computed using a Morlet wavelet transform. PSDs where averaged across electrodes and across visits for subjects with multiple visits. A between-group analysis examined spectral power differences between AS subjects and controls; a within-group analysis examined spectral power differences between AS subjects with different genotypes. Statistical analysis compared log-transformed PSDs using t-test.

Results: Individuals with AS are characterized by excessive delta-band power compared to controls ($p < 0.05$, Bonferroni corrected across all frequencies; peak frequency 2.7 Hz). Deletion and non-deletion groups both show excess delta-band power — however, delta power is significantly greater in the deletion genotype ($p < 0.05$).

Conclusions: Differences in EEG delta power between deletion and non-deletion AS genotypes suggest a role in AS pathogenesis for non-imprinted 15q11.2-q13.1 genes or regulatory elements within this region. For instance, given the relevance of GABAergic signaling for electrophysiological oscillations, deletions of the genes *GABRA5, GABRB3, GABRG3* may contribute to greater delta power in some patients. These findings suggest differences in disease pathophysiology between AS patients with different genotypes, and, moreover, support the use of EEG as a stratification biomarker and functional readout in AS.

19 **182.019** EEG-Based Single Trial Classification Emotion Recognition: A Comparative Analysis in Individuals with and without Autism Spectrum Disorder

J. M. Mayor Torres[1,2], *E. J. Libsack*[1], *T. Clarkson*[1], *C. M. Keifer*[1], *G. Riccardi*[2] *and M. D. Lerner*[3], *(1)Stony Brook University, Stony Brook, NY, (2)Department of Information Engineering and Computer Science, University of Trento, Trento, Italy, (3)Psychology, Stony Brook University, Stony Brook, NY*

Background: Recent studies support the use of novel statistical techniques, including EEG-based single trial classification, to better understand individual differences in neural responses to emotion reappraisal tasks (Singh & Singh, 2017) a core deficit in Autism Spectrum Disorder (ASD). The Late-Positive-Potential (LPP) is an event-related potential (ERP) that occurs 400-1500ms (Ferri et al., 2012) post-stimulus, is related to emotion reappraisal, and is attenuated in ASD (Benning et al., 2016). Research in typically developing (TD) populations (Mehmood, & Lee, 2016) has evaluated EEG-based single trial classification using LPP features to predict neural response to emotion categories. However, little is known about how well these pipelines can predict emotion states in individuals with and without ASD. Exploring the performance of a novel EEG single trial emotion classification pipeline in TD and ASD groups can advance understanding of both functional network-activation and of emotion reappraisal in individuals with ASD relative to TD peers.

Objectives: Evaluate the performance of a novel EEG single trial classification pipeline for predicting pleasant/unpleasant emotions elicited by DANVA-2 (Nowicki, 2004) stimuli in TD and ASD groups, as well as the capacity of models in one group to predict pleasant/unpleasant emotions in the other.

Methods: 17 participants (M=13.15, SD=1.36) including 9 TD and 8 ASD with ADOS-2 confirmed diagnosis (Lord et al., 2012). For each participant we ran a 3-fold cross-validation (Figure 1) including a complete dataset composed of 48 affective faces (examples) times the corresponding LPP time-points as features. We evaluated three LPP windows per-channel: early (400-800ms), middle (800-1200ms), and late (1200-1500ms). We then used the top channels modality (Kushaba, et al., 2011) to automatically select the two most predictively-sound channels per fold. Subsequently, we compared the predictive power of the top two predictively-sound channels in the TD model to the top two channels in the ASD model and vice versa to examine generalizability of these models across diagnostic groups (different group channel modality).

Results: The model, with high accuracy, predicted concurrent emotion in both TD and ASD groups using the identified top channels (Figure 2A). The average Precision (Pr) and Recall (Re) differed between modalities, and – crucially – between TD/ASD groups for the LPP middle window features (Figure 2B & 2C); These values differed between modalities across all three windows (all F(1,30) > 178, all p < .001). For instance, in the middle window the degradation in predictive Precision was 35.2% for TD and 34.2% for ASD between modalities (Figure 2C).

Conclusions: Our results suggest that LPP response represents an important set of features for pleasant/unpleasant face-elicited emotion prediction across/between TD/ASD groups. However, when the top channels for each group were used to predict the emotion state of the facial stimulus in the opposite group, the recall and precision metrics degraded significantly. Moreover, the cross-group model results lend support to the proposition that individuals with ASD demonstrate more diffuse functional neural-networks during emotional reappraisal than TD individuals, which is consistent with structural connectivity findings (Rudie et al., 2013).

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182.020 Electrophysiological Biomarkers in Dup15q Syndrome: Evaluation of Clinical Predictors and Longitudinal Stability

V. Saravanapandian[1], *J. Frohlich*[1], *C. DiStefano*[1], *S. Huberty*[2] *and S. Jeste*[3], *(1)University of California Los Angeles, Los Angeles, CA, (2)Mcgill University, Montreal, QC, Canada, (3)University of California, Los Angeles, Los Angeles, CA*

Background:

Dup15q syndrome is a neurodevelopmental disorder characterized by global developmental delay, hypotonia, intellectual disability (Battaglia et al, 2010), and an increased risk for both autism spectrum disorder (ASD) and epilepsy (Conan et al, 2014). Our previous study identified a unique electrophysiological signature in the form of increased beta oscillations (12-30 Hz) that distinguish Dup15q children from typically developing and non-syndromic ASD children (Frohlich et al, 2016). This EEG signature strongly resembles the pattern induced by gamma-aminobutyric acid alpha subunit (GABAA) receptor modulation and likely reflects overexpression of the GABAA receptor genes in the syndrome. With rigorous data collection in a much larger cohort, we have now quantified beta oscillations longitudinally and examined its relationship to clinical variables, which will help evaluate its properties as a potential biomarker to be used in longitudinal and intervention studies.

Objectives:

To determine: 1) whether beta power relates to clinical and demographic features including age, duplication type, epilepsy, IQ, social, communication, adaptive and motor skills in individuals with Dup15q syndrome and 2) whether beta power is stable over time.

Methods:

Spontaneous resting state EEG was recorded from n=56 Dup15q syndrome patients (age range: 5 months - 41 years) seen both at UCLA and at the National Dup15q family conferences (IDDRC-NIH Grant#U54HD087101). Participants under medications that pharmacologically elicit beta oscillations were excluded. Relative beta power was computed, averaged across the whole scalp and simple linear regression models were implemented to model effects of clinical features. In participants who had follow-up EEG recordings (n=13, age range: 15-162 months), a generalized linear mixed model was used to model longitudinal beta power. Clinical measures tested included verbal and nonverbal cognition based on the Mullen Scales of Early Learning, adaptive function based on the Vineland Adaptive Behavior Scales (VABS), and autism severity based on the Autism Diagnostic Observation Schedule (ADOS).

Results:

Epilepsy diagnosis predicted beta power (R^2=0.1839 P=0.0011) in Dup15q syndrome, consistent with our previous findings. A trend towards younger participants having higher beta oscillations was seen but not statistically significant (R^2= 0.0658, P=0.0612). Verbal, nonverbal cognition and adaptive skills did not predict beta power. Autism severity was associated with increase in beta power but not statistically significant (R^2= 0.1703, P = 0.0632). Beta power was significantly stable over time (P = .003), except in three participants who developed epilepsy between visits and beta power reduced after seizure onset.

Conclusions:

Elevated beta oscillations in Dup15q syndrome appear to be stable over time in the absence of epilepsy. Further investigation is needed to evaluate EEG power changes after epilepsy onset, and to identify whether beta oscillations represent a protective biomarker for the development of seizures. The lack of a relationship with behavior reinforces the hypothesis that the unique brain activity pattern seen in Dup15q syndrome reflects the overexpression of the GABAA receptor genes and proves to be a robust biomarker of disease. Identification of brain-based biomarkers in rare disorders like Dup15q is instrumental in understanding the underlying biology of atypical brain development and can be used in targeted therapeutic trials.

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182.021 Electrophysiological Markers of Resting-State Neural Network Abnormalities in Children with ASD, ADHD, and Co-Occurring ASD+ADHD

E. Shephard[1], *C. Tye*[2], *K. L. Ashwood*[3], *B. Azadi*[4], *M. H. Johnson*[5], *P. Asherson*[6], *G. McLoughlin*[7] *and P. Bolton*[2], *(1)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom of Great Britain and Northern Ireland, (2)Department of Child & Adolescent Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Department of Child and Adolescent Psychiatry, King's College London, London, United Kingdom, (5)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (6)King's College London, London, United Kingdom, (7)King's College London, London, United Kingdom of Great Britain and Northern Ireland*

Background: Autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) frequently co-occur but the reasons for this overlap are unclear. Abnormalities in oscillatory functional neural networks have been associated with ASD and ADHD, and may help to disentangle the neurobiological basis of these disorders and their co-occurrence. However, no previous work has compared oscillatory neural networks between ASD, ADHD, and co-occurring ASD and ADHD (ASD+ADHD).
Objectives: The objective of this study was to identify similarities and differences in resting-state oscillatory functional neural networks in children with ASD, ADHD, co-occurring ASD+ADHD, and typically developing control children.

Methods: Resting-state electrophysiological recordings were collected from boys with ASD (*n* = 19), ADHD (*n* = 18), ASD+ADHD (*n* = 29), and typical development (TD, *n* = 26). Oscillatory neural networks in delta (1-3Hz), theta (4-8Hz), alpha (8-12Hz), and beta (12-20Hz) frequencies were compared between groups using graph theoretical methods.

Results: Children with ASD showed a hypoconnected theta network and reduced local theta network inter-connectedness compared to children with ADHD, and ASD symptoms predicted greater hypoconnectivity in theta and beta networks. In contrast, children with ADHD showed widespread hyperconnectivity in theta and beta frequencies compared to TD and ASD children and limited theta fronto-posterior hypoconnectivity compared to TD. ADHD symptoms predicted greater hyperconnectivity. Children with ASD+ADHD showed theta network hyperconnectivity compared to TD and beta network hypoconnectivity compared to TD and ADHD children.

Conclusions: Children with ASD and ADHD were dissociable based on abnormalities in resting-state oscillatory networks, while children with ASD+ADHD showed evidence of both ASD-related hypoconnectivity and ADHD-related hyperconnectivity. These findings suggest ASD and ADHD are associated with distinct neurobiological atypicalities, which manifest together in co-occurring ASD+ADHD.

22 **182.022** Event-Related Potentials Linked to Executive Function Reflect Individual and Developmental Differences in Children with Autism Spectrum Disorders

R. Gilbert[1]*, L. J. Nelson*[2] *and S. Faja*[1]*, (1)Boston Children's Hospital, Boston, MA, (2)Boston University, Boston, MA*

Background: Many children with autism spectrum disorder (ASD) have difficulty with executive function (EF), which involves complex problem solving and goal-directed behavior, in comparison to typically developing children. The N2 event-related potential (ERP) component is generally associated with EF, and may specifically reflect the neural correlates of inhibition and conflict monitoring (Faja et al., 2016). Previous research has shown differences in the scalp distribution of the N2 component, with more widespread posterior and left-lateralized activation for younger children and children with reduced EF (e.g., Lamm et al., 2006). Examining age-related differences in the neural underpinnings of the N2 component in children with ASD may offer insight into the nature of EF challenges in ASD (difference versus delay) and enable interpretation of individual differences relative to age expectations.
Objectives: To explore individual differences and development of EF by examining age-related changes in behavioral performance and N2 responses, particularly their scalp distribution, during a Go/NoGo task.

Methods: Participants included 67 children diagnosed with ASD aged 7 to 11 grouped by age (40 children ages 7-9.49 and 27 children ages 9.5-11 years). EEG was collected while participants completed a cued Go/NoGo task. Neural responses were recorded and N2 mean amplitude and latency was characterized for the go and nogo conditions at Fz and Cz. Twenty-one younger and 16 older children provided usable ERP data. Accuracy was also collected during the task for all participants.

Results: Repeated-measures ANOVA (condition x electrode site x age group) with peak amplitude suggested that the N2 component becomes more focused around Fz with age. Older children with ASD exhibited stronger activation at Fz relative to Cz, in comparison to younger children with ASD, who showed strong activation at Fz and moderate activation at Cz (electrode x age: F(1,35)=4.31, p=0.045). Behaviorally, accuracy was higher for the go than nogo condition (F(1,65)=123.93, p≤0.001). Older children were more accurate during both the go and nogo conditions, as compared to younger children (F(1,65)=13.62, p≤0.001) However, the interaction between age group and go/nogo condition was not significant (F(1,65)=1.79, p=0.186). Better performance across go/nogo conditions related to smaller peak amplitude (greater efficiency) in the older cohort at Fz, r(16)=0.505, p=0.046, but was not significant in the younger cohort.

Conclusions: Individual and developmental differences in scalp activation of the N2 component appear related to neural activation during an EF task. Increased specificity of N2 peak amplitude at Fz with age compared to Cz may indicate greater anterior shift in the neural source of the N2 or a decreased posterior contribution as EF develops in school age children with ASD. Additionally, the relation between greater neural efficiency at Fz and improved behavioral performance across conditions in the older cohort suggests individual differences in EF ability beyond the effects of age can be observed at the neural level.

23 **182.023** Evidence of Altered Neural Responses to Hearing the Own Name in Autism Spectrum Disorder

R. El Kaddouri[1]*, A. D. Nijhof*[2]*, J. Goris*[3]*, M. Brass*[3] *and J. R. Wiersema*[4]*, (1)Experimental Clinical and Health Psychology, Ghent University, Ghent, Belgium, (2)Institute of Psychiatry, King's College London, London, United Kingdom, (3)Department of Experimental Psychology, Ghent University, Ghent, Belgium, (4)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background: Diminished responding to hearing the own name in infancy is one of the earliest and strongest predictors of later diagnosis of ASD. Remarkably, as of yet there is no study that systematically investigated the neural correlates of hearing the own name in individuals who received a diagnosis of ASD.
Objectives: Our aim was to study the neural responses, by means of event-related potentials (ERPs), to hearing the own name in children and adults with a formal diagnosis of ASD. Atypical processing of the own name in ASD in childhood and adulthood would suggest that this is related to a fundamental deficit. It may also point to specific mechanisms underlying the lack of response to the own name in children at risk for ASD. Based on earlier research in neurotypicals, we expected stronger positive parietal activity when hearing the own name versus other (familiar and unfamiliar) names in neurotypicals, and this effect to be diminished or absent in individuals with ASD.

Methods: The study on adults is finalized, while the study on children is still ongoing. 24 adults with ASD and 24 neurotypical adults participated in the experiment. Data of 12 children with and without ASD were analyzed. Participants carried out an auditory oddball paradigm. The sequence of stimuli comprised one frequently presented standard sound (66%), an infrequent target sound (4%), and three categories of names that were presented as equally infrequent task-irrelevant deviants: participants' own name (10%), the name of a close other (10%), and the name of another person unknown to them (10%). They were instructed to only respond with a button press to the target sound.

Results: A late parietal positivity (PP) was observed specifically for own names in neurotypical adults, indicating enhanced attention to the own name. This preferential effect was completely absent in adults with ASD. Source localization analyses associated this group difference to diminished activation in the right temporo-parietal junction (rTPJ) in adults with ASD. ASD diagnosis could be predicted with fair accuracy, based on own name related brain activity. Data collection is still ongoing in children but early analyses show very similar patterns as seen in adults with ASD. Also children with ASD significantly differ from their typically developing peers, in that they do not show amplification of parietal positive activity, which was observed in neurotypical children. Both the adult findings and results from the analyses on the full sample of children will be presented during the meeting.

Conclusions: The findings indicate atypical neural responses to hearing the own name in individuals with ASD, both in children and adults. In adults, this was associated with decreased rTPJ activation, a region that plays a key role in self-other distinction and mentalizing and has been strongly implicated in ASD in earlier research. Further research is warranted to evaluate the EEG response to the own name as a putative neurocognitive biomarker of ASD across the lifespan.

24 **182.024** Examining the Effect of Attention on Sensory Registration in Autism Spectrum Disorders

J. Crasta[1], *P. L. Davies*[2] *and W. J. Gavin*[3], *(1)Physical Medicine and Rehabilitation, Kennedy Krieger Institute, Baltimore, MD, (2)Colorado State University, Fort Collins, CO, (3)Human Development & Family Studies, Colorado State University, Fort Collins, CO*

Background: Individuals with autism spectrum disorders (ASD) have significant deficits in sensory processing and attention. Researchers have suggested that sensory processing deficits in ASD may be associated with deficits in attention. However, there is a lack of research systematically examining the impact of attention on sensory processing at the neural level.

Objectives: The study examined the effect of attention on phases of neural auditory processing in individuals with autism spectrum disorders (ASD) using electroencephalography (EEG). We hypothesized that consciously directing attention to incoming information would result in more typical neural processing in individuals with ASD.

Methods: Participants included 24 young adults with high-functioning ASD (17 – 30 years; $M = 23.31$, $SD = 3.77$; 17 males) and 24 age-matched neurotypical individuals. All participants were administered a performance-based measure of attention, the Test of Everyday Attention, and filled out the self-report Adolescent/Adult Sensory Profile. Individuals with ASD had significantly greater attention deficits and sensory processing challenges compared to the neurotypical group. EEG data were recorded while they heard random presentations of four auditory stimuli (50 milliseconds in duration) at two different frequencies (1 and 3 kHz) and at two different intensities (50 and 70 dB). All participants completed two attention conditions; the passive condition involved only listening to the stimuli, followed by the active condition, wherein participants were instructed to press a button only to the 1 kHz 50 dB tone. For each condition, participants heard 80 trials of each tone in pseudo-random order with a two-second inter-stimulus interval. Repeated-measures ANOVAs were used to examine the N1-P2-N2-P3 amplitude and latency differences. Additionally, time-frequency analyses were used to examine neural oscillatory activity.

Results: Directing attention to the tones resulted in P2, N2, and P3 amplitude and latency differences for all participants. There were no group differences in N1, P2, N2, or P3 amplitudes for either attention condition. However, individuals with ASD had significantly longer N1, N2, and P3 latencies, suggesting delayed processing. N1 latency delays were present during both attention conditions. N2 and P3 latency delays were present during the passive condition but not during the active condition, implying an attention-based amelioration of the processing delay in ASD. Behavioral measures of sensory processing and attention correlated with neural measures of auditory processing, such that more efficient neural processing (shorter N1 latency) was associated with more typical attention and sensory processing abilities.

Conclusions: Actively directing attention to the tones impacts auditory processing, and may result in more typical processing in ASD. Study findings have significant implications related to understanding neural auditory processing in ASD and provide support that sensory processing issues in ASD are related to attention. Additionally, these results can help practitioners understand the neural basis of behavioral manifestations of ASD, especially those atypical behaviors that occur in response to sensory experiences in everyday activities.

25 **182.025** Exploring Mismatch Negativity Processing in Autism Spectrum Disorder during an Auditory Odd-Ball Task: Evidence from the EU-AIMS LEAP Cohort.

J. Ahmad[1], *P. Garces*[2], *D. V. Crawley*[1], *C. L. Ellis*[3], *E. Kong*[1], *E. J. Jones*[4], *J. Cooke*[1], *A. San Jose Caceres*[1], *J. Tillmann*[5], *T. Charman*[6], *J. K. Buitelaar*[7], *B. Oranje*[8], *D. G. Murphy*[9,10], *G. Dumas*[11], *L. Mason*[4] *and E. Loth*[1,12], *(1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann-La Roche, Basel, Switzerland, (3)Social, Genetic and Developmental Psychiatry Centre, Kings College London, London, United Kingdom, (4)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (5)Institute of Psychiatry Psychology & Neuroscience, London, United Kingdom, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (7)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (8)Department of Psychiatry, Brain Center Rudolf Magnus, NICHE Lab, University Medical Center Utrecht, Utrecht, Netherlands, (9)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (10)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (11)Human Genetics and Cognitive Functions Unit, Institut Pasteur, Paris, France, (12)Forensic and Neurodevelopmental Sciences, The Sackler Institute for Translational Neurodevelopmental Sciences, IoPPN, King's College London, London, United Kingdom, London, United Kingdom*

Background:

The mismatch negativity (MMN) is an ERP component thought to index neural prediction, calculated by subtracting the *average* response to a standard repeating tone from a rarer deviant. Prior attempts at examining the MMN in ASD have been inconsistent, indicating either smaller, larger, earlier, later, or no group differences in MMN components. Critically, sample sizes have been small (approximately 10-35 per group), and the clinical profile of participants has varied. These inconsistencies may be due to methodological differences (including lack of power) and/or the existence of different ASD subgroups – given the recognition of the clinical and etiological heterogeneity of ASD. Recent investigations of MMN have been framed within the predictive coding hypothesis, which suggests that the brain matches incoming stimuli against expectation. According to this account, participants with ASD should show a smaller MMN, since increased sensory drive may lead to standard tones being processed more similarly to deviants.

Objectives:

1. In a large heterogeneous sample (N= 519) we aim to test differences in the MMN between the ASD and control groups overall, and split age groups (adults, adolescents, children),
2. To identify potential subgroups of ASD with MMN abnormalities using normative modeling.
3. To correlate MMN markers with ASD symptomatology (social interactions, repetitive behaviours, and sensory processing).

Methods:

The project included participants from the EU-AIMS LEAP study. Participants passively listened to an auditory oddball stream, consisting of standards (1000Hz, 50ms), and 3 deviant types, each with a probability of 6% (duration (1000Hz, 100ms), frequency (1500Hz, 50ms), and combined frequency + duration deviants (1500Hz and 100ms)). The MMN was analysed at Fz. After extensive quality control and preprocessing, N=257 individuals with ASD/ASD-ID, and N=193 individuals with TD/ID were retained for analysis (6-30; IQ 50-148). Case control differences, and normative modelling with Gaussian Processes were conducted to quantify ASD participant's deviation from the age relevant TD model mean.

Results:

Contrary to expectations, ASD participants scored similarly to controls in respects to each MMN types [for amplitude and peak latency all *F*s<.58, *p*s>.27]. When analyses were split by age groups (adults, adolescents, and children) or by testing site, all comparisons remained non-significant [MMN components: *p*s>0.07]. The MMN amplitude and latency did not correlate with ASD symptomatology [*r*s<.08, *p*s>.65], but the MMN peak correlated with age: younger participants had a larger MMN [*p*= 9.5192E^{-8}, *r*=.25]. Normative modelling revealed the percentage of ASD participants with values within +- 1 SD of the TD mean (71.20%), less than 1-2SD (9.72%), less than 2SD (3.50%), greater than 1-2SD (13.61%), and more than 2SD (1.95%).

Conclusions:

To our awareness, this is the largest study of an oddball task in ASD. We found no evidence for abnormalities in ASD on the MMN –this was consistent when moderating variables (e.g. age, or inter-site variability) were considered. Future analysis will investigate differences in higher-level predictions, more sensitive measures of onset latency, and a scalp-wide effects. Furthermore, oscillatory time-frequency analysis will be conducted.

26 **182.026** Functional Connectivity Alterations of the Prefrontal Thalamic Pathway in Autism Spectrum Disorder Are Age and Sex Dependent

A. Rausch[1], *M. H. P. Reinartz*[1], *C. B. Beckmann*[1,2,3], *J. K. Buitelaar*[1,4], *W. B. Groen*[5] *and K. V. Haak*[1,3], *(1)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (2)Centre for Functional MRI of the Brain (FMRIB), University of Oxford, Oxford, United Kingdom, (3)Donders Institute for Brain, Cognition and Behaviour, Radboud University, Nijmegen, Netherlands, (4)Karakter Child and Adolescent Psychiatry University Centre, Nijmegen, Netherlands, (5)Karakter Child and Adolescent Psychiatry University Center, Nijmegen, Nijmegen, Netherlands*

Background:

The thalamus maintains connections throughout the brain and its dysfunction has been associated with autism. However, DTI studies investigating structural functional connectivity are inconsistent and little is known about subregion-level thalamic functional connectivity (FC) in ASD. Therefore, we investigated subregion thalamo-cortical FC strength in ASD using a discovery sample and four replication samples of the ABIDE I dataset. The replication samples varied from our discovery sample with respect to sample size, scanning site and imaging parameters, sex-ratio, and the age range studied.

Objectives:

To delineate robust thalamic subregion abnormalities in ASD, we aimed to reproduce our findings from an adolescent discovery sample across four distinct replication samples.

Methods:

In the discovery sample (ASD=19 male/1 female, 12-22y; CTR=22male/3female, 13-22y), using an age and gender corrected correlation analysis, we calculated the full-correlations between four thalamic subregions (prefrontal (PF-T), temporal (TE-T), parietal-occipital (OP-T) and sensory, primary motor and pre-motor (SM-T)) and their associated cortical lobes separately in resting-state fMRI scan data. We identified increased FC strength along the right prefrontal thalamic nucleus (PF-T) and the right ventromedial prefrontal cortex (vmPFC). In the planned analysis in the four replication samples ($ASD_{Leuven29}$=14 male, 18-32y; $CTR_{Leuven29}$=15 male, 18-29y; $ASD_{Leuven35}$=12 male/3 female, 12-16y; $CTR_{Leuven35}$=15 male/5 female, 12-16y; ASD_{USM101}=58 male, 11-50y;CTR_{USM101}=43male, 8-39y; ASD_{NYU184}=68 male/11 female,7-39y; CTR_{NYU184}=79 male/26 female, 6-31y) we extracted the mean time series between the right PF-T and vmPFC ($PF\text{-}T_{vmPFC}$ FC strength) and its r-to-*Z* transformed correlations were calculated. Using *lmrob* a robust linear modelling method as implemented in the statistical R software package 'robustbase', we predicted the effect of age, sex and symptom severity (SRS) or diagnostic group status (Group) on $PF\text{-}T_{vmPFC}$ FC strength.

Results:

The $PF\text{-}T_{vmPFC}$ FC strength effect was dependent on site when investigating the SRS score (χ^2(*df*=1)=8.17, df=3, p=0.043) across all sites, or absent when investigating diagnostic group across all sites. However, we found sex dependent effects in both of the samples that contained females (Leuven35=(χ^2(*df*=1)=28.10, df=1, p<0.0001; NYU184=(χ^2(*df*=1)=4.33, df=3, p=0.037)) when investigating the SRS score, but only in one sample using diagnostic status as predictor (Leuven35=(χ^2(*df*=1)= 12.5, p<0.0001)). In one sample, we found interaction effects with diagnostic group and age (Leuven29= χ^2(*df*=1)=6.06, p<0.015)). In 2 of the 4 samples, there was an effect of age ((Leuven29= χ^2(*df*=1)=5.96, p<0.015; USM101= χ^2(*df*=1)=4.17, p<0.05). In the sample that was the most similar to the discovery sample, Leuven35, we found that sex, age and diagnostic status as well as sex, age and SRS symptom scores were robust predictors of right $PF\text{-}T_{vmPFC}$ FC strength (all p-values <0.001).

Conclusions:

Increased thalamic FC strength in ASD was identified in prefrontal nucleus within our discovery sample. PF-T_{vmPFC} FC strength was not predicted by SRS scores or diagnostic status across all sites per se, while there were age and sex interaction effects with diagnostic group. These findings suggest that there are age and sex specific developmental thalamic-cortical pathways in the etiology of ASD.

27 **182.027** Imaging-Genetics of Gender Differences in ASD: Sex-Specific Additive Effects of Oxytocin Receptor Gene Polymorphisms on Reward Circuitry

L. M. Hernandez[1]*, K. E. Lawrence*[1]*, S. A. Green*[2]*, N. T. Padgaonkar*[1]*, D. Geschwind*[1]*, S. Y. Bookheimer*[2] *and M. Dapretto*[2]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA*

Background: Sex differences in the prevalence of Autism Spectrum Disorder (ASD) are well documented; yet, the mechanisms underlying this gender bias remains unknown. As the ASD phenotype is defined primarily by social impairments, exploring sex differences in brain networks and genes associated with social behavior is a logical first step. Allelic variations on the oxytocin receptor gene (*OXTR*) have been associated with increased rates of ASD (LoParo 2014), and animal models suggest OXTR signaling in the nucleus accumbens (NAcc) is crucial for typical social behavior (Keebaugh 2015). In a predominantly male sample, we recently showed that *OXTR* risk-allele-dosage was associated with decreased NAcc-reward circuit connectivity in ASD youth, whereas typically developing (TD) carriers of disease-associated variants showed increased NAcc-frontal connectivity, suggesting a compensatory mechanism in the face of increased genetic risk (Hernandez 2017). Importantly, however, evidence from animal models indicates gender-specific expression of the *OXTR* in the brain (Olazábal 2016) and gender-specific associations between *OXTR* methylation and brain volume have been documented in humans with psychiatric disorders (Rubin 2016).
Objectives: To examine the moderating effects of gender on the relationship between *OXTR* risk-allele-dosage and functional connectivity of the brain's reward network in males and females with ASD (ASD-M, ASD-F) and matched TD controls (TD-M, TD-F).

Methods: DNA was genotyped for four ASD-associated *OXTR* SNPs (rs53576/rs237887/rs2254298/rs1042778). Participants were 32 ASD-F, 37 ASD-M, 33 TD-F, and 34 TD-M, ages 9-17 (males were the same subjects as in Hernandez 2017). Children completed a resting-state fMRI scan. ASD-F/TD-F data were processed according to the pipeline used for ASD-M/TD-M in Hernandez 2017. Data were motion scrubbed, activity was extracted from bilateral-NAcc and correlated with all other brain voxels to create resting-state maps. Single-subject resting-state maps were combined and compared at the group level, modeling the number of *OXTR* risk alleles as a covariate of interest. Results were thresholded at $z>3.1$ ($p<.001$), corrected for multiple comparisons at $p<.05$.

Results: Greater *OXTR*-risk-allele-dosage was associated with greater connectivity between NAcc and ventro-medial prefrontal cortex in TD-F, and greater connectivity between NAcc and subcortical brain regions in ASD-F. Comparing ASD-F to ASD-M, a significant interaction was detected such that as risk-allele-dosage increased, ASD-F showed an increase in connectivity between the NAcc and frontal and subcortical brain regions whereas ASD-M showed a decrease in connectivity with these same brain regions. Further, in ASD-F greater NAcc-frontal connectivity was associated with better social cognition measured by the Social Responsiveness Scale ($p=.001$); mirroring the brain-behavior relationship we previously reported in TD-M (Hernandez 2017).

Conclusions: In the face of increased genetic risk on the *OXTR,* unlike ASD-M, ASD-F showed increased NAcc-frontal connectivity, the same pattern observed in TD-M. Importantly, this increase in NAcc-frontal connectivity was associated with better social cognition in both ASD-F and TD-M groups. This neurobiological compensatory mechanism supports a female protective model whereby a greater number of genetic/environmental risk-factors are required for ASD-F to display altered brain connectivity and to exhibit high levels of ASD-associated symptomatology, which may ultimately help to explain observed sex differences in the prevalence of ASD.

28 **182.028** Impact of Gender on Resting-State Network Connectivity in Youth with ASD

K. E. Lawrence[1]*, L. M. Hernandez*[1]*, S. A. Green*[2]*, N. T. Padgaonkar*[1]*, H. Bowman*[3]*, S. Y. Bookheimer*[2] *and M. Dapretto*[2]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (3)CART, UCLA, Los Angeles, CA*

Background: Autism spectrum disorder (ASD) is consistently shown to have a higher prevalence rate in males than females (Fombonne, 2009), and nearly all neuroimaging studies in ASD to date have used samples that are predominantly or entirely male (Philip et al., 2012). Such neuroimaging studies in males have found differences in resting-state functional connectivity between participants with ASD and typically developing (TD) controls, with multiple studies particularly implicating the salience network in ASD (Uddin et al., 2015). However, genetic and behavioral evidence suggests that findings from males with ASD may not generalize to their female counterparts, as females require a greater genetic load to develop ASD (Werling & Geschwind, 2013) and may display differences in symptom profiles relative to males with ASD (Lai et al., 2015). Furthermore, a couple of recent neuroimaging studies have reported some gender differences in brain connectivity among individuals with ASD (Alaerts et al., 2016; Ypma et al., 2016), underscoring the importance of further investigations into the impact of gender on functional connectivity in ASD.
Objectives: Examine how functional connectivity findings within the salience network differ between girls and boys with ASD, as well as how girls and boys with ASD differ from gender-matched TD controls.

Methods: As part of an NIH-funded multi-site network, resting-state functional magnetic resonance imaging (fMRI) data was collected from a total of 195 individuals with ASD and TD controls. An approximately equal number of girls and boys contributed data to each group, and all subjects were between the ages of 8 and 17 years old. Salience network connectivity was examined using a seed located in the anterior insula (Seeley et al., 2007), with nuisance regressors and ICA-AROMA used to reduce potential motion confounds (Pruim et al., 2015). Site, IQ, and pubertal development were included as covariates at the group level. Comparisons between the female and male subjects of the ASD and TD groups were completed in FSL and prethreshold masked to focus on those areas which displayed significant positive or negative connectivity with the SN seed. Connectivity z-scores from significant group clusters were subsequently extracted and correlated with behavioral measures.

Results: Relative to boys with ASD, girls with ASD displayed greater positive connectivity with premotor regions and reduced positive connectivity with insular and frontal areas. Girls with ASD furthermore demonstrated increased negative connectivity with sensorimotor regions compared to boys with ASD, who instead had greater negative connectivity with temporal and cerebellar structures. When comparing girls and boys with ASD to their TD counterparts, there were no significant differences between girls with and without ASD. However, relative to TD boys, boys with ASD displayed significant reductions in both positive and negative connectivity with temporal and parietal regions.

Conclusions: These findings suggest that brain regions associated with salience detection and sensorimotor processing are differentially connected in males and females with ASD. Furthermore, our results demonstrate that brain alterations found in males with ASD may not generalize to females with ASD and emphasize the necessity of considering gender when investigating brain-based phenotypes in ASD.

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182.029 Increased Spontaneous Blink Rate Suggests Dopaminergic Function Abnormalities in Individuals with Fragile X Syndrome:

N. Woodruff[1], *S. P. White*[2], *M. W. Mosconi*[3], *J. Wang*[4], *E. Pedapati*[5], *C. A. Erickson*[5], *M. J. Byerly*[6], *J. A. Sweeney*[7] *and L. E. Ethridge*[8], *(1)The University of Oklahoma, Norman, OK, (2)Department of Psychiatry, University of Texas Southwestern Medical Center, Dallas, TX, (3)Kansas Center for Autism Research and Training (K-CART), University of Kansas, Lawrence, KS, (4)Department of Psychology, Zhejiang University of Technology, Hangzhou, China, (5)Division of Child and Adolescent Psychiatry, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (6)Center for Mental Health Research and Recovery, Montana State University, Bozeman, MT, (7)Psychiatry, University of Cincinnati, Cincinnati, OH, (8)Pediatrics, University of Oklahoma Health Science Center, Norman, OK*

Background: Spontaneous blink rate (SBR) stands as a non-invasive measure of central dopaminergic function that has been studied in the context of a variety of neurological disorders; increased SBR is associated with increased dopaminergic activity and has been found in schizophrenia, and anxiety disorders. The relative ease of carrying out these studies offers a promising, cost-effective method to evaluate a possible role of dopaminergic dysfunction and anxiety in Autism Spectrum Disorders or related neuropathologies such as Fragile X Syndrome (FXS).

Objectives: To verify that a difference exists between spontaneous blink rates in FXS individuals relative to neurotypical controls, and identify any correlations between SBR and aberrant behavioral or electrophysiological measures associated with FXS, which would suggest a possible role of hyper- or hypo-dopaminergic states in specific FXS-related deficits.

Methods: EEG data was collected on 13 FXS patients and 12 matched controls (ages 14-56) while conducting a passive auditory habituation task consisting of 150 stimulus trains of four tones presented 500ms apart with an inter-train interval of 4000 ms. Virtual EOG channels produced from recorded EEG data, along with the EEG spatial topographies were used to identify blinks. Blinks were manually identified by evaluating EOG waveforms and verifying the topographical distribution of EEG activity at the peak waveform amplitude.

Results: Preliminary results indicate that FXS has a higher overall blink rate (mean = 0.58 blinks/sec, Mann-whitney U test p=0.03) compared to controls (mean = 0.32 blinks/sec). Blink rate during stimulus train presentation did not differ from overall blink rate for either group. In neurotypical controls, induced gamma EEG activity was negatively associated with SBR (r= -0.580 , p= 0.048), consistent with studies reporting DRD4-modulated gamma inhibition in fast-spiking interneuron/excitatory pyramidal cell networks in auditory cortex. While FXS exhibited overall higher induced gamma activity, F(1,27)=10.1, p=.004, they did not show a relationship between gamma and SBR, suggesting a breakdown in dopaminergic regulation of network inhibition.

Conclusions: Spontaneous blink rate may offer a simple, non-invasive measure of dopaminergic function that can be taken during passive tasks making this approach valuable to research involving very young, or intellectually disabled individuals. FXS showed increased SBR throughout the task but did not show a further enhancement of blink rate during stimulus presentation, indicating no enhanced startle response to the auditory stimuli. The combined results provide evidence for dopaminergic dysfunction which may be related to EEG phenotypes and potentially anxiety phenotypes in FXS but may only indirectly relate to sensory hypersensitivity associated with FXS. SBR combined with EEG easily translates to mouse models of FXS, suggesting a potentially powerful mechanism for exploring receptor-level dopamine dysfunction in FXS and its associated behaviors.

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182.030 Individual Face Discrimination and the Influence of Fixation in ASD Measured with Fpvs EEG

S. Vettori[1], *S. Van der Donck*[2], *M. Dzhelyova*[3], *J. Steyaert*[4], *B. Rossion*[3] *and B. Boets*[4], *(1)K U Leuven, Leuven, Belgium, (2)KU Leuven, 3000 Leuven, Belgium, (3)Psychological Sciences Research Institute and Institute of Neuroscience, UCL, Louvain-la-Neuve, Belgium, (4)Leuven Autism Research Consortium (LAuRes), KU Leuven, Leuven, Belgium*

Background:

Fluently recognizing faces and facial expressions is highly important for our social interactions. Impaired and atypical face processing have often been postulated as a key deficit in autism spectrum disorders (ASD). Furthermore, decreased visual attention to the eye region has been suggested in ASD, as well as an increased preference for the mouth region of faces. Despite the great amount of research on face identity and facial expression recognition in ASD, results are mixed.

Objectives:

Therefore, we wish to examine face processing in ASD by means of an implicit and innovative EEG approach, and we will relate EEG findings to visual face scanning patterns assessed with eye-tracking.

Methods:

We combine fast periodic visual stimulation (FPVS) with scalp electroencephalography (EEG) and eye-tracking. The core idea of FPVS is that the periodicity of the electrophysiological response on the human scalp corresponds exactly with the periodicity (frequency) of the visual stimulation. Hence, it can be used for efficiently measuring categorization responses of complex visual stimuli in the human brain.

First, the ability to rapidly discriminate individual faces was assessed in matched groups of boys with (N = 23) and without (N=23) ASD. If oddball images of various facial identities are periodically interleaved in a series of identical faces, the sensitivity to facial identity can be quantified by assessing the neural response at this oddball frequency. Additionally, we manipulated the orientation of the faces (upright versus inverted), as well as the position of the fixation cross (the eye region versus the mouth region).

In a second paradigm, administered in the same groups, we examined spontaneous visual face processing both with frequency-tagging EEG (preferential neural processing) and with eye-tracking (preferential looking) . In this paradigm, the eye and the mouth region of a face are each flickering at a particular frequency, which allows to disentangle the neural processing of the eye versus mouth region. The neural responses to each of the face parts were quantified and were related to the simultaneous eye-tracking data.

Results: We observed a significantly lower neural sensitivity for individual face discrimination in the ASD group, as indicated by lower bilateral occipito-temporal responses. This group difference was present no matter whether the fixation was on the eye region or on the mouth region, but is specific for upright and not for inverted faces. At the conference we will also add and discuss the results of the second paradigm, investigating preferential neural processing and preferential looking of the eye region versus the mouth region of faces.

Conclusions:

The literature suggests that individuals with ASD show face processing impairments and atypical visual scanning patterns. We examined these hypotheses with an innovative EEG paradigm. We found impaired holistic processing of faces in the ASD group, not modulated by the position of the fixation cross. Additionally, we examined how spontaneous visual face processing patterns differ in children with ASD versus typically developing children, by measuring both which face part (eye or mouth region) is preferentially processed (EEG) and which part is preferentially looked at (eye-tracking).

31 **182.031** Interhemispheric Resting-State Functional Connectivity and Corpus Callosum Volume Changes in Autism

***S. Yao**, Q. Li, Z. Zhao, B. Becker and K. M. Kendrick, Life Science and Technology, UESTC, Chengdu, China*

Background: Autism spectrum disorder (ASD) has been associated with a number of potential structural and functional brain biomarkers using both region of interest and brain-wide approaches. A number of previous studies have suggested that reductions in functional interhemispheric connectivity and corpus callosum volume, may be associated with ASD[1], although this remains to be fully established in large datasets.

Objectives: We investigated whether resting-state interhemispheric functional connectivity and corpus callosum volumes were altered in ASD compared to healthy control subjects and if they were associated with symptom severity.

Methods: The present study used resting state fMRI and T1-weighted MRI data from 402 subjects with autism spectrum disorder (ASD) and 496 controls from the ABIDE database (http://fcon_1000.projects.nitrc.org/indi/abide). Interhemispheric resting state functional connectivity was computed using the 'voxel-mirrored homotopic connectivity' function implemented in the DPARSF software. We also conducted a structural region of interest (ROI) analysis on white matter segments using the corpus callosum mask from the Talairach Daemon database atlases. Group differences of the interhemispheric functional connectivity and the corpus callosum size were examined using a two-sample t-test, and a threshold of $p < 0.05$ false discovery rate (FDR) corrected at peak level was set for multiple comparisons. Associations with symptom severity in the ASD group (using ADOS scores) were also calculated by Pearson correlation.

Results: Two-sample t-tests on interhemispheric functional connectivity revealed decreased interhemispheric connectivity in the default mode network (dorsal medial prefrontal cortex (mPFC), ventral mPFC and posterior cingulate cortex (PCC)) the salience network (posterior insula (PI)), the mirror neuron system including inferior parietal lobule, precentral gyrus and superior temporal gyrus, thalamus and visual processing regions (lingual, fusiform and inferior occipital gyri) in ASD relative to control groups ($P_{FDR} < 0.05$). The PCC interhemispheric functional connectivity was negatively correlated the total ADOS scores (all 3 subscales - $r = -0.189$, $p = 0.004$) and both the communication ($r = -0.220$, $p = 0.001$) and social sub-scales ($r = -0.133$, $p = 0.044$). The PI interhemispheric connectivity was also negatively correlated with the ADOS communication sub-scale ($r = -0.147$, $p = 0.026$). The white matter ROI analysis of the corpus callosum showed significantly reduced volumes in both the anterior and posterior parts of the corpus callosum in the ASD compared to the control groups ($P_{FDR} < 0.05$), but these were not associated with ADOS scores. Results remained significant after including total brain volume and either full or verbal IQ measures as covariates.

Conclusions: Our findings provide evidence for both reduced resting-state interhemispheric functional connectivity and corpus callosum volumes in ASD subjects. Changes in posterior cingulate and insula interhemispheric functional connectivity are also associated with symptom severity and may represent useful potential ASD biomarkers.

References

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32 **182.032** Is Implicit Processing of Fearful Faces Impaired in ASD?

***S. Van der Donck**[1,2], S. Vettori[1,2], M. Dzhelyova[3], J. Steyaert[4,5], B. Rossion[3] and B. Boets[1,4], (1)Center for Developmental Psychiatry, Katholieke Universiteit Leuven, Leuven, Belgium, (2)Leuven Autism Research Consortium (LAuRes), Katholieke Universiteit Leuven, Leuven, Belgium, (3)Psychological Sciences Research Institute and Institute of Neuroscience, UCL, Louvain-la-Neuve, Belgium, (4)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium, (5)Leuven Autism Research Consortium (LAuRes), KU Leuven, Leuven, Belgium*

Background: Being able to quickly read faces and facial expressions is crucial for social interactions, and even survival. Many studies suggest that individuals with autism spectrum disorder (ASD) show deficits in emotion recognition, especially with regard to fearful faces. In addition, it has been suggested that individuals with ASD may show a reduced preference for the eye region and may focus more on the mouth region.

Objectives: The present study aims at examining the nature of face processing impairments in 23 8-to-12 year old children with ASD versus 23 matched typically developing (TD) control children. In particular, we investigated the neural sensitivity to implicitly discriminate between neutral and fearful faces, and whether this relates to behavioural indices of facial emotional processing and to atypical visual scanning patterns of the face.

Methods: We combined fast periodic visual stimulation (FPVS) with scalp electroencephalography (EEG) and eye-tracking. The general principle of FPVS EEG is that it elicits a steady-state visual evoked potential at exactly the same frequency of visual stimulation. If oddball fearful faces are periodically interleaved in a series of neutral faces, sensitivity to these socio-communicative cues can be quantified by assessing the neural response at the oddball frequency. Additional within-subject manipulations comprised the orientation of the faces (upright versus inverted) and the positioning of the fixation cross (on the eye region versus on the mouth region). Behavioural indices of face processing comprised the detection of non-periodic emotional faces in a stream of neutral faces, the assessment of the Emotion Recognition Task and the Emotion-Matching Task, and the assessment of visual scanning patterns during explicit emotion recognition tasks.

Results: Neural responses at the oddball frequency and its harmonics are present in both groups of children, and both groups show a similar face inversion effect (with reduced responses for inverted faces and a shift from higher-level lateral occipito-temporal response peaks for upright faces towards lower-level medial-occipital response peaks for inverted faces). Unexpectedly, in both groups occipito-temporal responses were increased when focusing on the mouth as compared to the eye region, regardless of the orientation of the faces. Most importantly, between-group analyses showed significantly reduced bilateral occipito-temporal and medial occipital responses in ASD compared to TD, regardless whether faces were presented upright versus inverted or whether fixation was on the eyes or on the mouth. These implicit EEG data will be complemented with explicit behavioural emotion processing data and with face scanning patterns obtained via eye tracking.

Conclusions: Analyses show clear peaks at the oddball frequency and its harmonics in both the ASD and control group, meaning that children with ASD are capable to implicitly discriminate facial expressions. Reduced responses for inverted faces indicate the presence of the inversion effect in ASD and TDs. However, generally reduced neural oddball responses in the presence of equal baseline responses indicate that children with ASD have a lower sensitivity to fearful faces, compared to controls. This suggests a quantitative difference in emotion processing abilities.

33 **182.033** MEG Gamma Oscillations and Directional Sensitivity to Visual Motion in Children with ASD: Two Sides of the Inhibition Deficit.

T. A. Stroganova[1]*, O. V. Sysoeva*[1]*, M. S. Davletshina*[2]*, I. A. Galuta*[2]*, D. E. Goiaeva*[2]*, A. O. Prokofyev*[1] *and E. V. Orekhova*[1]*, (1)MEG-Center, Moscow University of Psychology and Education, Moscow, Russian Federation, (2)Autism Research Laboratory, Moscow University of Psychology and Education, Moscow, Russian Federation*

Background: Altered balance between excitation (E) and inhibition (I) in neural networks is thought to underlie core symptoms of ASD, including sensory processing abnormalities. In line with this hypothesis we have recently found in children with ASD a reduction of spatial suppression (SS) – a perceptual phenomenon that depends on the efficacy of inhibition in the visual cortex. If present, the E/I imbalance in ASD may affect neural gain control (i.e. the rate at which inhibition shapes neuronal firing in response to increasing excitatory input) and result in an altered pattern of intensity-related changes of gamma oscillations (30-100Hz) – the populational neural activity that is highly sensitive to the E/I ratio.

Objectives: We tested the hypothesis that the E/I imbalance is a common factor that alters both directional sensitivity to visual motion and the intensity-related changes in MEG gamma oscillations in ASD.

Methods: MEG was recorded in 43 neuro-typical (NT) boys and 36 boys with ASD aged 6-15 years. Children watched high-contrast concentric circular gratings moving at a visual angular velocity of 1.2(slow), 3.6(medium) or 6.0(fast) °/sec. To assess the neural gain control we calculated the velocity-related change in gamma response power in the 'slow' vs. 'fast' conditions – gamma suppression magnitude (gSM). Greater gSM reflects a greater reduction in the gamma power with increasing motion intensity, i.e. stronger gain control. SS has been tested in a separate psychophysical experiment wherein subjects detected the direction of motion of a small (1°) and large (12°) gratings presented for a short time. The direction discrimination deteriorates with increasing stimulus size as the result of the top-down modulated inhibition in the primary visual cortex (V1). The SS was calculated as a difference between log discrimination thresholds for the large vs. small stimuli.

Results: The power of gamma oscillations decreased with increasing visual motion. As expected, velocity-related suppression of the visual gamma response was reduced in the ASD group. The perceptual SS effect was diminished in boys with ASD mainly due to their abnormally elevated direction discrimination threshold for the small gratings. In the NT boys gSM correlated with the SS and with their discrimination threshold for the large gratings. In boys with ASD, the correlation with the SS was also present, but it was mainly due to impaired direction discrimination for the small gratings in those with low gSM.

Conclusions: The significant correlations between the neural gain regulation index and measures of motion direction sensitivity supports the hypothesis that the E/I balance is a common underlying factor for both. Our findings suggest that the normal variations in the E/I balance have a role for the top-down suppression effects associated with increasing stimulus size. In children with ASD, on the other hand, the E/I imbalance affects motion direction discrimination mainly for the small gratings suggesting impairment of the local inhibition in V1. By showing the role of E/I imbalance in abnormal directional discrimination in ASD, our findings extend the recent evidence for a broadening of the population receptive fields in V1 in ASD individuals.

34 **182.034** Motor Performance and Neural Activity of Motor Networks in Children with Autism Spectrum Disorder during Imitation of Motor Hand Actions

C. Butera[1]*, E. Kilroy*[1]*, L. A. Harrison*[1]*, S. A. Cermak*[1] *and L. Aziz-Zadeh*[2]*, (1)USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy, University of Southern California, Los Angeles, CA, (2)USC Mrs. T.H. Chan Division of Occupational Science and Occupational Therapy; Psychology, University of Southern California, Los Angeles, CA*

Background: Recent work has demonstrated that motor deficits are highly prevalent in children with Autism Spectrum Disorders (ASD) (Fournier et al, 2010; Ming, Brimacombe & Wagner, 2007). Additionally, imitation skills have been found to be significantly impaired in children with ASD (Williams et al. 2004). Previous imaging work has shown reduced neural activity in adolescents with ASD during imitation of hand gestures when compared to typically developing (TD) peers (Wadsworth et al, 2016). The mechanisms underlying this imitation deficit are unclear, though there may be a relationship between reduced motor skills and imitation impairments in ASD.

Objectives: (1) To compare performance on the Movement Assessment Battery for Children (MABC-2; Henderson, 2007) and MABC Checklist (Henderson, 2007) between a sample of TD children and children with ASD. (2) To assess how performance on these motor assessments correlate with neural activity in motor-related brain regions during an imitation task.

Methods: Data from 9 high-functioning participants with ASD (age 10.93 ± 1.86), and 15 TD participants (age 11.15± 1.39) were analyzed. The MABC-2 was administered and scored by an occupational therapist. MABC Checklist was completed by parents and scored by a research staff member. fMRI data was collected on a 3-T Siemens MAGNETOM Prisma scanner. In the scanner participants were instructed to imitate videos of hand actions (i.e., stapling paper, slicing bread) presented in a block design. Standard preprocessing and motion correction were applied, and whole brain comparisons between groups were made. Parameter estimates from motor regions (e.g., primary motor cortex) were extracted and correlated with motor skills.

Results: Two tailed t-tests showed both MABC-2 and MABC Checklist scores were significantly impaired in ASD compared with TD participants ($p<.001$). In the ASD group, significant correlations between MABC-2 total standard score and imitation of hand actions were found in the right precentral gyrus ($r=.67$, $p=.04$), and the left postcentral gyrus ($r=.69$, $p=.03$). However in the TD group, there were no significant correlations with MABC-2 scores and neural activity during imitation. Finally, there were no significant correlations with MABC checklist scores in either group.

Conclusions: These data suggest that in ASD, MABC-2 scores may be related to activity patterns in premotor and primary motor regions recruited during hand action imitation. This relationship is not observed in the TD group. Future directions include involving larger sample sizes, comparing to children with primary motor impairments (e.g., dyspraxia) and correlating findings with other motor and social assessments in our sample.

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182.035 Neural Correlates of Response to Joint Attention in Toddlers with Autism Spectrum Disorder and Their Typically Developing Peers.

A. Piatti, *S. Van der Paelt, P. Warreyn and H. Roeyers, Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background:

Joint attention development is atypical in children with autism spectrum disorder (ASD). As far as initiation of joint attention is concerned, the literature points unanimously to an impaired development in individuals with ASD, whereas there is less agreement concerning response to joint attention, as observational methods alone do not consistently detect differences between children with ASD and typically developing (TD) children. On the other hand, toddler studies using eye-tracking, as well as neuroimaging research in older children suggest that, in spite of a preserved gaze-following ability, response to joint attention in ASD and TD children might be qualitatively different.

Objectives:

With this study we have been investigating the neural correlates of joint attention response in toddlers with ASD and their TD peers using fNIRS, to gain a deeper insight into joint attention development in ASD.

Methods:

We are planning to test 20 toddlers with ASD and 20 TD toddlers. 40% of total data has been collected to date, as we have tested 5 toddlers with ASD (all boys, mean age 3.13 ± 0.63) and 13 TD controls (6 boys, mean age 2.99 ± 0.68). Participants watched fragments of age-appropriate cartoons (duration: 11-13 s) interspliced by a static baseline (duration: 13-15 s). In 50% of trials, the start of the cartoon is signalled by the experimenter (joint attention condition). In the other 50% of trials, the attentional cue is a computer sound and the experimenter looks away from the screen while the cartoon plays.

Results:

Preliminary results (ASD: 25% of data analysed, TD: 65% of data analysed) show group differences over the effects of joint attention over dorsomedial prefrontal cortex (DMPFC) and right temporo-parietal junction (rTPJ). Over DMPFC we found an ATTENTION x GROUP interaction in the 0-5 s time-window (F(1,16) = 11.719, p =.002). Follow-up analysis shows that effects of joint attention were only present in the TD group (F(1,12) = 16.265, p = .001). Over rTPJ, the ATTENTION x GROUP interaction approaches significance in the 10-15 s time-window (inferior rTPJ/Brodmann area 41: F (1, 14) = 4.348, p =.059; superior rTPJ/Brodmann area 40: F (1, 13) = 4.163, p =.061). Follow-up shows that the interaction is due to a lack of activation during joint attention in the ASD group (p >.05).

Conclusions:

We found atypical activation in children with ASD during response to joint attention in areas (DMPFC and rTPJ) that are involved both in general attentional orienting and in mentalisation. The timing of the activation over these areas suggests that children with ASD do orient to social attention cues, but this process is slower for them than for their TD peers, which in turn may impair their ability to infer the social intention of the initiator of joint attention.

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182.036 Neural Representations of Facial Identity and Emotional Expressions in Young Adults with and without ASD

M. H. Hendriks[1,2]*, C. Dillen*[3]*, N. Daniels*[2,3]*, J. Bulthé*[1]*, F. Pegado*[1]*, J. Steyaert*[2,4]*, H. Op de Beeck*[1] *and B. Boets*[2,4]*, (1)Department of Brain and Cognition, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research Consortium (LAuRes), KU Leuven, Leuven, Belgium, (3)Department of Rehabilitation Sciences, KU Leuven, Leuven, Belgium, (4)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium*

Background: “Why didn’t you say hello? One of your classmates just passed by.” Most people are experts in the recognition of faces and facial expressions. However, individuals with autism spectrum disorders (ASD) often have difficulties processing faces, both in recognizing facial identity -especially when they don’t expect seeing someone- and in interpreting feelings based on facial expressions. Even though face processing difficulties are included in the diagnostic criteria of ASD, the empirical evidence is mixed.

Objectives: The goal of this study was to quantify the quality of neural representations with regard to facial identity and emotional expression. Although there might not be a large difference between the groups at a behavioral level, we studied whether there may be differences at the brain level between individuals with and without ASD while looking at faces with different identities and different facial expressions.

Methods: 52 young adults (age 17-23 years) participated in this study. Data were acquired while participants were lying in a 3T MRI scanner. They were looking at short movies of a dynamic face, which gradually transitioned from a neutral facial expression to an emotional facial expression. The movies comprised four different identities and six different emotions. Participants had to push a button whenever the current movie differed from the previous one, regardless of this change occurring in identity or expression. 45 Individuals were included in the analyses (21 ASD, 24 control participants). We tested whether different emotions and identities could be consistently classified and differentiated based on neural activity patterns in a series of face selective brain regions. More specifically, we performed multi-voxel pattern analyses (MVPA) based on a support vector machine to investigate whether different emotions and identities can be decoded on the basis of their neural activation pattern.

Results: Initial analyses show that different facial identities can be reliably distinguished in posterior temporal cortex, superior temporal sulcus, inferior occipital cortex, and primary visual cortex, in both groups. Likewise, different facial expressions can be decoded in these same brain regions. Thus far, our analyses suggest that there are no significant differences in neural response patterns between these two groups.

Conclusions: Neural activation patterns can be used to reliably decode facial identity and facial expression in occipito-temporal brain regions, both in adults with ASD and in neurotypical controls. The initial findings lead us to conclude that there are no detectable differences in the quality of the neural representations and activation patterns between individuals with and without ASD. At the conference, we will present some more fine-grained analyses, including associations with a large battery of behavioral tasks assessing face processing.

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182.037 Neural Representations Underlying the Observation of Interpersonal Socio-Affective Touch in Adults with and without

Autism Spectrum Disorder

[1], B. Boets[2] and H. Op de Beeck[1], (1)Department of Brain and Cognition, KU Leuven, Leuven, Belgium, (2)Center for Developmental Psychiatry, KU Leuven, Leuven, Belgium

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Background: Humans can easily grasp the affective meaning of socio-affective touch when observing other`s interactions. This ability may be linked to theory of mind (ToM) and somatosensory resonance. For example, when we see one person consoling another by giving a hug, we can understand the meaning of the hug and imagine its warmth. However, individuals with autism spectrum disorder (ASD) exhibit impairments in the use of nonverbal communication such as social and reciprocal touch, which gives them a huge disadvantage in social interactions. Despite the importance of touch in social communication and the pervasiveness of this aversion in ASD, surprisingly little is known about touch communication impairments in ASD, ultimately limiting diagnostic tools and therapeutic interventions.

Objectives: The present study aims to develop an experimental paradigm to address where and how socio-affective touch communication is represented in the brain of individuals with and without ASD. In particular, we examined the involvement of ToM and somatosensory resonance networks in processing observed social touch communication in the neurotypical (NT) brain in order to compare it with the brain processing of individuals with ASD.

Methods: A novel socio-affective touch database of 39 videos, covering pleasant (e.g., hugging a person), and unpleasant social touch (e.g. slapping a person), was used as stimuli (Figure 1). First, 21 NT participants evaluated valence and arousal of each video from which we extracted a group affective similarity matrix. Subsequently, the participants underwent fMRI scans during which they watched the same videos and performed an orthogonal task. Importantly, the participants also received positive and negative touch on their ventral forearms in the scanner in order for us to capture individual touch sensitive cortices as regions of interest (ROI). The social brain regions, including the temporoparietal junction (TPJ) known as a ToM area, were also included as ROIs. Using correlational multi-voxel pattern analysis (MVPA) methods, we generated a neural similarity matrix in each ROI. Lastly, multiple regression analysis was implemented in order to predict the neural data based on the perceived affect (combination of valence and arousal) of socio-affective touch.

Results: The results from pleasantness and arousal ratings suggest that positive touch was perceived as pleasant and negative touch as unpleasant with high inter-subject consistency on ratings. For example, the participants perceived a passionate hug as pleasant and highly arousing and a nudge as unpleasant and mildly arousing. Importantly, this affective meaning of touch was well represented in social brain areas and some parts of touch sensitive somatosensory regions. However, neural patterns in visual cortices as control regions could not be explained by perceived affect of observed touch communication (Figure 2).

Conclusions: Our findings highlight the involvement of perspective taking and somatosensory resonance when observing other`s affective touch interactions. Our results provide pivotal insights on neural mechanisms underlying the observation of interpersonal socio-affective touch in NT individuals. We are currently administering the same paradigm in 23 matched adults with ASD. At the conference we will be able to present group comparisons for the behavioral and neural data.

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182.038 Neurophysiological Correlates of Altered Motivation Towards Social and Non-Social Stimuli in ASD

C. Luckhardt[1]*, H. Althen*[2]*, J. Kopf*[3] *and C. M. Freitag*[1]*, (1)Autism Research and Intervention Center of Excellence Frankfurt, University Hospital Frankfurt, Frankfurt am Main, Germany, (2)Autism Research and Intervention Center of Excellence Frankfurt, Goethe Universitat Frankfurt am Main, Frankfurt am Main, Germany, (3)Dept. of Psychiatry, Psychosomatic Medicine and Psychotherapy Frankfurt, Goethe Universitat Frankfurt am Main, Frankfurt am Main, Germany*

Background:

In recent years the social motivation hypothesis of ASD (Chevallier, 2012) has gained popularity. Neuroimaging studies do not only suggest that individuals with ASD perceive social stimuli as less salient (Delmonte, 2012), but also that they show increased motivation towards non-social stimuli (Cascio, 2013). Directly comparing the neural response to social emotional versus non-social stimuli is therefore of great interest. The late positive potential (LPP) is a well suited neurophysiological measure for this purpose, as it represents motivational and attentional processes during the perception of social stimuli (Schupp et al. 2000). It is sensitive to the emotional content of stimuli and perceived relevance, and thereby related to the allocation of attentional resources (Schupp et al., 2004; Hajcak and Olvet, 2008; Ferrari et al., 2010).

Objectives:

The objective was to compare neural correlates of motivation and attention for social and non-social stimuli between children and adolescents with ASD and healthy controls.

Methods:

Participants viewed images of positive, negative and neutral emotional scenes involving humans, as well as neutral pictures of plants, while EEG was recorded. A one-back memory task was performed to sustain attention. Afterwards ratings of valence and arousal were obtained for all stimuli. The LPP was analyzed for each stimulus category as an area measure of 300-600 ms post stimulus onset at central, left and right posterior-parietal electrode clusters. LPP area measures and valence and arousal ratings were compared between groups using repeated measures ANOVAs (Between: Group ASD vs. CON, Within: Condition positive/negative/neutral/plant).

Results:

Analysis of a preliminary sample of 20 individuals with ASD and 10 controls (which were matched for age and IQ) indicate that children with ASD perceived negative emotional images as less arousing (p=.009), while plant pictures were rated as more arousing compared to controls (p=.040). Valence ratings also showed that the ASD group rated the negative emotional pictures as less negative (p=.040), and found plant stimuli just as pleasant as positive emotional stimuli (p_{ASD} =1.0, p_{CON}=.005). Looking at the LPP a group by condition interaction was found in the right hemisphere (F[3,84]=2.8; p=.043). Post-hoc tests suggested that this might have been due to higher LPPs for plant stimuli in the ASD compared to the control group (p=.091, $Mean_{ASD}$=5714.3±2995.5 µV*ms; $Mean_{CON}$=3812.6±2362.2 µV*ms).

Conclusions:

These preliminary results indicate that individuals with ASD do indeed perceive social emotional and non-social stimuli differently. This pattern is also confirmed by an increased LPP response for non-social stimuli. These findings expand existing evidence by showing that the LPP is not only increased for non-social stimuli that are of special interest to individuals with ASD (Benning, 2016), but also for other seemingly random non-

social objects like plants.

39 **182.039** Oxytocin´s Effect on Empathy in Autism – Neural Activation As a Function of the Oxytocin Receptor Gene Variation.

S. Stroth[1]*, A. K. Wermter*[2]*, S. Krach*[3]*, M. Haberhausen*[2]*, F. Paulus*[4]*, T. Stehr*[5]*, A. Mayer*[6] *and I. Kamp-Becker*[7]*, (1)Philipps University Marburg, Marburg, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University of Marburg, Marburg, Germany, (3)Center of Brain, Behavior and Metabolism, Luebeck, Germany, (4)Philipps-University Marburg, Marburg, Germany, (5)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Marburg, Germany, (6)Lübeck University, Lübeck, Germany, (7)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany*

Background: Individuals with autism spectrum disorder have deficits in the capacity to intuitively represent their own and others' mental states which is associated with impairments in social interaction and communication. Although ASD is considered a neurobiological disorder, primary treatments nowadays consist of psychological and educational interventions to address the core deficits related to the disorder. Pioneering but strong evidence suggests that oxytocin (OXT) has the potential to enhance motivation and attention to social cues in patients with ASD, facilitating the processing of social emotions, social reward and higher cognitive functions such as empathy and Theory of Mind. Beyond a therapy effect, it has been demonstrated that genetic factors can influence an individuals response to OXT, either by directly acting on OXT genes or via the regulation of genes in pathways related to OXT.

Objectives: In view of the individual variability in OXT response, the consideration of individual factors such as genetic variations is warranted in studies investigating the efficacy of OXT administration in ASD treatment. Therefore, we aim to analyse the effect of genetic variation in the oxytocin-receptor-gene (*OXTR*) on the neural pathways involved in social affect in a group of persons with ASD.

Methods: We examined in a placebo-controlled, double blind, randomized fMRI study (including three experiments to examine social affect on distinct levels) with crossover-design the effect of oxytocin in dependence of a specific genotype. 26 young men (Age mean 23,0±4,4; IQ mean 107,9±18,2) who matched the DSM IV criteria for ASD and who had a confirmed ICD-10 diagnosis of high-functioning ASD took part. 15 participants had a validated variation in the *OXTR* and 10 participants were without the risk allele.

Results: On the behavioural level we can observe differential effect of OXT in dependence of the *OXTR*. Participants with the variation in the *OXTR* show a significant increase of social affect. Further differences on underlying brain networks will be analysed and presented

Conclusions: The consideration of genetic variation in the *OXTR* seems to have the potential to identify those participants with ASD who get the most out of OXT treatment.

40 **182.040** Relations between Frontal Gamma Power, Socioeconomic Status, and IQ Among Adolescents with and without ASD

K. M. Rivera[1]*, A. J. McVey*[1]*, H. K. Schiltz*[1]*, A. D. Haendel*[2]*, S. Pleiss*[3]*, A. Carson*[4]*, B. Yund*[5] *and A. V. Van Hecke*[6]*, (1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Great Lakes Neurobehavioral Center, Edina, MN, (4)Baylor College of Medicine, Houston, TX, (5)Psychology, University of Wisconsin Milwaukee, Milwaukee, WI, (6)Psychology, Marquette University, Milwaukee, WI*

Background: Research suggests that socioeconomic status (SES) has implications for cognitive development (e.g., executive functioning and IQ) among typically developing (TYP) children (Farah et al., 2006), namely that children from lower SES backgrounds experience difficulties in these cognitive domains. Studies have found that the cognitive impact of SES can be observed on a neurological level through electroencephalogram (EEG) in the frontal gamma band (Tomalski et al., 2013); this area has been linked with higher-order cognitive processes (Gou, Choudhury, & Benasich, 2011). Lower gamma power has been examined in individuals with ASD (Maxwell et al., 2015), however, the relation of SES, frontal gamma power, and IQ among a sample of youth with ASD has not been examined.

Objectives: The objective of the present study was to evaluate the relations between SES, EEG frontal gamma power, and IQ among adolescents with and without ASD. It was hypothesized that frontal gamma power and IQ would be positively related to SES.

Methods: Fifty-nine adolescents with ASD and 18 without ASD (TYP), aged 11-17, participated. Participants were from a social skills intervention study; data here was from the pretest (before intervention) time point. Participants completed a three-minute resting state EEG paradigm from which frontal gamma power was calculated and the KBIT-2 (Kaufman & Kaufman, 2004) to obtain IQ. Parents/primary caregivers completed a demographic form that asked about their own education and household income, which were used as separate indicators of SES.

Results: No significant differences in demographic variables were found between groups. Spearman correlations revealed no significant associations between SES and frontal gamma power within either group for income (ASD: $r_s(57)=-.020$, $p=.880$; TYP: $r_s(18)=-.202$, $p=.421$) or education (ASD: $r_s(59)=-.203$, $p=.124$; TYP: $r_s(18)=.045$, $p=.860$). There was a significant association between SES and IQ for education in both groups (ASD: $r_s(59)=.259$, $p=.047$; TYP: $r_s(18)=.614$, $p=.007$) and income in the TYP (ASD: $r_s(57)=.122$, $p=.366$; TYP: $r_s(18)=.488$, $p=.040$). Pearson's correlations were conducted to examine the association between frontal gamma power and IQ within each group; a negative link was found in the ASD ($r_s(59)=-.266$, $p=.042$), but not the TYP, group.

Conclusions: Contrary to hypotheses, results showed no relation between frontal gamma power and SES among adolescents with or without ASD. This is in contrast to previous work that identified association between brain development and SES among typically developing children (Noble, Houston, Kan, & Sowell, 2012). Additionally, there was a negative link between IQ and frontal gamma power in the ASD group but no relation in the control group. This finding could be from the atypical gamma power found in individuals with ASD. Paradoxically, IQ was related to education among both groups which suggests that SES might influence certain cognitive processes in ASD. Of note, the current sample was comprised of participants from relatively high SES and, thus, links between SES and neurological functioning may have been undetectable due to the small number of participants in the lower SES categories.

41 **182.041** Resting-State Functional Thalamo-Cortical Overconnectivity Is Associated with Block Design Peak in Autism

E. Danis[1]*, F. Samson*[2]*, E. B. Barbeau*[3]*, A. Boré*[4] *and I. Soulieres*[5]*, (1)University of Quebec in Montreal, Montréal, QC, Canada, (2)McGill University, Montreal, QC, Canada, (3)Cognitive Neuroscience Unit, Montreal Neurological Institute, McGill University, Montreal, QC, Canada, (4)Centre de recherche de l'Institut universitaire de gériatrie de Montréal, Montreal, QC, Canada, (5)Psychology, University of Quebec in Montreal, Montréal, QC, Canada*

Background: The thalamus relays sensory information to the cortex, but is also implicated in cognition trough cortico-thalamo-cortical connections (Sherman, 2012). Thus, this subcortical structure's intrinsic activity might have a role in autistics' atypical perceptual processing, which is related to their superior performance in visual tasks (Falter et al., 2013), like the Block Design (BD) task (Muth et al., 2014). There are a few reports of thalamic differences between autistic and non-autistic individuals with regards to its structure, activity and connectivity, but we do not have yet a clear and specific pattern of thalamic differences and their associations with cognitive performances.
Objectives: To investigate intrinsic functional connectivity involving the thalamus during rest in autistic versus non-autistic individuals and to verify the presence of associations with cognitive performance.

Methods: Thirty-five autistic (31 males) and 43 non-autistic (42 males) individuals underwent a resting state fRMI scan (Siemens Tim Trio 3T). Groups were matched on age (14-38 years; Autistics *M*=21.3, *SD*=6.1; Non-autistics *M*=22.6, *SD*=5.3), Wechsler Performance Intelligence Quotient (IQ) (Autistics *M*=106.0, *SD*=12.4; Non-autistics *M*=104.8, *SD*=13.4), Raven's Progressive Matrices (RPM) percentiles (Autistics *M*=72.2, *SD*=23.7; Non-autistics *M*=72.4, *SD*=22.3) and manual preference. Seed-to voxel analyses were performed between the thalamic nuclei and the rest of the brain in both groups. Connectivity values of regions showing significant differences between autistics and non-autistics were then correlated with the participants' Wechsler Full-scale, Verbal and Performance IQ, their RPM percentile and their BD scaled score and peak (the difference between the BD scaled score and the mean of all other Wechsler subtests).

Results: A pattern of greater thalamo-cortical connectivity was observed in autistic compared to non-autistic participants. Specifically, the autistic group presented stronger connections between the thalamus and the fusiform gyrus, the superior, middle and inferior temporal gyri, the temporal pole, the superior occipital gyrus and the inferior frontal regions than the non-autistic group. Interestingly, these over-connections were observed for a specific thalamic region, the medio-dorsal nucleus. The analysis of the correlations between the connectivity values of each of the cortical regions showing stronger connections with the medio-dorsal nucleus in the autistic relative to non-autistic participants with cognitive measures revealed significant positive correlation with BD peak values.

Conclusions: A pattern of stronger intrinsic connectivity between thalamus and posterior regions was observed in autistic participants relative to non-autistic participants. This stronger connectivity mainly involved a specific region from the thalamus, the medio-dorsal nucleus. The medio-dorsal thalamic nucleus typically has reciprocal connections with the prefrontal cortex and has a role in executive functions and learning (Ferguson & Gao, 2014). Its resources could be partially reallocated from the prefrontal cortex to the occipito-temporal regions in autistic individuals (as they exhibited stronger thalamo-occipitotemporal connectivity). As the strength of these connections correlates with visuospatial performance, this thalamo-occipitotemporal enhanced connectivity seen in autistic individuals may contribute to their visuospatial and cognitive strengths.

42 **182.042** Sex Differences in Interhemispheric Resting State Functional Connectivity in Autism Spectrum Disorder in Early Childhood

J. K. Lee[1], *B. Heath*[1], *A. L. Hechtman*[2], *C. Gohring*[3], *K. Huynh*[3], *D. G. Amaral*[1], *S. Ozonoff*[2] *and C. W. Nordahl*[1], *(1)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (2)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (3)UC Davis MIND Institute, Sacramento, CA*

Background: Sex differences in the neuropathology of autism spectrum disorder (ASD) are currently poorly understood. While prior research reported sex and ASD related differences in diffusion properties and organization of the corpus callosum in pre-school age children (Nordahl et al., 2015), these interhemispheric connectivity differences have not been examined using resting-state functional magnetic imaging (rfMRI).
Objectives: The current research examines sex-differences in interhemispheric resting state functional connectivity in preschool aged children with and without ASD, and how individual differences ASD symptom severity relates to interhemispheric connectivity.

Methods: The sample included 119 children with ASD (86 male, 33 female) and 68 age-matched typically developing (TD) controls (40 male, 28 female) (mean age 3.7 years). Diagnostic assessments for ASD were carried out by expert clinicians using the ADOS and ADI-R. Structural and resting state EPI BOLD images were acquired during natural nocturnal sleep. Resting state images were preprocessed using tools from AFNI, FSL, and ANTS in the Configurable Pipeline for the Analysis of Connectomes (C-PAC; Craddock et al., 2013). In brief, EPI images were time-shifted, motion corrected, and band-pass filtered (.008 < f < .08 Hz). Volumes with frame-wise displacement greater than 0.25mm were scrubbed. EPIs were then co-registered to the participant's structural T1-weighted image and then to symmetric MNI space, and smoothed at 6 mm FWHM. Interhemispheric connectivity was assessed using voxel-mirrored homotopic connectivity (VMHC). Cluster based correction for multiple comparisons was carried out using Gaussian Random Field theory using FSL (Z >2.58, p_{GRF} <.05). For each interaction cluster, mean interhemispheric connectivity was extracted for each participant to test simple effects and slopes; reported p-values for these tests are adjusted for multiple comparisons using Bonferroni.
Results:

Preliminary results reveal atypical interhemispheric functional connectivity in both boys and girls with ASD. Both males and females with ASD exhibit decreased interhemispheric connectivity between left and right posterior cingulate and precuneus cortices relative to TD (*p* = .01), with a cluster in the precuneus exhibiting a larger decrease in ASD males relative to TD males than do ASD females relative to TD females (Interaction: *p* = 1.0e-4). Reductions in interhemispheric connectivity relative to TD were also observed in paracingulate cortex and frontal operculum in males (*p*s ≤ .002). Greater ADOS severity scores predict greater interhemispheric connectivity in the cerebellum in females (b = .12, *p* = .048), but not males (b = -.07, *p* = .12), (interaction: *p* = .006). Greater ADOS severity scores predict decreased interhemispheric connectivity in two clusters in precuneus and superior temporal gyrus in males (bs = ≤ -.07, *p*s ≤ .001), but positively in the middle temporal gyrus for females (b = .08, *p* = .03) (interactions: *p*s ≤ 3.1e-5). These results suggest that the neural phenotype of ASD in young children is differentially presented in males and females compared to their respective typically developing peers.

Conclusions: These preliminary data suggest that females and males with ASD have partially dissimilar patterns of interhemispheric functional connectivity.

43 **182.043** Sex-Specific Fetal Programming Impact of Testosterone on Later Developing Intrinsic Functional Connectivity between Social Brain Default Mode Subsystems

M. V. Lombardo[1], *B. Auyeung*[2], *T. Pramparo*[3], *A. Quartier*[4], *M. C. Lai*[5], *R. Holt*[6], *J. Waldman*[6], *A. N. Ruigrok*[6], *N. Mooney*[6], *P. Kundu*[7], *E. Bullmore*[6], *J. L.*

Mandel[4], A. Piton[4] and S. Baron-Cohen[8], (1)University of Cyprus, Nicosia, Cyprus, (2)University of Edinburgh, Edinburgh, United Kingdom, (3)Univeristy of California, San Diego, La Jolla, CA, (4)Institut de Génétique et de Biologie Moléculaire et Cellulaire, Illkirch, France, (5)Department of Psychiatry, University of Toronto, Toronto, ON, Canada, (6)University of Cambridge, Cambridge, United Kingdom, (7)Translational and Molecular Imaging Institute, Icahn Institute of Medicine at Mt. Sinai, New York, NY, (8)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom

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Background: Many early-onset neurodevelopmental conditions such as autism affect males more than females and affect corresponding domains such as social cognition, social-communication, language, emotion, and reward. Testosterone is well-known for its role as a sex-related biological mechanism that affects such conditions and domains of functioning. Developmentally, testosterone may sex-bias early fetal brain development by influencing early neuronal development and synaptic mechanisms behind cortical circuit formation, particularly for circuits that later develop specialized roles in such cognitive domains.

Objectives: As a model for sex-specific mechanisms involved in autism, we investigate how fetal testosterone (FT) biases neural circuitry development in a sex-specific manner. We also examined the question of how androgens directly affect gene expression in these circuits during early prenatal periods of brain development.

Methods: Age-matched neurotypical male and female adolescents (n=32 per group, 13.22-17.18 years) were scanned with resting state fMRI (rsfMRI) on a multi-echo EPI sequence at 3T. FT was measured with radioimmunoassays on amniotic fluid samples collected during midgestation. rsfMRI data were preprocessed using multi-echo independent components analysis (ME-ICA). Functional connectivity between neural circuits was measured utilizing group-ICA and dual regression as implemented in FSL. Between-component connectivity was estimated with partial correlations (ridge regression) using FSLNets. To gain insight into how androgens affect gene expression in a model of human prenatal neurodevelopment, we further examined how gene expression changes in human neural stem cells (hNSC) after treatment with a potent androgen, dihydrotestosterone (DHT) (a re-analysis of data from Quartier et al., in revision, *Biol Psychiatry*). We then tested for enrichment between DHT-dysregulated genes and genes that show spatial patterns of gene expression that are similar to the default mode network. Spatial gene expression similarity is measured using the Neurosynth Gene Expression Decoding feature on the Allen Institute Human Brain Gene Expression Atlas data.

Results: Variation in fetal testosterone (FT) exerts sex-specific effects on later adolescent functional connectivity between social brain default mode network (DMN) subsystems. Increasing FT is associated with later dampening of functional connectivity between DMN subsystems in males ($r = -0.69$), but has no effect in females ($r = 0.02$). This difference between sexes was highly significant ($z = 3.35$, $p = 7.88e-4$). No other circuits were identified at FDR $q<0.05$ as affected by FT in a sex-specific manner. Within hNSCs, DHT dysregulates genes involved in early neurodevelopmental biological processes such as neurogenesis, cell differentiation, regionalization, and pattern specification. Gene sets with a high degree of spatial expression similarity in the adult brain to cortical midline DMN circuitry are also highly enriched in DHT-dysregulated genes (OR = 1.88, $p = 0.000002$). These DMN-related and DHT-dysregulated genes are highly enriched (fold enrichment > 5) in synaptic biological processes.

Conclusions: This work highlights sex-specific prenatal androgen influence on human social brain DMN circuitry and is of high-relevance to male-biased conditions affecting social brain development such as autism. Prenatal androgens may act as male-specific influences on DMN cortical circuit formation and maintenance by affecting genes involved in both early neurodevelopmental processes (e.g., neurogenesis, cell differentiation) and later synaptic processes.

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182.044 Spontaneous and Explicit Mentalizing in Adults with Autism Spectrum Disorder: An Fmri Study

***A. D. Nijhof**[1], L. Bardi[2], M. Brass[3] and J. R. Wiersema[4], (1)Institute of Psychiatry, King's College London, London, United Kingdom, (2)Ghent University, Ghent, Belgium, (3)Department of Experimental Psychology, Ghent University, Ghent, Belgium, (4)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium*

Background:

The socio-communicative difficulties of individuals with autism spectrum disorder (ASD) are hypothesized to be caused by a specific deficit in the ability to represent one’s own and others’ mental states, referred to as Theory of Mind or mentalizing. However, many individuals with ASD show successful performance on explicit measures of mentalizing, and for this reason, the deficit is thought to be specific to spontaneous mentalizing. While there is initial behavioral support for this hypothesis, spontaneous mentalizing in ASD has not yet been studied at the neural level. Recent findings in neurotypicals indicate a crucial role for the right temporoparietal junction (rTPJ) in both explicit and spontaneous mentalizing.

Objectives:

The goal of the current study was to investigate brain activation during both explicit and spontaneous mentalizing in adults with ASD and a neurotypical control group, by means of fMRI. Based on our hypothesis of a core mentalizing deficit in ASD associated with rTPJ abnormalities, decreased rTPJ activity was expected for both forms of mentalizing in adults with ASD.

Methods:

A group of 24 adults with ASD and 21 neurotypical controls carried out a spontaneous and an explicit version of the same mentalizing task. They watched videos in which both they themselves and another agent formed a belief about the location of an object (belief formation phase). Only in the explicit task version participants were instructed to report the agent’s belief on some trials.

Results:

At the behavioral level, no group differences were revealed in either of the task versions. A planned region-of-interest analysis of the rTPJ showed that this region was more active for false- than for true-belief formation, independent of task version, especially when the agent’s belief had a positive content (when the agent was expecting the object). This effect of belief was absent in adults with ASD. A whole-brain analysis revealed reduced activation in the anterior middle temporal pole in ASD for false- versus true-belief trials, independent of task version.

Conclusions:

Our findings suggest neural differences between adults with ASD and neurotypical controls both during spontaneous and explicit mentalizing, and indicate the rTPJ to be crucially involved in ASD. Moreover, the possible role of the anterior middle temporal pole in disturbed mentalizing in ASD deserves further attention. The finding that these neural differences do not necessarily lead to differential performance warrants further research.

45 **182.045** The Dup15q Syndrome EEG Signature Resembles the EEG Effect of GABA-a Modulators

J. Frohlich[1], *S. Huberty*[2], *V. Saravanapandian*[1], *C. DiStefano*[1], *S. Jeste*[3] *and J. F. Hipp*[4], *(1)University of California Los Angeles, Los Angeles, CA, (2)Mcgill University, Montreal, QC, Canada, (3)University of California, Los Angeles, Los Angeles, CA, (4)Neuroscience and Rare Diseases (NRD), Roche Pharma Research and Early Development, Roche Innovation Center, Basel, Switzerland*

Background:
Duplication 15q11.2-q13.1 (Dup15q) syndrome is a neurogenetic syndrome that is highly penetrant for autism spectrum disorder (ASD), as well as intellectual disability (ID) and epilepsy. Excess beta (12-30 Hz) oscillations in the electroencephalogram (EEG) are the distinguishing electrophysiological feature of Dup15q syndrome that may relate to clinical traits [Frohlich et al, 2016]. It is uncertain to what extent this EEG signature relates to expression of gamma-aminobutyric acid-A receptor (GABAaR) genes *GABRA5*, *GABRB3*, *GABRG3* in the duplicated 15q11.2-q13.1 locus.

Objectives: We sought to compare the Dup15q syndrome power spectrum to spectral changes induced by the benzodiazepine midazolam in healthy volunteers (HV). Midazolam and other benzodiazepines are non-selective GABAaR positive allosteric modulators (PAMs) that enhance the inhibitory chloride current through the GABAaR in the presence of GABA. In this manner, midazolam may provide an acute reference model for the electrophysiological effects of GABAaR gene overexpression as presumed in Dup15q syndrome.

Methods: Spontaneous EEG recordings were obtained from n = 24 children with Dup15q syndrome with ages spanning from 16 months to 14 years. These recordings were directly compared to those from 1) n = 14 age-matched typically developing (TD) children, 2) n = 14 age-and-IQ-matched children with non-syndromic ASD. Power spectral densities (PSDs, 1-32 Hz) were obtained using a Morlet wavelet transform and normalized to give relative power. The analysis was unbiased with respect to directionality, frequency band, and electrode location and accounted for multiple comparisons using cluster randomization statistics. Group differences in spectral power were compared to changes induced by midazolam in n = 12 healthy adult volunteers 1 hour following a 5mg oral administration relative to pre-dose baseline.

Results: Power differences between children with Dup15q syndrome and control groups strongly resembled spectral changes induced by midazolam in HV. Specifically, the Dup15q cohort exhibited a greater than 100% increase in relative beta power mirroring a 20-40% increase induced by midazolam in HV. Statistically significant ($p < 0.05$) clusters encompassing all channels revealed decreased power peaking at 9.5 Hz and increased power peaking at 22.6 Hz in Dup15q syndrome relative to pooled controls. A subset of electrodes belonged to a cluster of decreased power peaking at 3.8 Hz in Dup15q syndrome.

Conclusions: Spectral power anomalies identified in Dup15q syndrome are consistent with a pattern of increased high frequency oscillations and decreased low frequency oscillations reported in healthy adult volunteers challenged with midazolam and other benzodiazepine compounds. While some caution is required comparing results from adults to children, we nonetheless suggest an electrophysiological isomorphism between the Dup15q syndrome EEG biomarker and midazolam-induced EEG changes. Considering that children with Dup15q syndrome have 1) duplications of GABAaR subunit genes and 2) EEG changes mirroring those induced in HV by the GABAaR PAM midazolam, we conclude that EEG anomalies in Dup15q syndrome likely relate to overexpression of GABAaR genes. In fact, previous work [Urraca et al, 2013] has reported such EEG anomalies in patients with paternal 15q11.2-q13.1 duplications, thus obviating the paternally silenced gene *UBE3A* as the cause of such EEG patterns.

46 **182.046** The Influence of Age and ASD on Verbal Fluency Network Differences

L. C. Baxter[1], *B. B. Braden*[2], *A. Nespodzany*[3], *E. Wood*[3] *and C. J. Smith*[4], *(1)Radiology, Barrow Neurological Institute, Phoenix, AZ, (2)College of Health Solutions, Arizona State University, Tempe, AZ, (3)Barrow Neurological Institute, Phoenix, AZ, (4)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: Language functioning is variable in autism, ranging from nonverbalism in more severely affected individuals to problems with pragmatic aspects of language comprehension as well as other aspects of language processing in high functioning individuals. Aging also influences word production, in part due to decline in processing speed and changes in executive functioning.
Objectives: To investigate the influence of age and autism on fluency and its underlying brain networks.

Methods: Participants were recruited through the community and underwent screening for ASD prior to cognitive and MRI assessments. Inclusion/exclusion criteria included IQ > 80, male, and general good health. Participants included older (n =21; M=53; SD=8; 40-70) and younger (n = 18, M=21; SD=3; 18-25) individuals with ASD and age- and IQ-matched Typically Developing (TD) participants (older: n = 20, M=50; SD=7; 40-64; younger: n = 13, M=21, SD=3; 18-25). Outside the scanner, participants performed the Controlled Oral Word Association Test (COWAT) and participants also performed a fluency task modified for functional MRI (fMRI) task on a Philips 3 Tesla scanner. Group ICA was first used to visualize any network differences across groups, and nodes from significant networks were extracted from group data for further analysis using SPSS (v19).

Results:
The young adult ASD group had a lower mean COWAT score; therefore, the COWAT covariate was used for fMRI analyses. There were no significant group differences for fMRI task performance measured by mean number of words produced. All groups produced a network involving left inferior frontal cortex (LIFC), in the general area often termed “Broca’s area” that is critical for expressive language. Other networks reflecting increased activity during word generation included the right cerebellum, anterior cingulate, left hippocampus. Precuneus/posterior cingulate regions showed greater engagment during the baseline condition. Not all groups utilized these regions to the same extent when performing the fluency task, despite all groups having very similar task performance. Some regions contributing to this fluency task showed clear aging effects, while others showed group differences. The left hippocampus was far less engaged in the fluency task for both older ASD and TD individuals; in contrast, both older and younger adult ASD groups showed less cerebellar activation compared to the TD groups. No significant age by ASD interactions were observed, but among older individuals only, significant increased engagement of Broca’s area was observed in the ASDs compared to the TD group, possibly reflecting compensation for other weaknesses.

Conclusions: We found that both age and the presence of ASD influenced brain networks engaged during a fluency task. With our current sample, we did not find any significant age-by-group interactions, but a trend that older individuals with ASD may utilize Broca’s area to a greater degree to compensate for other network weaknesses. Interestingly older adults use less memory-related regions than their younger counterparts, while individuals with ASD generally tend to engage the cerebellum less than TDs.

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182.047 The Role of Biological Sex and Age in the Intrinsic Functional Properties of Males and Females with Autism

D. L. Floris[1]*, M. C. Lai*[2]*, M. P. Milham*[3] *and A. Di Martino*[4]*, (1)Donders Centre for Cognitive Neuroimaging, Nijmegen, Netherlands, (2)The Hospital for Sick Children, Toronto, ON, Canada, (3)Institute for Pediatric Neuroscience, NY, NY, (4)The Child Mind Institute, New York, NY*

Background: The male preponderance in the prevalence of autism spectrum disorder (ASD) has sparked research into its sex differences. While sex differences have been reported to vary with age in cognitive-behavioral studies of typical and atypical development, very little is known about neural sex differences across neurodevelopment in ASD. Initial resting-state functional magnetic resonance imaging (R-fMRI) findings suggest that females and males with ASD present with different neurophenotypes (Alaerts *et al.*, 2016, Ypma *et al.*, 2016). However, no study has considered developmental sex differences in the intrinsic functional brain of those with ASD.

Objectives: We aimed to explore the role of biological sex and age in the intrinsic functional properties of the brain in males and females with ASD relative to neurotypical males and females.

Methods: We leveraged the combined large-scale Autism Brain Imaging Data Exchange (ABIDE I and II) repositories to select de-identified, low-motion R-fMRI from the publically available ABIDE repositories to include females with ASD aged 5 to 30 years, IQ- and age-matched males with ASD as well as age-matched neurotypical control males and females. We examined five voxel-wise R-fMRI metrics that have been found to be affected in ASD and to have distinct patterns by sex. R-fMRI data was preprocessed using the Configurable Pipeline for The Analysis of Connectomes. We set a general linear model at each voxel assessing the main effect of sex, age and diagnosis and their three-way interaction while accounting for head motion, acquisition sites and mean measure signal. We employed Gaussian random field theory correction with stringent statistical thresholds ($Z \geq 3.1$; $p<0.05$).

Results: Data selection yielded the largest-to-date neuroimaging sample of females with ASD (N=91), along with a sample of males with ASD (N=422) and controls (N males=472, N females=218). Across most R-fMRI metrics, there were significant main effects of diagnosis, sex, and age, along with their significant three-way interaction. A region in the right inferior parietal lobule (IPL) showed consistently across a range of R-fMRI metrics decreases as a function of increasing age in females with ASD compared to males with ASD. The opposite pattern was evident in neurotypicals. This region significantly mapped onto cognitive components related to sensory visceral, inhibitory control and theory of mind functions. Across all results sex differences were most pronounced in adults compared to younger ages.

Conclusions: Results of this cross-sectional design indicate that relative to neurotypical males and females, age-related sex differences in ASD occur in IPL consistently across R-fMRI metrics. The pattern in males with ASD resembles that seen in neurotypical females, whereas the pattern in females with ASD resembles that in neurotypical males, suggesting that age-related factors come into play in models of ‘gender-incoherence’ of ASD. Future work is warranted to confirm current results in longitudinal samples.

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182.048 Using Resting State Functional MRI to Build a Personalized Autism Diagnosis System

O. Dekhil[1]*, H. Hajjdiabe*[2]*, B. Ayinde*[3]*, A. Shalaby*[4]*, A. Switala*[5]*, A. Elshamekh*[6]*, M. Ghazal*[2]*, R. Keynton*[4]*, A. S. El-Baz*[5] *and G. Barnes*[7]*, (1)Bioengineering, university of Louisville, Louisville, KY, (2)Electrical and Computer Engineering, Abu Dhabi University, Abu Dhabi, United Arab Emirates, (3)Electrical and Computer Engineering, University of Louisville, Louisville, KY, (4)Bioengineering, University of Louisville, Louisville, KY, (5)University of Louisville, Louisville, KY, (6)Bioengineering, Univeristy of Louisville, Louisville, KY, (7)University of Louisville School of Medicine, Louisville, KY*

Background:

Autism spectrum disorder (ASD) is a neurodevelopmental disorder affecting approximately 1 in 68 people. Yet, there is no confirmed cause identified for ASD. Studying brain functional connectivity via resting state functional MRI (rs-fMRI) is one of the trending techniques used in understanding ASD.

Objectives: We tested the feasibility of using rs-fMRI data to build a computer-assisted diagnosis (CAD) system for ASD. From the clinical point of view, such a system could be of great value as it helps to predict and understand behavior of autistic individuals from very early, since rs-fMRI may be acquired even from infants. This is an important step towards advancing personalized medicine in autism, which is the ultimate goal of our group’s research efforts in this area.

Methods:

Resting state functional MRI data for 202 subjects were obtained from the National Database for Autism Research (NDAR). These were used to train and test a deep learning-based system to automatically detect rs-fMRI features potentially diagnostic for ASD. Power spectral density of time courses corresponding to the spatial activation areas were raw features input to a stacked autoencoder network. The higher-order representations produced by the network were used to build a classifier based on probabilistic support vector machines.

Results:

Hyperparameter optimization for the stacked autoencoder resulted in the selection of sparseness $\rho = 0.3$, sparse penalty $\beta = 1.0$, and weight regularization $\mu = 10^{-5}$. With these training parameters, classification accuracy was estimated via two-fold cross validation to be 0.856, with sensitivity of 0.984 and specificity of 0.798. Area under the ROC curve was 0.962. Using the ASD prevalence of the general population (1:68), the corresponding positive predictive value (PPV) is 0.44 and negative predictive value (NPV) is 0.998. In a high risk population where an older sibling has ASD, the prevalence is 18.7% (*Pediatrics* 128:e488, 2011), and the corresponding PPV is 0.925 whereas NPV is 0.982.

Conclusions:

This fMRI algorithm may be more informative in high-risk cases than in the general population. In a study of high-risk infants (*Sci Transl Med* 9:eaag2882, 2017), rs-fMRI networks at 6 months of age correctly predicted an ASD diagnosis at 24 months in 9 out of 11 who converted to ASD, and correctly predicted 48 of 48 who did not convert. Few rs-fMRI networks were correlated with social communication and cognitive ability in high-risk infants, while many more were correlated with repetitive behaviors. This suggests a developmental context since striatal and brainstem neural networks tend to mature earlier than cortically based networks. In the older population of the present study, we identified similar regions with altered connectivity previously noted in ASD including the pre-motor, supplementary motor, dorsal lateral, medial prefrontal, and sensorimotor cortex and regions involved in language. Previous rs-fMRI studies have noted that some of these regions, as parts of the Default Mode Network and interhemispheric connectivity networks, have reduced connectivity in ASD (*Front Psychiatry* 7:205, 2017). The data presented suggest the algorithms, especially when combined in a multimodal approach, have the potential to inform a diagnosis of ASD.

49 **182.049** Utilizing Resting-State fMRI to Explore Insula Functional Connectivity in Individuals with and without Autism Spectrum Disorders

*S. M. Francis[1], J. Camchong[1], A. Tseng[1], L. Goelkel-Garcia[2], L. Brickman[3], B. A. Mueller[1], K. O. Lim[1] and **S. Jacob**[1], (1)Department of Psychiatry, University of Minnesota, Minneapolis, MN, (2)Department of Anesthesiology, University of Minnesota, Minneapolis, MN, (3)Rosalind Franklin University of Medicine and Science, Chicago, IL*

Background: Under the theory of embodied simulation put forth by Gallese and colleagues (2005, 2006), impairments in brain regions that integrate internal and external information may lead to deficits in social information processing (SIP). Recent neuroimaging studies report that the insula plays a key role in behavioral aspects that mediate SIP. The insula consists of three cytoarchitectectonically distinct regions: the anterior insula (AI), which participates in emotional salience detection and attentional control; the posterior insula (PI), which is involved in sensorimotor integration, body orientation, environmental monitoring, and response selection; and a transitional dysgranular zone. Autism spectrum disorders (ASD) are commonly characterized by deficits in social interaction and communication. Given these observed social behavioral impairments in ASD and the role played by the insula in SIP, investigating the functionality of this area in ASD is important.
Objectives: To further understand the role of the insula in ASD, we investigated differences in functional connectivity (FC) during the acquisition of resting-state functional magnetic resonance imaging (rs-fMRI) data in male children and adolescents with and without ASD.

Methods: Resting-state FC data was collected in 30 male participants (Age: 10-17 years). Thirteen participants had ASD diagnoses (Age: M=14.6; range 10.2-18) and 17 individuals were typically-developing controls (Age: M=14.4; range: 10-17.5). With seed-based FC measures, we compared resting FC in AI and PI networks between groups. We utilized the Social Communication Questionnaire (SCQ) to assess social functioning.

Results: We found lower FC in the ASD group between AI and superior frontal gyrus (SFG) and thalamus when compared to controls. We also noted hypoconnectivity between PI and inferior parietal lobule (IPL), fusiform gyrus (FG), and lentiform nucleus/putamen in comparison to controls. Conducting a regression analysis using SCQ scores as a continuous variable (without having a distinction between groups), we observed lower SCQ scores were associated with higher FC between: AI and SFG; AI and thalamus; PI and FG; and PI and IPL.

Conclusions: It has been hypothesized that the heterogeneity observed in ASD may be associated with variation in connectivity within and between neural networks. In our investigation, we found hypoconnectivity between the insula and several brain areas (e.g., IPL, FG) in participants with ASD relative to controls. When using SCQ scores from the ASD and control groups to create a continuum, we observed lower scores were associated with higher FC between the insula and some of the same regions. These findings suggest further investigation of the insula's role in SIP across a spectrum of social abilities is needed.

50 **182.050** Visual-Evoked Potential Morphology Differences across Rare Genetic Disorders with Heightened Risk for ASD

***L. Gabard-Durnam**[1], C. E. Mukerji[2], K. J. Varcin[3], J. LeBlanc[4], L. M. Baczewski[5], J. Keller[6], S. Jeste[7] and C. A. Nelson[6], (1)Pediatrics, Harvard Medical School, Boston, MA, (2)Harvard University, Cambridge, MA, (3)Telethon Kids Institute, University of Western Australia, Perth, Western Australia, Australia, (4)Harvard Medical School, Boston, MA, (5)Education, UCLA Center for Autism Research and Treatment, Los Angeles, CA, (6)Boston Children's Hospital, Boston, MA, (7)University of California, Los Angeles, Los Angeles, CA*

Background: Many rare genetic disorders confer elevated risk for developing Autism Spectrum Disorder (ASD). These disorders provide unique opportunities to evaluate how specific mutations contribute to ASD phenotypes, including altered sensory information processing. However, few studies have directly compared how different genetic mutations disrupt cortical processing of sensory information. Visual-evoked potentials (VEPs), measured with electroencephalography (EEG), provide a noninvasive, translational index of basic sensory processing for comparing visual cortical function across ASD populations, and they could serve as a stratification biomarker across conditions.
Objectives: (1) We compared VEP component morphologies to identify distinct markers of disrupted visual processing across the following disorders: Rett Syndrome, Tuberous Sclerosis Complex (TSC), Phelan-McDermid Syndrome (PMS), FOXG1, CDKL5, and PTEN. (2) Given the challenging nature of processing brief, high-artifact EEG recordings collected in infants and young children, we developed a standardized, automated pipeline optimized for this class of EEG data to improve statistical power and reproducibility of results.

Methods: Data collection is ongoing. Using 128-channel HydroCel Geodesic Sensor nets, pattern-reversal VEPs have been elicited from 37 female Rett participants and 20 age-matched typically developing (TD) children, 17 TSC participants, and 18 age-matched TD infants, 7 PMS participants, 2 FOXG1 participants, 4 CDKL5 participants, and 2 PTEN participants. Analyses below focus on the Rett and TSC participants, although we will present data on all groups at INSAR. Data were manually-inspected for artifact, and subject to automated amplitude-based artifact detection. VEPs were extracted for the Oz electrode. We also introduce and compare processing with the Harvard Automated Processing Pipeline for EEG (HAPPE), freely-available software for fully-automated, standardized processing optimized for developmental EEG data.

Results: The TSC group had significantly more negative N1 amplitudes than the Rett group ($p < 0.005$), but was not significantly different from either TD group ($p > 0.05$). The Rett group also had significantly smaller P1 and N2 component amplitudes compared to the Rett age-matched TD group, the TSC group, and the TSC age-matched TD group (all $p < 0.005$). No latency effects distinguishing either disorder group from the other groups were observed. Post-hoc analysis revealed that the N1 amplitude difference between the Rett and TSC groups was driven by the 9 TSC infants who later received an ASD diagnosis (TSC+ASD), where the TSC+ASD subgroup had significantly more negative N1 components than the Rett group ($p < 0.001$). HAPPE processing of the EEG data outperformed multiple alternative processing strategies, rejecting more artifact while retaining 3 times more trials.

Conclusions: VEP component morphologies are differently affected across the rare genetic disorder groups relative to each other and age-matched TD groups. Preliminary analysis suggests that the youth with ASD differ from each other across the rare genetic disorders as well. Identifying VEP morphology differences that are common across or specific to the distinct mutations may provide translational biomarkers for measuring both the progress of the disorders and future interventions. Therefore, we also introduce HAPPE, an automated pipeline for optimally processing EEG data from developmental populations to facilitate comparisons between studies of these ASD-related disorders.

51 **182.051** ERPs to Congruent Pictures and Sentences in Minimally Verbal Children and Adolescents with ASD

***E. Zane**[1], S. Kresh[2], A. Benasich[3] and V. L. Shafer[4], (1)FACE Lab, Emerson College, FACE Lab, Boston, MA, (2)CUNY Graduate Center, New York, NY, (3)Center for Molecular & Behavioral Neuroscience, Rutgers Univ., Newark, NJ, (4)Speech-Language-Hearing Sciences, CUNY Graduate Center, New York, NY*

Background:

Individuals with Autism Spectrum Disorder (ASD) are believed to struggle with multimodal processing and integration (Brandwein et al., 2013). Such deficits contribute to reduced speech discrimination in ASD (Smith and Bennetto, 2007; Stevenson et al., 2014), since one must rely on simultaneous audio-visual (AV) cues to differentiate sounds in noisy environments (Sumby and Pollack, 1954).

Not only do such lower-order language processes – e.g., phoneme differentiation – require multimodal integration, but so can higher-order processes, like semantic interpretation. When a sentence is spoken in the real world, information represented by the sentence often refers to objects/characters and events present in the visible environment. If an individual cannot simultaneously process AV information, she may struggle to connect linguistic information to her environment, and may miss opportunities for assigning visual referents to linguistic symbols when first acquiring language (Gleitman and Gleitman, 1992; Siskind, 1992).

Objectives:

To use Event Related Potentials (ERPs) to determine how minimally verbal (MV) children and adolescents with ASD process auditory sentences while viewing contextually congruent photographs.

Methods:

We recruited 9 MV children and adolescents with ASD (3 F; Mean age = 7;4) and 9 age-matched neurotypical (NT) peers (2 F; Mean age = 7;4). We also recruited one adolescent with ASD with preserved language/cognitive abilities (VASD) and his NT twin (age=12;9). We showed these 20 participants 224 photographs of animals performing an action (e.g., a frog jumping); 300ms later, a congruent sentence was played (e.g., “the frog jumps”). Photographs remained on-screen while sentences played, and we recorded ERPs from photograph onset.

Averaged activity in posterior electrodes between 400-600ms post-picture onset was used to explore group differences in the Late Posterior Positivity response (LPP), an ERP implicated during the processing of complex pictures (Ferrari et al., 2008). Paired t-tests compared LPPs in individuals with ASD to NT matches.

Results:

In all NT participants, an LPP was elicited, while only one participant with ASD showed such a response ($p < 0.001$). The participant with VASD did not show an LPP.

Conclusions:

NT individuals show large LPP responses to photographs, suggesting that they are attending to the photographs while listening to the sentences. The amplitude and duration of LPPs are similar to posterior positivities elicited by matching AV information in previous studies (Molholm et al., 2004), indicating that the congruency of AV information in our study may have amplified the LPP in NT individuals.

The vast majority of our ASD cohort showed no LPP. Most showed visual obligatories, indicating they initially processed photographs similarly to the NT group; lacking LPPs suggest they stopped attending to photographs once encountering auditory information. Because the child with VASD also showed this pattern, this response might be particular to ASD, rather than dependent on language ability. Future research should test this possibility. Our result accords with speech-perception research showing that individuals with ASD predominantly focus on auditory information when perceiving simultaneous audio-visual cues (Brandwein et al., 2013). Results have far-reaching implications for the on-line processing and acquisition of language meaning in ASD.

52 **182.052** Inter and Intra Hemispheric EEG Coherence in Adolescents with ASD Related to Social Function

A. D. Haendel[1]*, A. Barrington*[2]*, H. K. Schiltz*[3]*, A. J. McVey*[3]*, K. M. Rivera*[3]*, S. Pleiss*[4]*, A. Carson*[5]*, B. Yund*[6] *and A. V. Van Hecke*[7]*, (1)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (2)Biomedical Engineering, Marquette University, Milwaukee, WI, (3)Marquette University, Milwaukee, WI, (4)Great Lakes Neurobehavioral Center, Edina, MN, (5)Pediatrics, Autism Center, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (6)Psychology, University of Wisconsin Milwaukee, Milwaukee, WI, (7)Psychology, Marquette University, Milwaukee, WI*

Background: While differences in neural connectivity among those with ASD is well-established, there is a paucity of studies that have examined brain connectivity across an intervention for ASD. Electroencephalogram (EEG) is a flexible tool to assess neural differences related to ASD (Coben, Mohammad-Rezazadeh, & Cannon, 2014). People with ASD have been characterized as having relatively greater right-versus-left-frontal hemisphere activity (Burnette et al., 2011; Moncrieff, 2010). Further, at rest, people with autism show functional under-connectivity in anterior-posterior connections (Cherkassy et al, 2006).

Objectives: The primary objective of the current study was to examine EEG coherence in the alpha band and relations to social behavior among adolescents with ASD before and after a social skills intervention.

Methods: Fifty-nine (59) adolescents between the ages of 11-16 years participated in this study. Autism was confirmed with the ADOS and IQ was assessed with the KBIT-2; an IQ of ≥ 70 was necessary for participation. Participants were part of a RCT of the PEERS® intervention, which is a manualized, social skills treatment for youth with ASD. Both before and after intervention, adolescents or caregivers completed the Quality of Socialization Questionnaire (QSQ), Social Responsiveness Scale (SRS) and Test of Adolescent Social Skills Knowledge (TASSK).Electroencephalogram (EEG) was performed in a three-minute eyes-open resting state paradigm. The Magnitude Squared Coherence (MSC) was calculated with MatLab using the Minimum Variance Distortionless Response method (MVDR; Capon, 1969) to examine the relation between two signals. Six coherence measures (frontal, temporal, and parietal regions in each hemisphere respectively) were calculated for each participant at pre- and post-intervention. The alpha band (8-12 Hz) was examined because it is associated with neural activity at rest. After distribution analysis, Spearman rank-order (rho) correlations were performed of EEG coherence and social outcome scores before and after intervention.

Results: At pre-, a positive relation was found between the Temporal Right-Temporal Left coherence and the QSQ Total, (r_s (59) = .36, $p < .05$). At post-, results revealed negative links between the SRS Autistic Mannerisms Subscale and Frontal Left-Frontal Right (r_s (59) = -.39, $p < .01$), Temporal Right-Temporal Left (r_s (59) = -.31, $p < .05$), Parietal Right-Parietal Left (r_s (59) = -.36, $p < .01$), and between QSQ Total and Frontal Right-Parietal Right (r_s (59) = -.32, $p < .05$).

Conclusions: Findings at pre-intervention provide further support for the under-connectivity theory of ASD. Furthermore, results demonstrate additional associations between coherence and social behavior were found at post test. Across intervention, as autism severity symptoms decrease, the neural connectivity between specified brain regions increases. These findings will be examined further by comparing additional participants as well as comparing data to typically developing adolescents as well as a delayed treatment group. Findings of this study have implications for the structure of interventions for ASD across settings as well as gaining an understanding of neural and behavioral plasticity in ASD.

Poster Session
183 - Diagnostic, Behavioral & Intellectual Assessment
11:30 AM - 1:30 PM - Hall Grote Zaal

54 **183.054** A Comparison of Males and Females Presenting for an ASD Evaluation in Young Childhood

S. Richardson[1]*, C. Beacham*[2]*, L. J. Dilly*[1] *and C. Klaiman*[3]*, (1)Marcus Autism Center, Atlanta, GA, (2)Marcus Autism Center, Children's Healthcare of Atlanta, and Emory University School of Medicine, Atlanta, GA, (3)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA*

Background: The research on gender differences in ASD symptomatology is inconsistent, yet clinicians often perceive differences in presentation for girls and boys. One large scale study with a wide age range represented found weaker observed social communication and interaction skills for females (Frazier et al., 2014), while another found stronger skills for females, at least on certain ADOS-2 modules (Mussey et al., 2017). Other studies suggest fewer repetitive behaviors in females (Frazier et al., 2014; Mandy et al., 2012). Despite the importance of identifying ASD at an early age, prior research has not specifically focused on gender differences in toddlers and how this may be captured on assessment measures.
Objectives: Evaluate gender differences in autism symptomatology in toddlers, assessed by the ADOS-2, and level of developmental functioning, as assessed by the Mullen.

Methods: The sample consists of 178 males and 44 females between the ages of 14-45 months (M = 29.39 months, SD = 6.5 months) referred based on parent concerns and/or provider recommendations who received an ASD diagnosis. Comprehensive ASD diagnostic evaluations consisted of the Mullen Scales of Early Learning (Mullen), Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), parent-report measures (M-CHAT-R, ASQ-3), and parent interviewing.

Results: Preliminary analyses showed no differences in ADOS-2 module used by gender (Module T = 58%, Module 1 = 36%, Module 2 = 7%). There were no significant differences between the four assessed Mullen domains by gender (Visual Reception: Males M = 31.31, SD = 11.36; Females M = 33.82, SD =11.59, Fine Motor: Males M = 28.45, SD =9.77, Females M = 28.59, SD = 10.18, Receptive Language: Males M = 25.06, SD = 10.4; Females M = 26.36, SD = 10.24, Expressive Language: Males M = 25.86, SD = 9.61; Females M = 26.98, SD = 9.53). Additionally, there were no significant differences in ADOS-2 Social Affect, Repetitive Behaviors, or total scores. At the item level, there was only one trend found with females scoring lower on facial expressions directed to others. Follow-up, exploratory analyses found more differences in toddlers with below average to average Mullen expressive language scores (n = 27 males, 8 females). Girls were found to have significantly lower scores on facial expressions directed to others ($t(33)= 3.02$, $p<.005$), quality of social overtures, ($t(26) = 2.13$, $p <.05$), and a trend for lower scores on pretend play ($t(33) = 1.78$, $p = .08$).

Conclusions: Results are generally consistent with previous research conducted with older individuals finding that girls and boys are more similar than dissimilar. Subtle differences were found for individuals without significant delays in expressive language skills, with girls showing a greater range of facial expressions, increased quality of social overtures, and better pretend play skills; however, this should be interpreted with caution as findings need to be replicated in a larger sample. Although findings from this community-referred sample can be generalized to clinical practice, it is possible that more subtle, higher-functioning children were missed in this sample, particularly considering the delays found developmental functioning for this sample.

55 **183.055** A Patient Report Outcome Measure of Sensory Difficulties in Autism Spectrum Disorder

H. Bruining[1]*, D. M. van Andel*[2] *and H. van Stel*[3]*, (1)Brain Centre Rudolf Magnus, Amsterdam, Netherlands, (2)Brain Center Rudolf Magnus, Department of Psychiatry, UMC Utrecht, Utrecht, Netherlands, (3)Julius Center, UMC Utrecht, Utrecht, Netherlands*

Background:
The addition of hyper or hypo reactivity to sensory input as diagnostic criterion in Autism Spectrum Disorder (ASD) calls for a new approach to identify and quantify atypical sensory behavior in daily life. Studies report both over and under responsiveness in children with ASD and similar physiological sensory processing deficits can lead to a variety of behaviors. Currently used instruments cannot capture the wide heterogeneity of these behaviors: the questionnaires are often diagnostic tools, developed from the perspective of the professional and symptom based. Besides, it is acknowledged that current tools and questionnaires for ASD have significant limitations to be used as a patient-oriented outcome measure for intervention research. They have no established cut-off for clinically relevant change, a *minimal important difference*. Considering the recent focus on and rise in novel interventions aimed at treating aberrant sensory processing, the need arises for relevant outcomes from the perspective of patients and/or caregivers themselves that can be used in both clinical and research settings.

Objectives:

To develop and validate a patient-reported outcome measure (PROM) for problems arising from sensory reactivity difficulties in daily life that additionally serves as (relevant) effect measure in intervention studies.

Methods:

This is a mixed-methods study guided by the iterative approach described in the US Food and Drug Administration Guidance for Industry Patient-reported Outcome Measures. Information from 20 parents of patients with different severity of ASD and intellectual functioning was collected. Qualitative thematic data analysis resulted in main themes, pool of items and response options, providing a pilot version of the PROM. Weighting was added to individualize the PROM. ‘Think aloud’-procedures will be used to evaluate and optimize pilot versions and psychometric testing will be carried out to assess validity, reliability and sensitivity to change.

Results:

First results show major discrepancy between items on conventional questionnaires and our reported main themes. We have identified novel and meaningful problem areas, such as fatigue, anger outbursts and attentional problems, which currently used questionnaires have failed to address.

Results of the development of the PROM and preliminary data will be presented.

Conclusions:

By using a novel approach to identify and quantify sensory reactivity deficits in children with ASD in daily life, we will be able to develop a multidimensional and individually tailored PROM. Now we can identify and compare sensory reactivity deficits on both individual and group level for future application as outcome measure for interventions and clinical trials.

56 **183.056** A Promis®-Based Approach to Item Development and Factor Analysis of the Emotion Dysregulation Inventory for Youth with ASD

T. N. Day[1]*, L. Yu*[2]*, M. Siegel*[3]*, S. W. White*[4]*, P. Pilkonis*[2] *and C. A. Mazefsky*[5]*, (1)Florida State University Autism Institute, Tallahassee, FL, (2)University of Pittsburgh School of Medicine, Pittsburgh, PA, (3)Maine Medical Center - Tufts School of Medicine, Westbrook, ME, (4)Psychology, The University of Alabama, Tuscaloosa, AL, (5)Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA*

Background: Poor emotion regulation maintains behavioral problems in autism spectrum disorder. Thus, emotional dysregulation is an ideal treatment target. However, measures of this construct are lacking for youth with ASD, and available measures that do exist are reliant on verbal ability. Little is known about the presentation of emotion dysregulation in youth with ASD – especially across the range from nonverbal to fully verbal and intellectual capacity.

Objectives: Using Patient-Reported Outcomes Measurement Information System (PROMIS) guidelines, this presentation will describe the creation of items tapping observable manifestations of poor emotion regulation in youth with ASD, and the dimensionality of emotion dysregulation in ASD. These represent the initial steps in the development of the *Emotion Dysregulation Inventory* (EDI).

Methods: A comprehensive literature search and the development of a conceptual model occurred to derive the item-bank. Candidate items underwent expert review, followed by interviews conducted with caregivers of 19 individuals with ASD who ranged in age, verbal ability, and cognitive functioning. The interviews combined a think-aloud and debriefing methodology; further detail will be provided. The 66 candidate items were evaluated via caregiver report in two samples: (1) Interactive Autism Network (IAN; *n*=1323, ages 6-17) representing the full range of ASD severity and adaptive functioning; and (2) Autism Inpatient Collection (AIC; *n*=432, age 4-20). The AIC is a six-site study of psychiatric inpatients with ADOS-confirmed ASD that includes participants with extreme forms of emotion dysregulation. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted in non-overlapping subsamples (*n*=870 for EFA, 885 for CFA).

Results: Clinicians and researchers with expertise in ASD reviewed candidate items; recommended modifications were incorporated. Parent interviews indicated that items had sufficient coverage of emotional reactivity and regulation and were understandable to parents. Collectively, these steps provided evidence of face validity for the target construct. EFA identified a 2-factor model: (1) Reactivity, characterized by intense, rapidly escalating, sustained, and poorly regulated negative emotional reactions, and (2) Dysphoria, characterized by anhedonia, sadness, and nervousness. The factor structure did not differ for the IAN and AIC samples, despite lower verbal and cognitive ability in AIC compared to IAN. CFA in an independent sample demonstrated adequate to good fit for both factors. An overall total score to subsume the two factors was not supported.

Conclusions: The strategy used to develop the EDI was effective in creating an item bank with sufficient content coverage and ease of understanding. Factor analyses of EDI candidate items supported distinct dimensions of emotion dysregulation in ASD. Consistent with studies in non-ASD samples, the tendency to experience intense negative emotion and difficulty regulating emotion emerged as a single factor (i.e., Reactivity), which was separable from general unease (Dysphoria). Future directions include the downward age extension of the EDI to examine the presentation of emotion dysregulation in younger children.

57 **183.057** Adolescent Autism Traits: Associations with Parental Age and Physiological Functioning

A. Arias[1]*, A. J. McVey*[1]*, H. K. Schiltz*[1]*, A. D. Haendel*[2]*, K. M. Rivera*[1]*, S. Pleiss*[3]*, A. Carson*[4]*, B. Yund*[5] *and A. V. Van Hecke*[6]*, (1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Great Lakes Neurobehavioral Center, Edina, MN, (4)Baylor College of Medicine, Houston, TX, (5)Psychology, University of Wisconsin Milwaukee, Milwaukee, WI, (6)Psychology, Marquette University, Milwaukee, WI*

Background: Both older maternal and paternal age, have been identified as risk factors for having a child with autism (Grether et al., 2009). Little is known regarding the links between parental age and autism severity. Furthermore, atypical cardiac activity has been uncovered among adolescents with ASD (Van Hecke, et al. 2009), suggesting physiological dysregulation (Guy et al., 2014). Thus, autism severity may be associated with physiological arousal and parental age might have implications for both.

Objectives: 1) Explore relations between caregiver-report of autism traits and parental age among a sample of adolescents with ASD. 2) Examine associations between caregiver-report autism traits and physiological arousal measured using heart rate. 3) Determine if HP mediates the link between parental age and caregiver-report of autism traits. Our hypotheses are that positive associations will be uncovered for our first objective, whilst negative associations will be found in our second objective. Finally, HP will mediate the link between parental age and autism traits.

Methods: 167 adolescents with ASD aged 11-16 and their parents/caregivers participated in this study. Participants presented for a RCT of a social skills intervention; data here is from pretest. Descriptive statistics are in Table 1. Caregivers completed a demographic form that asked about maternal and paternal age. Presence of autism was confirmed with the ADOS, IQ was measured with the KBIT-2. All participants had an IQ ≥ 70. Caregivers also completed the Autism Quotient (AQ) and Social Responsiveness Scale (SRS) as measures of autism traits, which were analyzed at a subscale and total score level. Higher scores on these measures indicated greater autism severity. Heart period (HP) data were collected from a sub-sample (*n* = 94).

Results: Negative links were uncovered between maternal age and the AQ Communication (*r*(167) = -.157, *p* = .043) and SRS Cognition subscales (*r*(167) = -.187, *p* = .016). Considering paternal age, negative relations were found for the AQ Communication (*r*(160) = -.192, *p* = .015), SRS Cognition (*r*(160) = -.223, *p* = .005), SRS Autistic Mannerisms subscales (*r*(160) = -.179, *p* = .023), and SRS Total (*r*(160) = -.194, *p* = .014). Associations between HP and the SRS Cognition (*r*(93) = -.206, *p* = .046), Autistic Mannerisms (*r*(93) = -.224, *p* = .030), and Total (*r*(93) = -.315, *p* = .002) were found. No significant mediation was uncovered.

Conclusions: The negative links uncovered between parental age and autism severity suggest that milder symptoms are found in children of older parents. This may indicate that, in addition to established associations with risk for having a child with autism, parental age may also be associated with the severity of autism symptoms. Because older parental age was associated with less severe scores on the SRS, future studies might explore other factors related to parental age (such as parenting style) as these may impact the severity of autism symptoms in their children (Mohammadi & Zarafshan, 2014). Furthermore, a negative link was discovered between autism severity and physiological arousal, thus, more physiological dysregulation seems to be related to greater autism severity.

58 **183.058** ADOS-2 Classification in a Psychiatric Population

C. Colombi[1,2]*, A. M. Fish*[1] *and M. Ghaziuddin*[3]*, (1)Psychiatry, University of Michigan, Ann Arbor, MI, (2)University of Michigan, Ann Arbor, MI, (3)University of Michigan, Ann Arbor, Ann Arbor, MI*

Background: the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2), is considered a "gold-standard" instrument for diagnosing autism spectrum disorder (ASD) in adults. Despite good sensitivity and specificity of the ADOS-2 are demonstrated in research and clinical settings with highly trained examiners, little is known about the accuracy of the diagnostic classification with psychiatric populations. Objectives: to evaluate the accuracy of the ADOS-2 diagnostic classification in an acute psychiatric population.

Methods: we evaluated diagnostic classification of the first 36 individuals admitted to the inpatient unit with a possible ASD diagnosis. Reasons for admission included anxiety, depression, conduct disorder, oppositional defiant disorder, self-injurious behavior, and suicidal ideation.

Results: 8 out of a total of 36 individuals with ASD did not meet diagnostic criteria for classification in the ADOS-2. 8 out of a total of 36 individuals with Non Spectrum diagnosis met diagnostic criteria for classification in the ADOS-2. Sensitivity and specificity were both at 77% with 20 individual classified correctly (55%) and 16 individuals classified incorrectly (44%).

Conclusions: results indicate that the ADOS-2 diagnostic classification in patients admitted to a psychiatric unit should be interpreted carefully given the number of individuals classified incorrectly by the instrument.

59 **183.059** Adult Manifestations of Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS): A Combined Epidemiological and Case Register Study.

E. Horwitz[1]*, R. A. Schoevers*[2] *and C. A. Hartman*[3]*, (1)University Psychiatric Clinic, University Medical Center Groningen, Groningen, Netherlands, (2)Psychiatry, University Medical Center Groningen, Groningen, Netherlands, (3)Department of Psychiatry, Interdisciplinary Center Psychopathology and Emotion Regulation (ICPE), University Medical Center Groningen, Groningen, Netherlands*

Background: Autism Spectrum Disorder is a highly heterogeneous disorder which is currently defined on the basis of childhood behavioral repertoire. Limited information is available on features of the autistic phenotype in adults. Knowledge on the outcome for individuals with normal intelligence with milder forms of ASD is scarce.
Objectives: The aim of this study is to describe autistic and comorbid psychopathology in young adults, with a previous clinical diagnosis of PDD-NOS. Based on scores on dimensional and categorical diagnostic measures their profile of ASD and comorbid psychopathology is compared to that of young adults in specialist psychiatric healthcare without an ASD diagnosis.

Methods: Participants from the TRacking Adolescents' Individual Lives Survey (TRAILS-clinical cohort) with a PDD-NOS (n=148) or other (n=250) diagnoses as registered in the Psychiatric Case Register North Netherlands between age 11 and 19 were compared, at age 19, on ASD symptomatology (Autism Diagnostic Observation Schedule (ADOS) module 4, Adult Social Behavior Questionnaire (ASBQ) self- and other-report versions) and comorbid diagnoses (Composite International Diagnostic Interview (CIDI) and ADHD self- and other checklists).

Results: Young adults with an PDD-NOS or Asperger diagnosis in childhood on average scored higher on the ADOS and ASBQ than clinical controls, but the majority (72%) did not exceed the ASD cutoff according to the ADOS. Eighty-one percent of the ASD group compared to 97 % of the clinical controls fell outside the ASD spectrum according to the ADOS Calibrated Severity Scale. Differences between ASD and control groups were larger on ASBQ other-report than on ASBQ self-report. On all subscales of the ASBQ differences between ASD and clinical control groups scores reached statistical significance, apart from self-report on the *violation of social conventions* and *sensory stimulation / motor stereotypies* subscales. Number of comorbid psychiatric disorders according to the CIDI did not differ significantly between the groups. The ASD group was more dependent on mental health care in and psychiatric medication than the clinical comparison group.

Conclusions: A clinical PDD-NOS diagnosis in early adolescence in most cases did not lead to an ASD classification according to ADOS in young adulthood in our sample. Compared to a clinical comparison group, young adults with a previous PDD-NOS diagnosis had on average higher scores on ASD measures, had an equal level of psychiatric comorbidity and were more dependent on mental health care. In adolescence, milder expression of ASD symptomatology may be transitory and might form part of a multidimensional early syndrome with important variation in diagnostic outcome.

60 **183.060** Are Approaches of „Machine Learning" and „Support Vector Machines" Suitable to Improve the ASD Diagnostic Process in Children and Adolescents?

I. Kamp-Becker[1]*, F. Hauck*[2]*, N. Kliewer*[2]*, S. Köhne*[3]*, L. Poustka*[4]*, S. Roepke*[5]*, V. Roessner*[6]*, N. Wolff*[7] *and S. Stroth*[8]*, (1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany, (2)Department of Information Systems, Freie Universität Berlin, Berlin, Germany, (3)Berlin School of Mind and Brain, Humboldt University Berlin, Berlin, Germany, (4)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (5)Department of Psychiatry, Charite Berlin, Berlin, Germany, (6)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Dresden, Germany, (7)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus Dresden, Dresden, Germany, (8)Philipps University Marburg, Marburg, Germany*

Background: Existing diagnostic instruments do, in fact, identify individuals with ASD accurately, but sometimes fail to differentiate individuals with ASD from those with other psychiatric disorders and complex neuro-behavioral profiles (such as ADHD, emotional and personality disorders and others). For these reasons, the identification of features which discriminate between different but overlapping phenotypes is of great importance. Recently, pattern classification methods based on machine learning algorithms have been used to predict or classify individuals of

different phenotypes.
Objectives: The objective of the talk is to focus on both, machine learning algorithms and support vector machines to classify distinguishing dimensions of the ASD diagnostic process .

Methods: These innovative approaches were applied to the data of 2,568 children, adolescents and adults to identify those items of the applied diagnostic tools which show the best discriminatory quality. All patients underwent the gold standard diagnostic procedures, ASD diagnosis was confirmed in 1,359 individuals. In almost the same amount of patients (N= 1,209) ASD was excluded and a differential diagnosis was found (e.g. ADHD, language disorder). The outlined machine learning methods (Decision Tree) as well as Support Vector Machine analyses were used to develop algorithms that differentiate ASD from other disorders.

Results: For children and adolescents, a reduced number of differentiating items that exhibited good diagnostic accuracy was identified. Sensitivity ranged from 79 – 96%, specificity was found between 63 – 77%.

Conclusions: In sum, for young children accuracy was higher than for older. Social orientation in interaction behavior seems to be a core and specific symptom of ASD differentiating ASD from other disorders with multitude symptom overlap.

61 **183.061** Association between Subclinical Autistic Traits and Cognitive Functions in General Children: Focusing on Sex Differences

M. Dai[1]*, J. Liang*[1]*, L. Lin*[1,2] *and J. Jing*[3]*, (1)Sun Yat-sen University, Guangzhou, China, (2)Peking University Health Science Center, Beijing, China, (3)Maternal and Child Health, Sun Yat-sen University, Guangzhou, China*

Background: Although sex difference in autism spectrum disorders and children with sub-clinical autistic traits has attracted a variety of research; few studies have addressed sex difference in the associations between AT and cognitive functions.
Objectives: This study aimed to: 1) explore the associations of autistic trait with intelligence profiles and executive functions among general children; and 2) examine whether the associations differed by sex.

Methods: Quantitative autistic traits of 429 general children aged 6-9 years from mainland China were measured using Social Responsiveness Scale. Children were divided into low- and high-autistic-trait (HAT and LAT) groups according to the Chinese cut-off score for ASDs screening. Their intelligence profiles and executive functions were assessed with Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) and Computerized Version of the Wisconsin Card Sorting Test (WCST) respectively. Demographic information was reported by parents. A series of hierarchical linear regression models for each sex separately were performed to examine the associations between autistic trait and cognitive profiles.

Results: Girls were related to a decreased odds ratio of being in the HAT group (OR=0.54, 95% CI: 0.33-0.88). After controlling for demographic covariates, we observed no significant associations between autistic trait and executive functions; children with HAT had significant lower scores than those with LAT in full IQ and three indices of WISC-IV (β ranged -3.74 to -6.02, all $P<0.05$), except for Processing Speed Index. These associations persisted in subgroups stratified by sex, except for Working Memory index. We found no sex-differences in the interrelations of autistic trait and relevant intelligence profiles (all $P>0.05$). However, the associations of HAT with certain intelligence profiles were much more stronger in girls than those found in boys, including full scale IQ (girls: $\beta=-8.61$, SE=2.54, $P<0.001$; boys: $\beta=-4.43$, SE=1.75, $P=0.012$), Verbal Comprehension Index(girls: $\beta=-8.76$, SE=3.06, $P=0.005$; boys: $\beta=-4.81$, SE=2.14, $P=0.025$) and Perceptual Reasoning Index (girls: $\beta=-9.25$, SE=2.49, $P<0.001$; boys: $\beta=-3.44$, SE=1.63, $P=0.036$).

Conclusions: In general population, autistic trait was negatively associated with certain intelligence profiles, both in boys and girls. Additionally, these associations were much stronger in girls than those in boys. These findings further our understanding of sex difference among individuals along the autistic trait continuum and underline that examining sex difference in the social-cognitive domain should not neglect eliminating the confound effects of sex difference in intelligence profiles.

62 **183.062** Comparison of Symptom Profiles in a Minority Sample of Preschool Children Referred for ASD

J. Durocher[1]*, M. N. Hale*[1]*, A. Beaumont*[1]*, M. Parladé*[1]*, S. Cardona*[2]*, G. Victoria*[3] *and E. M. Davis*[3]*, (1)University of Miami, Coral Gables, FL, (2)Psychology, University of Miami, Coral Gables, FL, (3)Mailman Center for Child Development, University of Miami, Miami, FL*

Background:
ASD diagnosis varies according to race/ethnicity; minority children less likely receive a diagnosis, are diagnosed later, and are more likely to be misdiagnosed with or conduct disorder (Mandell et al. 2002; Mandell et al., 2007). Further, findings regarding variability in symptom presentation and developmental profiles across cultural groups are inconsistent. Minority children have been shown to have lower cognitive and language scores, and higher severity of ASD symptoms including unusual eye contact, stereotyped language, echolalia, and nonfunctional routines/rituals (Chaidez et al. 2012; Cuccaro et al., 2005; Harrison et al.,2017; Landa & Garrett-Mayer 2006; Sell et al. 2012). However, other studies have found relatively little difference between White and Hispanic groups on ASD symptoms, cognitive or adaptive functioning (Chaidez et al., 2012).

Objectives: To compare differences in symptom presentation within a minority sample of Hispanic and Black/African American preschool-age children referred for diagnostic evaluations.

Methods: The sample is comprised of 103 children between the ages of 2 and 5 who were evaluated at an University-based specialty diagnostic clinic as part of a services grant for children suspected of having an autism spectrum disorder. Children were referred directly through local Part C and Child Find services based on the following criteria: (1) at risk for ASD based on screening (2) Medicaid eligible or lacking private insurance (3) Head Start or Early Head Start eligible, or (4) zoned for a Title 1 school based on address. IRB approval for retrospective data analyses was obtained. Participants included those children who received diagnoses of ASD (n=83, 80% of initial sample), with a mean age of 45.57 months (SD=10.54) and nonverbal IQ of 72.76 (SD =24.44). The sample consists of 21 females (25%) and 62 males (75%). Ethnicity/race breakdown is as follows: White Non-Hispanic (1.2%), Asian (1.2%, Hispanic (72.3%), Black/African American (25%). Subsequent analyses will be based on Black (n=21) and Hispanic (n=60) subjects only.

Results: Preliminary results suggest that Hispanic children were significantly older at referral (47.88 vs 39.71 months), t=2.75(27.211), p=.011. There were no group differences in nonverbal IQ, receptive or expressive language. Nonverbal IQ scores below 70 were seen in 52% of each sample; however, Black children had higher rates of speech/articulation disorder (57% vs.35%). Black children had higher ADOS total severity scores

(M=7.37, SD=1.832) than Hispanics (M=5.55, SD=1.832), t(77)= -3.14, p=.002. In contrast, Hispanic children were rated as more severe by parents on the ASRS with respect to Atypical Language (M_H=63.38; SD=8.96 vs. M_B=53.67; SD=11.89), t(38)=-2.334, p=.025 and Self-Regulation (M_H=60.84; SD=10.60 vs. M_B=52.68; SD=12.94), t(38)=-2.756, p=.007. Hispanics were rated as more severe on the BASC on the following subscales: aggression (M_H=51.78; SD=10.26 vs. M_B=46.33; SD=9.78), t(79)=2.12, p=.037 and anxiety (M_H=49.62; SD=9.65 vs. M_B=45.95; SD=5.72), t(59.596)=2.08, p=.042.

Conclusions:

Hispanic and Black children were more similar than different on the majority of measures, including cognitive, language and adaptive behavior. However, differences were found with respect to age of referral, clinician ratings of ASD symptom severity, and parent reported symptoms. Implications of these findings for the diagnostic and treatment process will be discussed.

63 **183.063** Denoising Autoencoders for Self-Supervised Clinical Subtyping of Autism Spectrum Disorder

C. H. Chatham[1], *J. F. Hipp*[2], *P. Garces*[3], *S. Holiga*[3], *J. Tillmann*[4], *E. J. Jones*[5], *M. Uljarevic*[6,7], *G. Dumas*[8], *E. Loth*[9], *T. Charman*[10] *and G. Honey*[11], *(1)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (2)Neuroscience and Rare Diseases (NRD), Roche Pharma Research and Early Development, Roche Innovation Center, Basel, Switzerland, (3)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann-La Roche, Basel, Switzerland, (4)Institute of Psychiatry Psychology & Neuroscience, London, United Kingdom, (5)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (6)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (7)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (8)Human Genetics and Cognitive Functions Unit, Institut Pasteur, Paris, France, (9)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (10)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (11)F. Hoffman La-Roche Ltd, Basel, Switzerland*

Background: Several measures have been proposed as candidate biomarkers for ASD but their correlations with clinical symptom severity are typically weak. Consequently, these biomarkers may be less prognostic of clinically-meaningful change, and less revealing of specific mechanisms to target for alleviating distress. One potential cause of these weak correlations is small underlying effects. Alternatively, larger correlations could be attenuated by population heterogeneity. For example, if distinct subtypes of ASD have distinct biomarker/clinical severity associations, then effect sizes could be reduced when ASD is treated as a single, unitary disorder. Although much prior work attempts to uncover the sources of heterogeneity in ASD, most techniques make restrictive assumptions about the nature of this heterogeneity. For example, classical clustering methods can uncover categorical differences within a population, but may give misleading results if dimensional differences exist. Conversely, classical factor analytic methods can recover dimensions, but may give misleading results in the presence of latent categories. There is a clear need for more equipotent techniques, where both latent categorical and latent dimensional sources of variation can be uncovered simultaneously in a data-driven manner.

Objectives: The objective of this study was to uncover latent categorical and/or dimensional clinical features of individuals with ASD, and to examine whether these features may disattenuate the correlation between biomarkers and the severity of clinical symptomatology.

Methods: We apply a self-supervised neural network architecture, the denoising autoencoder, to item-level scores from individuals with ASD on the Autism Diagnostic Interview-Revised, Social Responsiveness Scale, and Repetitive Behavior Scale-Revised, as well as v-scale scores from the Vineland-II Adaptive Behavior Scales. Input data was normalized for age and IQ, to increase variance related to atypical clinical symptomatology. Data from the Simons Simplex Collection (SSC; n=2329 in this analysis) was used to optimize the model through internal cross-validation. Generalization was assessed on a large holdout dataset (EU-AIMS LEAP; n=334 in this analysis).

Results: Our machine learning approach showed good cross-validation performance when item-level scores were compressed to 9 latent features. The model showed minimal overfitting when applied to the holdout dataset, EU-AIMS LEAP. Nine dimensions sufficed for reconstructing up to 85% of the variance in item-level scores, and never reconstructed less than 5% of the variance for any IQ- and age-adjusted item. Moreover, 2 subgroups of individuals with ASD could be reliably extracted from these 9 features, with one subgroup showing a statistically-significant pattern of increased severity across multiple domains (social responsiveness, repetitive behavior and sensory interests, inattentiveness symptoms, gastrointestinal symptoms, the presence of non-febrile seizures, and difficulties with sleep) but, notably, not full-scale IQ. Correlations between neuropsychological performance and clinical severity were (as a whole) larger within this highly-affected subgroup.

Conclusions: Modern machine learning techniques enable the extraction of both continuous and categorical differences among individuals with ASD. Failing to account for these sources of heterogeneity may attenuate the correlation of biomarkers and associated neuropsychological tests with measures of clinical severity.

64 **183.064** Detecting and Assessing Preschool Children with Autism Spectrum Disorder Using Child Behavior Checklist.

Y. H. Lin[1] *and C. C. Wu*[2], *(1)Department of Psychology, Kaohsiung Medical University, Kaohsiung, Taiwan, (2)Department of Psychology, Kaohsiung Medical University , Kaohsiung, Taiwan (Province of China)*

Background: Children with autism spectrum disorder (ASD) usually accompanied emotional and behavioral problems. Children with emotional and behavioral problems could result in more impairments on their social and communication, thus make stress on their caregivers.

Objectives: Children Behavior Checklist 1.5-5 (CBCL/1.5-5) is a tool for evaluating emotional and behavioral problems of preschool children and is used to screen ASD children. However, there is no research in Taiwan. In this study, the CBCL/1.5-5 is used to detect and assess preschool children with ASD.

Methods: 328 children under 48 months old, including 130 children with ASD, 135 children with developmental delay (DD), and 63 children with typical development (TD). The CBCL/1.5-5 was completed by the caregivers for measuring emotional and behavioral problems of all children.

Results: ASD group is higher than DD group and TD group on internalizing problems of broadband scales, withdrawn subscale of syndrome scales, and pervasive developmental problems subscales of DSM-direct scale. In addition, ASD group is higher than TD group on both externalizing and total problems of main scales, and emotionally reactive of syndrome scales. All of withdrawn, pervasive developmental problems and internalizing problems are better index for distinguishing children with ASD from children with DD. Using signal detection theory, cut-off scores of each subscales are as below: T-score of 65 in the withdrawn subscale, the sensitivity and specificity were 69% and 68%, respectively; T-score of 69 in the pervasive developmental problems subscale, the sensitivity and specificity were 70% and 64%, respectively; T-score of 62 in the internalizing problems subscale as the cut-off, the specificity were 63% and 60%, respectively. All of withdrawn, pervasive developmental problems, attention problems, internalizing problems and total problems are better index for distinguishing children with ASD from children with TD. Using signal detection theory, cut-off scores of each subscales are as below: T-score of 59 in the withdrawn subscale, the sensitivity and specificity were 87% and 75%, respectively; T-score of 64 in the pervasive developmental problems subscale, the sensitivity and specificity were 82% and 81%, respectively; T-score of 56 in the attention problems subscale, the sensitivity and specificity were 73% and 64%, respectively; T-score of 59 in the internalizing problems subscale, the sensitivity and specificity were 75% and 72%, respectively; T-score of 58 in the total problems subscale, the sensitivity and specificity were 79% and 68%, respectively. The results revealed that using the withdrawn and pervasive developmental problems subscale as a screening index for detecting children with ASD, it showed accepted validity.

Conclusions: Used the CBCL/1.5-5 as a screening tool for children with ASD, the withdrawn and pervasive developmental problems subscale have moderate validity, suggest the two subscales can be screening tool in the clinical setting.

65 **183.065** Development and Construct Validity of a Comprehensive Feeding Assessment for Children with Autism Spectrum Disorders

***K. K. Ausderau**, B. St John and M. O. Al-Heizan, University of Wisconsin-Madison, Madison, WI*

Background: Feeding challenges are estimated to occur in up to 89% of children with autism spectrum disorders (ASD). Restrictive feeding patterns and preferences may lead to nutrient deficient diets, limited participation in family mealtimes, challenging behaviors, and increased caregiver stress during mealtime. Currently, limited assessment tools exist to assess feeding challenges in children with ASD and ones that do are limited in scope and lack validity and reliability evaluation.

Objectives: The Feeding Assessment for Children with Autism was developed to 1) provide a more complete understanding of feeding disorders of children with ASD and 2) confirm validity of the assessment for use in research and clinical settings. The purpose of this study was to determine the construct validity of the Feeding Assessment for Children with Autism and describe association with child and parent characteristics.

Methods: Exploratory methodological research design was used to determine construct validity of the assessment tool. A large national sample (N=406) of caregivers of children (2 to 12 years in age) and reported feeding challenges was recruited through the Interactive Autism Network. Exclusion criteria included primary hearing, visual, or physical impairments, seizure activity in the last 12 months and other conditions known to co-occur with ASD.

The Feeding Assessment for Children with Autism Spectrum Disorders is a 51-question caregiver-report questionnaire developed to characterize feeding challenges in children with ASD. Questionnaire items are believed to be related to four underlying constructs: sensory (n=13), behavior (n=17), health (n=11), and oral motor (n=10) skills. Confirmatory factor analysis, internal consistency, model fit indices, factor loadings, and between-factor correlation matrix were conducted to determine construct validity.

Results: Primary analysis confirmed a four-factor model was appropriate for the questionnaire items with high internal consistency (0.87). Confirmatory model fit indices indicated moderate fit of questionnaire items into the four constructs. Factor loadings for all four theoretical factors were adequate and statistically significant ($p < .001$) with all loadings >.22. All between factor correlations were statistically significant ($p<.02$) with small-medium positive Pearson r correlations. The behavior factor had medium positive correlations with both oral-motor (.45) and sensory factors (.30).

Conclusions: Findings of the study provide preliminary confirmation of the construct validity of the Feeding Assessment for Children with Autism Spectrum Disorders, providing researchers and clinicians with a comprehensive and psychometrically sound assessment tool to address children's unique feeding challenges. Relatively small correlation magnitudes indicate questionnaire items successfully targeted the four unique feeding challenges. The highest between factor correlations were seen between behavior and all other factors, in particular oral motor and sensory. This finding lends support to the hypothesis that mealtime behaviors observed in children with ASD are in response to other challenges these children face including sensory responsiveness, underlying health concerns, and delayed oral motor skills. This tool will allow for more detailed characterization of feeding challenges with this population, and will help optimize individualized and targeted interventions for children with ASD.

66 **183.066** Development of a Video-Based Coding Tool: Autism Behavioural Change Observational Measure (ABCOM) to Monitor Response to Intervention in School-Age Children with Autism

*M. Custo Blanch[1], M. Sharda[1], R. Ferdinand-Peterkin[2], M. Tan[3], K. L. Hyde[1] and **A. Nadig**[4], (1)International Laboratory of Brain, Music and Sound Research (BRAMS), University of Montreal, Montreal, QC, Canada, (2)BRAMS, University of Montreal, Montreal, QC, Canada, (3)Abaton Integrative Medicine, Oakville, ON, Canada, (4)School of Communication Sciences and Disorders, McGill University, Montreal, QC, Canada*

Background:
Evaluating outcomes effectively is a significant challenge for intervention research in Autism Spectrum Disorder (ASD). Although many tools exist for monitoring response to intervention in toddlers, few tools exist for the school-age population (Cunningham, 2012). Commonly used measures such as the ADOS were designed for diagnostic purposes, are expensive and require highly-specialized training. The Brief Observation of Social Communication Change (BOSCC; Grzadzinski et al, 2016) was specifically developed to measure changes in social-communication in ASD but is limited to early intervention and depends on caregiver-child interactions during the ADOS. To date, there is no treatment-response tool for school-age children that has applicability across multiple intervention settings, allows for reliable description of functional skills across several clinically-relevant domains, and has the potential to be sensitive to changes in social-communication.

Objectives: The purpose of this study was to develop a flexible video observation-based behaviour coding instrument that may be used in multiple settings (e.g., therapist-child or educator-child play or therapy sessions) for school-age children with ASD to measure response to treatment. Crucially, the tool is designed to evaluate behaviors within a therapy session itself, and therefore does not require the administration of a separate assessment.

Methods: We developed a 27-item questionnaire called the Autism Behavioural Change Observational Measure (ABCOM) to monitor autism-relevant outcomes in school-age children with ASD. The ABCOM (Figure1) is designed to be used in naturalistic settings involving one-on-one interactions with an interventionist/educator. The items are categorized under 6 domains (Table1) which are rated on a likert-scale of 0(never/rarely applies) to 3(almost always applies) based on frequency of behaviours. We used 45-minute video-recordings from a completed randomized control trial (RCT: ISRCTN26821793) comparing music and non-music intervention in 6-12 year-old children with ASD, to develop and test the tool. Two experienced raters were trained using a standardized procedure (lasting 15 hours) using 3 example videos and a written manual to achieve acceptable levels of inter-rater reliability (measured using Intraclass Correlation Coefficient, ICC). 9 videos were coded by both raters till they met intended coding targets. 10 test videos were coded by each rater to measure inter-rater reliability for subsequent independent coding of videos to evaluate treatment-related change in each intervention group.

Results: After initial training and coding of 9 videos, both raters reached an ICC=0.92, p=.001. On the subsequent 10 test videos, raters had an ICC=0.95 (p<.001). Domain-wise ICC and internal consistency values (measured using Cronbach's alpha) are presented in Table1, suggesting high reliability and internal consistency for initiation of communication, shared social interaction and challenging behaviour domains, and acceptable levels of reliability for other domains.

Conclusions: The ABCOM has moderately high inter-rater reliability and consistency and maybe applied in multiple intervention settings to measure autism-related outcomes such as shared social interaction, initiation of communication and occurrence of challenging behaviours in school-age children. Though the ABCOM requires some training of coders, it removes the burden of administering a separate outcome assessment. In ongoing work we are applying this tool to measure the outcomes of the full music vs. non-music RCT.

67 **183.067** Development of the Observation Schedule for Children with Autism Spectrum Disorders– Anxiety and Behaviour (OSCA-AB): A New Measure of Parent and Child Behaviour for Use with Children with ASD

M. Palmer[1], *J. Tarver*[2], *J. Paris Perez*[1], *S. Scott*[1], *V. Slonims*[3], *E. Simonoff*[1], *A. Pickles*[4], *D. Hay*[5] *and T. Charman*[6], *(1)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (2)University of Birmingham, Birmingham, United Kingdom, (3)Guy's & St Thomas' NHS Foundation Trust (Evelina Children's Hospital), London, United Kingdom, (4)Biostatistics and Health Informatics, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (5)Psychology, Cardiff University, Cardiff, United Kingdom, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background: Most young children diagnosed with Autism Spectrum Disorders (ASD) display concerning and potentially problematic behaviours and emotions. Emerging evidence suggests that parent training interventions may reduce these difficulties in young children with ASD (Postorino et al., 2017). Trials of parent training frequently use parent-report measures as their primary outcome; however, as parents are the recipients of the intervention they are not blind to treatment status, which may lead to bias is estimating treatment effects (Sonuga-Barke et al., 2013). Objectives: We aimed to develop an objective outcome measure to allow blinded evaluations of interventions for parents of young children with ASD.

Methods: The Observation Schedule for Children with Autism Spectrum Disorders – Anxiety and Behaviour (OSCA-AB) is a measure of parent and child behaviour for use with children with ASD. It draws on existing well-validated observational measures of parent-child interaction. A range of researcher-led and parent-led tasks are completed. Tasks were modified to simulate everyday challenges that children with ASD may face and find difficult. They aim to elicit concerning behaviour and emotions by tapping into uncertainty and novelty, transition, turn taking, sensory processing and compliance. Observed frequencies of parent behaviour (positive and negative comments, clear commands, physical handling, scaffolding) and concerning child behaviours (non-compliance, destructive behaviour, aggression to self and others, avoidance) are coded. In addition, global codes are scored on a Likert scale. Intraclass correlation coefficients (ICCs) were used to establish inter-rater reliability (IRR) using a two way mixed effects model. A more modest ICC of >.60 was selected given that the measure is in development. Pearson correlation coefficients were calculated to investigate the associations between OSCA-AB scores and parent-reports of parent (Parenting Scale - PS) and child behaviour (Aberrant Behaviour Checklist - ABC, Home Situations Questionnaire-ASD - HSQ-ASD).

Results: To date, the OSCA-AB shows adequate IRR for scores on most child variables (ICCs >.60 for 10/15, *Mdn*=.69; *n*=18) and some parent variables (ICCs >.60 for 4/10, *Mdn*=.57). High correlations between the OSCA-AB scores and other validated measures of child behaviour are also evident (*r*=.64 and .61 for the ABC-Hyperactivity subscale and the HSQ-ASD, respectively). However, correlations between observed parent behaviours and parent-reports of their own parenting on the PS are low (*r*=.01-.07). On average, a total of 26 concerning child behaviours are displayed within the 23 minute observation. By May 2018 data from 50 families will be presented following further refinement of the measure and exploration of sensitivity to change over the course of the intervention.

Conclusions: Preliminary results indicate that the OSCA-AB may be a useful objective measure for eliciting concerning behaviour and emotions and parent-child interaction in ASD. Refinement is required to increase IRR for some child and parent variables. Further research is needed to establish whether the OSCA-AB will be a valid measure of parent and child behaviour among samples of young children with ASD and is sensitive to change following intervention.

68 **183.068** Direct in-Person Assessments Add Value When Discerning Autism Spectrum Disorder in SMC1A Variants.

P. A. Mulder[1], *S. A. Huisman*[2], *A. A. Landlust*[1], *R. C. Hennekam*[2], *I. D. van Balkom*[1] *and S. Piening*[1], *(1)Autism Team Northern Netherlands, Jonx (Lentis), Groningen, Netherlands, (2)Department of Paediatrics, Amsterdam Medical Centre, University of Amsterdam, Amsterdam, Netherlands*

Background:
The neurodevelopmental phenotype in individuals with SMC1A variants includes intellectual disability (ID), autism spectrum disorder (ASD) and self-injurious behavior (SIB). A reciprocal interaction exists between neurodevelopmental characteristics, physical phenotype and environment. Differentiating ASD from (profound to severe) ID can be difficult. Individuals with a (severe) ID may meet diagnostic criteria for ASD based on proxy-administered questionnaires, while clinical assessment of their daily functioning may not confirm ASD. This discrepancy can often be explained by the abilities matching their developmental age, which questionnaires do not take into account.

Objectives:

To explore the added value of direct in-person assessments in individuals with SMC1A variants in order to discern ASD from ID and improve our understanding of the neurodevelopmental phenotype.

Methods:

We collected data from behavioral questionnaires in 31 participants (21 international and 11 Dutch) with a SMC1A variant. After informed consent from parents, three authors (PAM, AL, SP) performed interviews and direct in-person neurodevelopmental assessments in a Dutch sample of eight participants. Assessment battery included Autism Diagnostic Observation Schedule - 2 (ADOS-2), Autism Questionnaire (AQ), Bayley III, Wechsler Intelligence Scale (WPPSI-III and WAIS-IV)), Vineland-2, and Short Sensory Profile (SSP)).

Results:

Based on the Social Communication Questionnaire (SCQ) 18/24 participants scored within the clinical cut-off for ASD. For the Dutch group, all eight scored within the clinical range for ASD on the SCQ. Four out of eight participants met ASD criteria based on assessment with the ADOS-2. After careful analysis, two authors (PAM, AAL) agreed that only two of these four participants were impaired by ASD in daily functioning when considering their developmental level (profound and moderate ID). Three of eight participants had a profound ID, 1/8 severe, 1/8 moderate and 2/8 mild and 1/8 scored borderline to normal functioning. Deficits in adaptive abilities were not in line with cognitive abilities (e.g. communication skills were poorer than expected based on developmental level).

Severe difficulties in sensory information processing were present in most participants, more processing time was needed, and shifting between tasks was delayed. Repetitive and restricted behavioural patterns were common.

Conclusions:

From these direct assessments, a clearer picture of neurodevelopmental functioning of individuals with SMC1A variants has emerged. Autism may be assumed in a larger population based on questionnaires, but is less frequently diagnosed after direct in-person assessment and considering behavior in light of developmental level. Direct in-person assessment provides valuable and specific information relevant to understanding the neurodevelopmental phenotype in individuals with SMC1A variants.

69 **183.069** Discontinuities in Autism Spectrum Disorder Traits Among Children with Intellectual Disability

R. Srinivasan[1]*, M. Erwood*[2]*, J. Wolstencroft*[3]*, D. H. Skuse*[4] *and I. D. Imagine*[2]*, (1)UCL GOS ICH, London, United Kingdom of Great Britain and Northern Ireland, (2)UCL GOS Institute of Child Health, London, United Kingdom, (3)UCL GOS ICH, London, United Kingdom, (4)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background:

Intellectual disability (ID) is characterised by significant limitations in cognitive functioning and adaptive behaviour, and is often associated with behavioural and mental health problems at all life stages. IMAGINE ID is a national UK study of up to 10,000 children with ID of known genetic origin that aims to identify genotype-phenotype risk. Whilst ID in general is strongly associated with ASD traits, the distribution of those traits in relation to genetic aetiology is not known.

Objectives:

Our focus is on children with ID due to pathogenic Copy Number Variants (CNV) or Single Nucleotide Variants (SNV), ascertained by NHS Regional Genetics Centres. By means of online/in-person phenotyping, we aimed to assess the prevalence and severity of ASD traits.

Methods:

1027 participants with ID have been phenotyped to date (mean age 9.1 years; SD=3.8, range 4-18 years). Genetic aetiology was established: i) by microarray analyses (NHS accredited laboratories, with array resolutions typically 100kb); ii) aetiological SNV identified from the UK Deciphering Developmental Disorders survey. Phenotyping was by standardized caregiver psychiatric interview, using the Development and Wellbeing Assessment (DAWBA), which has been validated against ADI/ADOS criteria. Ratings of ASD symptoms were made by experienced clinicians, with high reliability. DAWBA ASD symptom counts were used to generate a continuous severity score. A separate Social Aptitude Scale measured aspects of children's social skills independent of DSM-5 autistic symptomatology.

Results:

42.2% of participants had no significant ASD symptoms, 32.8% of participants met clinical criteria for a diagnosis of ASD, and 25.0% had sub-clinical ASD traits, as measured by a clinical evaluation from interview (DAWBA) material. The ASD group was 63.5% male, the ASD traits group was 52.5% male and the non-ASD group was 46.1% male. There were no significant differences in age, estimated mental age or language age between children with and without clinically identified ASD. When continuous scores were plotted for each subgroup, a normal distribution (confirmed by Shapiro-Wilks analysis) was found for each clinically-defined group. Standardized scores were significantly different ($P<0.0001$) from one another (ASD clinical: 0.76 (95% CI 0.69 to 0.83), ASD traits: 0.18 (95% CI 0.11 to 0.25), no ASD traits: -0.69 (95% CI -0.77 to -0.62). Social Aptitude Scale (SAS) standardized scores were substantially less discrepant from one another, but the mean SAS score was approximately 2SD below national UK norms.

Conclusions:

IMAGINE ID is the first study systematically to evaluate the prevalence of ASD in a national cohort of children with ID of known genetic origin. Our findings indicate that ID arising from CNV/SNV is strongly associated with markedly impaired social aptitude, independent of whether there coexisted significant ASD traits. This approach has the potential to serve as a new way of examining the heterogeneity within different genetic disorders presenting with the same clinical phenotype. The genotypes in this cohort are currently under investigation.

70 **183.070** DSM-5 Criteria and Diagnoses in Adulthood: Are There "Strong and Stable" Features?

S. J. Carrington[1]*, S. L. Barrett*[2]*, U. Sivagamasundari*[3]*, C. Fretwell*[4]*, J. Hall*[5]*, I. Noens*[6,7]*, J. Maljaars*[7,8]*, R. Kent*[9] *and S. R. Leekam*[10]*, (1)Psychology, School of Life and Health Sciences, Aston University, Birmingham, United Kingdom, (2)Wales Autism Research Centre, Cardiff University, Cardiff, United Kingdom, (3)Aneurin Bevan University Health Board, Cwmbran, United Kingdom, (4)Aneurin Bevan University Health Board, Caerleon, United Kingdom, (5)Neurosciences & Mental Health Research Institute, Cardiff University, Cardiff, United Kingdom, (6)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium, (7)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (8)Parenting and Special Education Research Unit, KU Leuven, Leuven, Belgium, (9)Institute of Psychiatry, Psychology and Neuroscience, Kings College London, London, United Kingdom of Great Britain and Northern Ireland, (10)School of Psychology, Cardiff University, Cardiff, NSW, United Kingdom*

Background: Autism spectrum disorder (ASD) is a lifelong condition, with some individuals not being diagnosed until adulthood. Individuals seeking diagnosis as adults, however, may present with a different profile compared to children. Previous research examining the stability of ASD behaviours over time has revealed inconsistent findings: while all symptoms tend to decrease over time (e.g. Seltzer et al., 2003), some findings indicate that social and communication difficulties reduce more than repetitive behaviours (e.g. Fecteau et al., 2003) while others find the opposite (e.g. Shattuck et al., 2007). It is, therefore, important to identify which behavioural features are the most robust and stable over time and likely to be potential diagnostic markers in adults.

Objectives: To identify robust features of autism in adults based on DSM-5 criteria.

Methods: Participants were 80 adults with clinically diagnosed ASD (mean age=33.94 years; 52 male, 28 female). The majority (53) were recruited as consecutive referrals from an adult specialist ASD national health clinic, while 27 adults with a known diagnosis of ASD were recruited through university recruitment registers. All adults had an IQ over 70. The Diagnostic Interview for Social and Communication Disorders-Abbreviated (DISCO-Abbreviated; Carrington, Kent, et al., 2014), was carried out independently by researchers. The DISCO-Abbreviated includes published items designed to fit the DSM-5 criteria for ASD, based on a child sample (Carrington, Kent et al., 2014). Frequencies of items and sub-domains endorsed by the adult sample were compared with the original, published sample.

Results: The overall profile of behaviour in adults, indicated by the mean number of behaviours exhibited in the subdomains of the DSM-5 criteria, was similar to previously published data in children; items relating to difficulties with social relationships were endorsed the most frequently, followed by deficits in socio-emotional reciprocity, suggesting that these difficulties in social interactions endure in adulthood. Deficits in non-verbal communication were relatively infrequently endorsed in adults. For the restricted and repetitive behaviours subdomains, the least frequently endorsed behaviours in adults were those related to hypo- and hyper-reactivity to sensory input. The subdomain in which the adult and child profile was most similar measured insistence on sameness. There were no gender differences.

The frequency of individual items endorsed in adults was generally lower than in children. Nevertheless, there were several items with high frequencies in adults. Strong social-communication behaviours included awareness of others' feelings (85%) and sharing of interests (76.3%), which were also highly frequent in children (88.9% and 88.9% respectively). The strongest behaviour for adults in domain B was a limited pattern of self-chosen activities, endorsed by 89% of adults and 97.2% of children. Importantly, those items identified as being most frequent in adults also remained stable over time.

Conclusions: Individuals diagnosed with ASD in adulthood showed a similar profile of behaviours to the published sample of children. Nevertheless, the reduced frequency of behaviours related to non-verbal communication suggest that these behaviours may be less central to diagnosis in adulthood than childhood. Moreover, several items were identified that may be strong and stable diagnostic markers for adults.

71 **183.071** Dyadic Physiological Linkage As a New Measure of Social Reciprocity in ASD

D. Swain[1], *R. S. Factor*[1], *J. Waldron*[2], *Y. Zhou*[3], *M. A. Bell*[4], *A. Scarpa*[5] *and A. Ross*[4], *(1)Virginia Polytechnic Institute and State University, Blacksburg, VA, (2)Psychology, Kaiser Permanente, Blacksburg, VA, (3)Economics, Virginia Tech, Blacksburg, VA, (4)Psychology, Virginia Tech, Blacksburg, VA, (5)Virginia Polytechnic Institute & State University, Blacksburg, VA*

Background: Although early intervention is preferable, little is known about interventions to support the growing population of adults with Autism Spectrum Disorder (ASD) (Mandell,2013; Warren et al.,2011). One core ASD impairment area involves social reciprocity. Because of the impact of social reciprocity impairments, further research on objective measures of social reciprocity can clarify its role in ASD and provide novel ways to assess response to treatment of social impairments.

Objectives: To address these issues, we examined physiological linkage (PL) as a form of social reciprocity. PL refers to coordinated physiological responses between one or more partners in a social interaction. PL is couched in several important constructs in psychology, such as affect matching, mirroring, perspective-taking, and joint attention. As such, we propose that PL encompasses the broader underlying construct of social reciprocity, and thus provides a unique, objective, and quantifiable measure that can be used to further our understanding of social competence in both typical and atypical development in naturalistic interaction contexts.

Methods: In the current study, twenty-six typically developing (TD) dyads and three ASD/TD dyads participated in a social task where each person discussed happy or sad events while the other listened and the cardiac inter-beat interval for each person was monitored. The second-to-second change in the logarithm of the IBI was calculated for each person in each dyad and a bivariate time-series model was specified and estimated, allowing for subject-specific intercepts and gender-specific dynamic lag structures.

Results: In general, for the TD dyads, the findings showed a small but highly significant linkage effect ($p<0.00005$) for both male and female dyads. The effect was stronger for female dyads, however, and persisted to a lag of 4 seconds. For males, the effect was weaker and only significant at a lag of 1 second. For the ASD/TD mixed dyads (2 female and 1 male), the results showed no significant linkage effects for either the ASD or TD subject, and the effect sizes for the results were small. In particular, the null hypothesis of no linkage effect on the ASD person could be rejected only with $p>0.184$ and 0.624 (for the females and the male, respectively); the analogous rejection p-values were 0.332 and 0.624 for the TD person. That is, the ASD person's log IBI did not appear to vary in response to the TD person's log IBI, and vice versa; and the TD person's log IBI did not appear to vary in response to the ASD person's log IBI either.

Conclusions: This study helps to elucidate that TD dyads may have a linkage effect, while ASD/TD dyads do not exhibit the same linkage. While the number of dyads analyzed is small, this preliminary study is one of the first to demonstrate differences in how individuals with and without ASD engage in social reciprocity through PL.

72 **183.072** Evaluation and Norms of the German Version of the Aberrant Behavior Checklist for Children and Adolescents

L. Vllasaliu, *S. Bode, I. S. Kästel, C. E. Köpp, M. Luh, C. M. Freitag and H. Cholemkery, Autism Research and Intervention Center of Excellence Frankfurt, University Hospital Frankfurt, Frankfurt am Main, Germany*

Background:

The aberrant behavior checklist (ABC) was originally developed to measure therapy success in people with mental retardation [1]. Today it is a well-established and worldwide used measure in effectiveness research especially for medication studies. Its validity and reliability has been replicated in different studies which could show its suitability for different age groups and disorders e.g. autism spectrum disorders [e.g. 2,3,4]. It is so widely used that most reviews trying to aggregate autism research can only base their meta-analyses on this questionnaire. Nevertheless the validation is not sufficiently done for every translation. The German version of the ABC has only been validated for adults with mental retardation so far [5] but not for children and adolescents with autism spectrum disorders where it is also widely used and necessary to ensure international comparability of therapy outcomes.

Objectives:

The aim of the present study is to (1) validate the German ABC in children and adolescents with autism spectrum disorder including the factor structure of the subscales, (2) examine its reliability and (3) develop norms.

Methods:

1003 parents of children aged between 4 and 17 years (M: 11.11, SD: 4.09, ♂: 569) were recruited at the Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy of the University Hospital in Frankfurt and filled in the questionnaires. Four different samples were thereby assessed: autism spectrum disorder (n = 225), healthy controls (n = 470), mentally disabled children (n = 128) and a clinical subsample with other mental disorders (n = 180). We examined the validity and reliability of the ABC under consideration of age and gender and developed German norms for this age group. A confirmatory factor analysis was used to confirm the factor structure.

Results:

Item selectivity and Cronbach's alpha were excellent, with the alpha if one of the items is deleted ranging between .963 and .969. The original factor structure of the ABC could be replicated. The retest reliability showed a value of *r* = 0.824 for all items and ranged from 0.796 to 0.864 in case of the five different subscales. The interrater reliability between mother and father ratings was ICC = 0.791 (CI: 0.44-0.92).

Conclusions:

Overall the psychometric properties of the German ABC for children and adolescents could be considered as good to excellent and the factor structure could be replicated. Considering this good results the German ABC can be recommended as a measure of therapy success. This is an important contribution to the international comparability of effectiveness research.

73 **183.073** Examining Symptomatology in ASD in Bilingually Exposed Children

*E. Fornaris[1,2], H. Poore[1,3] and **S. Hoffenberg**[4], (1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)The University of North Carolina at Chapel Hill, Chapel Hill, NC, (3)Emory University, Atlanta, GA, (4)Marcus Autism Center, Atlanta, GA*

Background: Although bilingualism and autism spectrum disorder (ASD) is a newer area of research, several studies have shown that introducing a second language to a child with ASD does not affect overall development. When comparing language development in monolingual versus bilingual children with ASD, researchers have found no significant differences in vocabulary, language comprehension, word production, or reading and writing (Uljarevic, Katsos, Hudry, & Gibson, 2016; Reetzke et al, 2015). Preliminary findings have suggested that bilingualism may provide advantages for children with ASD. Valicenti-McDermott and colleagues (2012) utilized primarily parent report on the *Childhood Autism Rating Scale* to examine ASD symptomatology, as well as developmental assessment scores on the *Bayley Scales of Infant Development.* They found that bilingually exposed toddlers with ASD engaged in more gesturing, cooing, and pretend play than monolingual peers with ASD; although studies have not examined these differences in toddlers using the *Autism Diagnostic Observation Schedule, Second Edition (ADOS-2).*
Objectives: The goal of this study is to determine whether differences exist between monolingually and bilingually exposed toddlers with ASD on symptomatology in the areas of language, gestures, play skills, and restricted/repetitive behaviors.

Methods: Participants were 51 toddlers diagnosed with ASD, ranging in age from 19 to 31 months (M=25.1 months, SD=3.8). 18 toddlers were classified as bilingually exposed and 33 as monolingually exposed. Monolingual families spoke English and bilingual families spoke English and another language (83.3% Spanish). The overall sample was 80% male; and 80% of participants were classified as low socio-economic status. 73% identified their ethnicity as non-Hispanic/Latino. Toddlers participated in the *ADOS-2,* Toddler Module and *Mullen Scales of Early Learning* assessments. Developmental assessment t-scores and *ADOS-2* codes for gestures (codes A7, A8), language (codes A1, A1a, A2), play (codes C1, C2, C3), and restricted/repetitive behaviors (codes D1, D2, D3, D5) were compared across bilingually and monolingually exposed children using one-way analysis of variance.

Results: There were no significant differences between monolingual and bilingually exposed children on demographic variables (i.e. age, gender, or SES), nor on developmental assessment scores in visual reception, fine motor, receptive language, or expressive language. There were also no significant differences in language, gestures, or restricted/repetitive behaviors on *ADOS-2* codes. Bilingually exposed toddlers demonstrated significantly greater play skills on the *ADOS-2* than their monolingual peers with ASD (F(1, 49)=3.97, p=.05, d=.58).

Conclusions: In this sample, bilingually exposed toddlers' language skills were not significantly different from their monolingual peers with ASD. This result supports previous findings that exposure to two languages does not exacerbate language delays in children with ASD. In this sample, however, bilingually exposed toddlers had stronger play skills than monolingual peers, consistent with the prior finding that bilingual exposure may confer benefit to children with ASD. This study did not replicate the previous finding that bilingually exposed children with ASD had relatively greater vocalizations or gestures. Given the global prevalence of bilingualism, understanding ASD in bilingual children is vital. Future work should utilize a larger sample size and further examine other possible differences in ASD symptomatology and overall development.

74 **183.074** Examining the Experience of Adults Receiving an Autism Spectrum Diagnosis and Their Later Well-Being.

__R. A. Charlton__[1], F. Happé[2] and P. Abbott[3], (1)Psychology, Goldsmiths University of London, London, United Kingdom, (2)Social, Genetic and Developmental Psychiatry Centre, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Autism Diagnostic Research Centre, Southampton, United Kingdom

Background: Relatively little is known about autism spectrum disorder (ASD) across adulthood, or the impact of receiving a diagnosis as an adult. High rates of mood disorders have been reported among autistic adults, and individuals report poor well-being and sleep quality.
Objectives: To follow-up adults who had received an ASD diagnosis to examine whether receiving the diagnosis had been positive and to explore factors associated with well-being.

Methods: Individuals diagnosed with ASD as adults were invited to participate. Of the adults who had consented to be contacted, 44 completed

the study. Individuals responded between 4-80 months (mean=32 months) after receiving an ASD diagnosis.
Individuals completed questionnaires about receiving a diagnosis, autism traits (Autism Quotient, AQ), quality of life (World Health Organization Quality of Life scale, WHOQoL), mental well-being (Warwick-Edinburgh Mental Well-being Scale, WEMWBS) and sleep quality (Pittsburgh Sleep Quality Index, PSQI).
Forty age and sex matched non-autistic neurotypical adults (NA) were recruited from the community as a comparison group. NA completed the same measures; the questions about diagnosis and the AQ were omitted.

Results: *Impact of receiving a diagnosis.* ASD adults were asked about the impact of receiving a diagnosis generally, on their own self-understanding, and on the understanding of others. Individuals were asked if they were aware of support they could access and whether this was what they had expected. Overall individuals felt that receiving a diagnosis had been a positive experience with 72.1% endorsing that it had generally made things better. In terms of post-diagnosis support, overall responses were negative. Most individuals (72.7%) were not clear what (if any) support they could access and 58.5% were not receiving the post-diagnosis support they had expected. See Table 1.

ASD traits and well-being. AQ scores correlated significantly and negatively with WHOQoL subscales (Physical, Psychological, Social, Environmental) and the WEMWBS, indicating poorer well-being with increasing self-report autistic traits. Poorer sleep quality was associated with higher self-report ASD traits, but this did not reach significance. Highly significant associations were observed between sleep quality and all WHOQoL subscales and the WEMWBS.

Group Differences, ASD-NA. The ASD group reported significantly poorer quality of life on all WHOQoL subscales, and on the WEMWBS. Individuals with ASD reported significantly poorer sleep quality than NA.

Conclusions: For most adults receiving an ASD diagnosis, the effect was generally positive, however post-diagnosis support and access to services was not satisfactory. ASD traits were strongly associated with poorer quality of life, mental well-being and sleep quality. Poor sleep quality was strongly associated with poorer quality of life and mental well-being; however the causal directions of these associations are unclear and require further study. Findings suggest that despite growing awareness that autistic adults may be at risk for poor quality of life and mental well-being compared to NA, a gap between awareness and intervention remains. Better monitoring of autistic adults to provide treatment (should poor mental well-being reach clinically significant levels) is required, as is the development of ASD specific interventions.

75 **183.075** Examining the Links between Restricted Interests/Repetitive Behaviors, Respiratory Sinus Arrhythmia, and Anxiety: Do Repetitive Behaviors Mediate the Relation between Rsa and Anxiety?

A. J. McVey[1]*, H. K. Schiltz*[1]*, A. D. Haendel*[2]*, S. Pleiss*[3]*, A. Carson*[4]*, K. M. Rivera*[1]*, B. Yund*[5]*, E. Vogt*[6] *and A. V. Van Hecke*[6]*, (1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Great Lakes Neurobehavioral Center, Edina, MN, (4)Pediatrics, Autism Center, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, (5)Psychology, University of Wisconsin Milwaukee, Milwaukee, WI, (6)Psychology, Marquette University, Milwaukee, WI*

Background: Recent research points to a relation between restricted interests/repetitive behaviors (RRBs) and respiratory sinus arrhythmia (RSA) in ASD (Condy, Scarpa, & Friedman, 2017; Matsushima et al., 2016). Specifically, findings demonstrate a negative link between RSA and ASD symptomology, that is, greater physiological dysregulation (lower RSA) is associated with greater autism severity. Co-occurring anxiety has also been related to both poorer vagal control (Hollocks, Howlin, Papadopoulos, Khondoker, & Simonoff, 2014) and more RRBs (Spiker, Lin, Van Dyke, & Wood, 2012) among samples of youth with ASD.
Objectives: The purpose of this study was to examine the relations between RRBs, RSA, and anxiety and test the mediating role of RRBs in the association between RSA and anxiety among a sample of adolescents with ASD. It was hypothesized that RSA would be negatively associated with RRBs, both RRBs and RSA would be positively related to anxiety, and that RRBs would mediate the association between RSA and anxiety.

Methods: One-hundred fifteen adolescents with ASD participated in this study. Participants presented for a RCT of a social skills intervention; data presented here were from pretest. Presence of ASD was confirmed using the ASDOS-G and IQ above 70 was confirmed with the KBIT-2. Parents or caregivers completed the Social Responsiveness Scale (only the Autistic Mannerisms subscale was used here as a measure of RRBs; SRS-AM) and the Social Anxiety Scale for Adolescents (SAS). Adolescents completed a three-minute eyes-open resting state paradigm during which heart rate data was collected.

Results: A Process mediation model was used to test the mediating role of RRBs (SRS-AM) in the relation between RSA and anxiety. A negative relation was uncovered between RSA and RRBs $F(1, 113) = 3.96$, $p < 0.049$, $r^2 = 0.03$, indicating that more RRBs were associated with greater physiological dysregulation. Analyses also revealed that both RRBs ($b = 0.78$, $p < .001$) and RSA ($b = 2.24$, $p = .02$) were significant predictors of anxiety $F(2, 112) = 18.08$, $p < .001$, $r^2 = 0.24$. The indirect effect of RSA on anxiety through RRBs, however, was nonsignificant ($b = -1.06$ [CI: -2.54-0.10]).

Conclusions: The hypotheses were partially supported. Results provide further evidence for the notion that greater physiological dysregulation is associated with more RRBs. In constrast to hypotheses, however, results suggest that more anxiety is associated with better physiological regulation, controlling for RRBs. Although there were links between RSA and both RRBs and anxiety, RRBs did not explain the association between RSA and anxiety. Rather, RRBs explained additional variance in anxiety over and above RSA alone. Therefore, physiological dysregulation seems to affect anxiety, but does not do so via increased RRBs.

76 **183.076** Experiences of Seeking for Assessment and Diagnosis of Autism Spectrum Disorder in Vietnam

H. S. Vu[1]*, H. Hoang*[1]*, G. Le*[1] *and N. N. Tran*[2]*, (1)Center for Creative Initiatives in Health and Population, Hanoi, Viet Nam, (2)Administration for Medical Service, Ministry of Health, Hanoi, Viet Nam*

Background:
Early identification and accurate diagnosis enables early intervention, which leads to improved quality of life of individuals with autism spectrum disorder (ASD). In Vietnam, especially in provinces, there is little understanding about when care-givers of young children have first concern about their children, where and when they seek for assessment services for their children, and how their children are assessed, what parents think about the quality of services. This online survey has been carrying out in order to provide data for programmers and policy makers in efforts to enhance services for the children with ASD.

Objectives:

- To describe the experiences of parents of children with ASD in seeking for assessment and diagnosis services for their children.
- To explore some factors that might influence to the early identification and seeking for assessment services of parents of children with ASD.
- To provide suggestions to improve early identification and assessment services

Methods:

An online survey has been carrying out nation-wide with parents of children who received diagnosis of ASD since early October, 2017 to end October, 2017 using surveymonkey platform (https://www.surveymonkey.com). This survey has been promoting mainly through social media: facebook, and through sending email to parents.

Results: Two weeks after launching the survey, 380 parents completed fully the questionnaires. Preliminary analysis indicated that parents began to be concerned about their children from 3 months of age at the earliest to latest time of 60 months. On average, parents in this study began to be concerned about their children at the age of 22.4 months. On average, parents waited 3.4 months from when they started to have concerns to when they sought out assessment and diagnosis. More than half of parents (51%), sought assessment at specialist department directly at tertiary hospital of pediatrics. One average, parents travelled 86 km to access assessment clinics for their children. Less than 10% of parents were introduced and referred for assessment services from health professionals. Nearly half (46%) children were assessed less than 30 minutes and nearly 90% respondent received conclusion of assessment and diagnosis during the day their children were assessed. Only 35% of respondents agreed that professionals spent enough time to assess their children. About one third agreed that professionals provided enough time to explain assessment results and information to them. 56% parents thought that assessor had good knowledge on autism. About 15% did not believed in the conclusion of diagnosis. We will continue to run the survey for two more week and carry out further analysis to compare between rural and urban respondents, as well as socio-economic groups.

Conclusions: There are some concerns about the quality of assessment and diagnosis services and lack of referrals within health system. Greater effort, including develop national guideline, is needed to improve the accessibility and quality of assessment and diagnosis for ASD.

77 **183.077** Gender Differences in Autism Spectrum Disorder Characterization within a State-Wide Community-Based Sample

E. Clarke[1]*, C. E. McCormick*[2] *and S. J. Sheinkopf*[3]*, (1)Rhode Island Consortium for Autism Research and Treatment, Providence, RI, (2)Human Development and Family Studies, Purdue University, West Lafayette, IN, (3)Brown Center for the Study of Children at Risk, Women and Infants Hospital, Providence, RI*

Background: Since first described by Kanner, autism spectrum disorder (ASD) has been conceptualized as a predominately male condition. However, the relationship between ASD and gender is more nuanced than previously assumed. Males are more likely to receive an ASD diagnosis than females with equal symptomatology, and females are diagnosed later in life than males (Mandy et al., 2011). This female under-identification may result from gender-specific behavioral profiles in ASD, and a lack of understanding of the female behavioral profile (Dworzynski et al., 2012).
Objectives: To evaluate potential differences in behavioral characteristics and diagnostic outcomes across gender in a community-based sample.

Methods: This study analyzed data from males (n = 1128) and females (n = 335) ages 2-69 years enrolled in the Rhode Island Consortium of Autism Research and Treatment (RI-CART), a state-wide community-based sample. Enrollees had or suspected an ASD diagnosis, came from varied racial and socioeconomic backgrounds, and lived in southern New England. To join RI-CART, enrollees completed behavioral and cognitive measures including the ADOS-2, VABS-II, and KBIT-2.

Results: Female RI-CART enrollees had significantly higher KBIT-2 scores $F(1, 274) = 4.552$ $p = .034$, $\eta^2 = .016$, VABS-II overall scores $F(1, 1020) = 6.297$, $p = .012$, $\eta^2 = .006$ and social skills subdomain scores $F(1, 1028) = 8.003$, $p = .005$, $\eta^2 = .008$. VABS-II daily living skills domain scores and SRS-2 overall scores did not significantly differ by gender. Amongst participants with a community diagnosis, females had a significantly higher age of diagnosis $F(1, 560) = 7.47$, $p = .006$, $\eta^2 = .013$. RI-CART enrollees of both genders with a community diagnosis of ASD had higher ADOS comparison scores than enrollees without a community diagnosis $F(1, 1024) = 196.97$ $p < .001$, $\eta^2 = .005$. The interaction between community diagnosis and gender was significant. Male enrollees without a community diagnosis had significantly higher ADOS comparison scores than their female counterparts—in contrast, the ADOS comparison scores of enrollees with a community diagnosis did not significantly differ across gender $F(1, 1204) = 5.479$ $p = .019$, $\eta^2 = .019$.

Conclusions: Female RI-CART enrollees had significantly higher age of diagnosis than male enrollees, as well as higher KBIT-2, VABS-II social skills subdomain, and overall scores. These findings support the idea of a female-specific ASD behavioral profile. This profile may also contribute to the significantly lower ADOS-2 comparison scores in females questioning an ASD diagnosis. Better verbal, social, and adaptive skills could cause parents and clinicians to under-identify females with ASD. The female profile seen in this study does not mirror the profile identified by some prior studies; this may be due to heterogeneity of the RI-CART sample (Fraizer et al., 2014). Future research should clarify the characteristics of the female behavioral profile, as well as the breadth and magnitude of the gender discrepancy in ASD diagnoses.

78 **183.078** Identifying ASD and Comorbid Conditions: Joint Use of the SDQ and CSBQ

B. Barger[1]*, D. Roberts*[2] *and A. Roach*[1]*, (1)Georgia State University, Atlanta, GA, (2)GA State University, Atlanta, GA*

Background:

There are many screeners designed to identify developmental disabilities, externalizing, and internalizing conditions. However, many existing studies are limited by small sample sizes, focus on single instruments, are limited in the numbers of conditions considered, and often use of cut-off scores of other screeners or assessments, rather than actual diagnostic groups, as predicted outcomes.

Objectives:

This study investigates the predictive validity of a measure of externalizing and internalizing conditions, the Strengths and Difficulties Questionnaire (SDQ), and a measure of problems commonly seen in children with developmental disabilities, the Children's Social Behavior Questionnaire (CSBQ). Specifically, in a group of children with ASD, developmental delays (DD), and intellectual disabilities (ID), we hypothesize that the SDQ externalizing subscales would most strongly predict conduct problems and co-morbid attention deficit disorder (ADD), the SDQ internalizing subscales would most strongly predict co-morbid anxiety problems and depression, and CSBQ scales would most strongly predict

ASD diagnosis.

Methods:

We used national data from the Survey of Pathways to Diagnosis and Services to examine the predictive validity of the SDQ externalizing (conduct and attention problems) and internalizing (emotion and peer problems) sub-scales, and the CSBQ subscales (behavior/emotions not in tune to social environment, social contact/interest, orientation problems, social information processing, stereotypy, fear/change-resistance) in children with ASD, DD, and ID (n=2370). Analyses were weighted and stratified binary logistic regression models predicting the following separate outcome variables: parent reported ASD diagnosis, conduct problems, ADHD, anxiety problems and depression. All models statistically controlled for the following variables: gender; federal poverty level; age; race/ethnicity (White, Black, Hispanic, Other); maternal education; insurance status (private, public, and none); and English Language status (English speaking, non-English speaking).

Results:

Results of logistic regression generally supported the validity of the SDQ externalizing and internalizing subscales in groups of children with ASD, DD, and ID: Specifically, the SDQ conduct problems subscale was the only SDQ scale predictive of conduct problems (aOR = 1.43 95%CI[1.14-1.80]); the SDQ attention problems scale was the only SDQ scale predictive of ADHD (aOR = 1.43 95%CI[1.27-1.60]); the SDQ emotion problems scale was the only SDQ scale predictive of depression (aOR = 1.41 95%CI[1.25-1.60]) and anxiety (aOR = 1.41 95%CI[1.22-1.63]). The SDQ peer problems (aOR = 1.17 95%CI[1.01-1.37]), conduct problems (aOR = 0.74 95%CI[0.61-0.89]), and prosocial (aOR = 0.70 95%CI[0.60-1.80]) scales also predicted ASD diagnosis.

The CSBQ scales orientation problems positively (aOR = 1.08 95%CI[1.00-1.17]) and fear/change-resistance negatively (aOR = 0.84 95%CI[0.72-0.98]) predicted co-morbid ADD; social contact/interest (aOR = 0.90 95%CI[0.82-0.98]) negatively predicted comorbid depression; fear/change-resistance (aOR = 1.23 95%CI[1.01-1.49]) positively predicted ASD diagnosis.

Conclusions:

Data from this study indicates that some SDQ subscales may be useful for identifying externalizing and internalizing conditions in children with ASD, DD, and ID. Future research should determine whether the specific subscales versus the broader externalizing and internalizing subscales are preferred in this population. Furthermore, more research on the clinical utility of the CSBQ subscales is needed.

79 **183.079** Is the ADOS a Useful Instrument to Help in the Diagnosis of ASD Women?

L. Boada[1], *M. L. Dorado*[1], *P. Hernández*[1], *L. López*[1], *A. Alcón*[1], *M. Burdeus*[1] *and M. Parellada*[2], *(1)Hospital Universitario Gregorio Marañón. Child and Adolescent Psychiatry. IISGM. CIBERSAM, Madrid, Spain, (2)Fundación Investigación Biomedica Gregorio Marañon, Madrid, Spain*

Background:

In the last recent years there is a growing amount of scientific literature that shows the different clinical manifestation of ASD symptoms in women compared to men. It is well known that female-specific manifestation of autistic features fits imperfectly with current, male-based conceptualizations of ASD (Hiller et al. 2014;Lai et al. 2015).

Compared to males, females with ASD are: 1) less likely to have externalizing behaviours, and are more vulnerable to internalizing problems, such as anxiety, depression and eating disorders (Mandy, 2012; Huke, 2013); 2) have a greater social motivation (Sedgewick et al. 2015) 3) better non-verbal communication (Rynkiewicz et al. 2016) and 4) score lower on measures of repetitive and stereotyped behaviour (Van Wjingaarden-Cremers et al. 2014).

For these reasons, females are at substantially elevated risk of going undiagnosed: frequently mislabelled or missed entirely (Lai and Baron-Cohen 2015). Thus, many females who, if skillfully assessed, would meet full diagnostic criteria for ASD, never receive a ASD diagnosis.

Objectives:

1) To compare scores in selected ADOS items between men and women (based on previous literature): gestures, eye-contact, facial expression, prosody, stereotyped language, imagination, stereotypes and mannerisms, sensory abnormalities, restrictive interest, hyperactivity and anxiety. This analysis will be performed in a sample of 100 women and 100 men in whom ADOS has been administered in the last 8 years.

2) To study the agreement between ADOS cut-off label and the final clinical judgement.

Methods:

200 participants (100 girls and 100 boys matched by chronological age and secondary, when possible, by mental age) evaluated, from April 2009 to September 2017, in a Child and Adolescent Psychiatry Department of a General University Hospital in the context of one of the following: 1) diagnostic evaluation 2) to treat comorbidity or 3) participating in different research projects.

Procedure:

The ADOS was administered individually by a clinician with the appropriate reliability for the administration of the instrument. The evaluation was video-recorded. All the ADOS were immediately scored at the end of the evaluation. Final diagnosis was determined by clinical psychologists and psychiatrists with extensive experience in ASD based on all available information, including (always) full psychiatric and developmental interviews with parents or guardians (ADI-R when necessary), unstructured observation of the child, review of previous medical and educational records and ADOS scores. The diagnosis was therefore established following standard recommendations (Volkmar et al 2014) based on DSM-IV-TR ASD criteria (before 2013) criteria and/or DSM 5 criteria (after 2013).

Results: At the present moment all the evaluations have already been conducted and data are being incorporated in a database. We will conduct the statistic analyses during the next month.

Conclusions:

ASD girls are at risk of receiving non-spectrum classification in ADOS or ADOS-2 while their developmental history and clinical manifestations confirm ASD.

It could be the case that future editions of evaluating tools as ADOS need to contemplate differed cut-off scores for girls and boys. We intend to provide data to help with the discrimination of symptoms or behaviors that are differentially expressed by girls and boys.

80 **183.080** Laboratory and Home-Based Assessment of Electrodermal Activity in Individuals with ASD

M. S. Goodwin[1], *I. R. Kleckner*[2], *R. M. Jones*[3] *and C. Lord*[4], *(1)Northeastern University, Boston, MA, (2)University of Rochester Medical Center, Rochester, NY, (3)Weill Cornell Medicine, New York, NY, (4)University of California Los Angeles, Los Angeles, CA*

Background:

Sweat secretion from the skin is modulated by postganglionic sympathetic fibers surrounding eccrine sweat glands. Because eccrine sweat glands receive only excitatory sympathetic nerve impulses, electrodermal activity (EDA) constitutes a purely sympathetic response. The most widely studied property of EDA is skin conductance, which can be quantified by applying electrical potential between two points of skin contact and measuring resulting current flow between them. Changes in EDA has been widely used as an objective peripheral index of cognition, arousal, emotion, and attention in the general population since it results from neuronal activity in the amygdala, premotor cortex, pre-frontal cortex, hypothalamus, reticular activating system, and hippocampus. However, because EDA recordings are also influenced by non-autonomic factors such as thermoregulation, metabolic demand, participant movement, electrical noise, and other artifacts, it is critical to implement rigorous, well-defined, and replicable quality control procedures for selecting data prior to conducting inferential statistical testing.

Objectives:

Our objectives were threefold. First, we sought to develop and evaluate a quality control procedure for automatically selecting EDA data for subsequent comparative testing. Second, after applying our procedure to identify valid segments of EDA data, we evaluated EDA responses across laboratory and in-home settings. Third, we conducted preliminary analyses on EDA reactivity and its association with a variety of experimental tasks in laboratory settings, over repeated measures in the home, and in relation to day-to-day fluctuations in child irritability as rated by parents using a smartphone.

Methods:

Twenty children and adolescents (5 females, range 5-13 yrs, M=8 yrs) with a confirmed diagnosis of ASD (ADOS calibrated severity score, M=7.9, SD=1.8) were observed repeatedly over an 8-week period in both laboratory and home settings while their EDA was wirelessly recorded with the Affectiva Q sensor and their day-to-day fluctuations in irritability was rated by parents using a smartphone.

Results:

First, starting with 181 hours of raw EDA data collected in the study, our automated quality control procedure identified 120 hours of valid data across the 20 participants, yielding, on average, 6 hours of quality data per participant across an average of 4.6 recording days. Second, EDA responses discriminated between a variety of negative vs neutral affect-inducing tasks in the laboratory (Brief Observation of Social Communication Change, Purdue Pegboard, passive movie watching, and an iPad puzzle). Third, patterns of EDA data identified individual differences within and between children with ASD assessed over 7-10 days in home settings based on tonic level, variability, and the ratio between sympathetic reactivity (increasing slope) and recovery (decreasing slope). Fourth, using Hierarchical Linear Modeling, mean and standard deviation EDA was found to predict daily ratings of irritability at *p*=0.002 and *p*=0.043, respectively.

Conclusions:

Being able to reliably and validly obtain peripheral measures of autonomic arousal from individuals with ASD in an untethered way in both laboratory and natural environments over time enables an efficient and scalable way to gather biomarker data that could be used in diagnostic, phenotypic, and clinical/intervention explorations in autism and related neurodevelopmental disorders.

81 **183.081** Males and Females with ASD: A Gender Comparison between Cognitive and Behavioral Profiles

A. Bentenuto[1], *A. Peripoli*[2], *I. Landi*[3], *N. Mazzoni*[1], *T. Del Bianco*[1], *I. Basadonne*[1], *L. Carrieri*[2], *S. Cainelli*[2] *and P. Venuti*[1], *(1)Psychology and Cognitive Science, University of Trento, Rovereto, Italy, (2)University of Trento, Rovereto, Italy, (3)Bruno Kessler Foundation, Trento, Italy*

Background:

Recent research suggest that some of the characteristic traits of the Autism Spectrum Disorder have different expression in males and females (Dworzynski et al., 2012). Accordingly, it has been proposed that the gender prevalence might not be so unbalanced and that girls with ASD are actually under-diagnosed or mis-diagnosed (Gould & Ashton-Smith, 2011). Few studies have investigated the gender differences in people with ASD, but conflicting results have often been reported (Bőlte et al., 2011; and Kumazaki et al., 2015; Koyama et al., 2009). In general, females with high-functioning ASD can camouflage their autistic characteristics more successfully than males. Furthermore, females perform better in working memory tasks and exhibit lower level of repetitive and respective behavior than males. (Bőlte et al.,2011; e Kumazaki et al., 2015; Koyama et al., 2009). Besides, males have higher spatial- visual skills than females.

Objectives:

In the present study, we compare the cognitive and behavioral profiles of a group of 29 males and 29 females with ASD for a total of 58 participants. (Chronological age M = 9y, SD = 7y, 5m)

Methods:

Participants were administered with a complete assessment in a clinical center located in the Nord of Italy. The cognitive profile have been assessed with the Griffiths Mental Development Scales (GMDS) or Wechsler Scales, according to participants' age. The behavioral profiles included the subscales of the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2).

Results:

Preliminary analysis on a total of 30 participants (15 males and 15 females) show that females obtained higher score in “Locomotion subscale” of GMDS (t = 1.8581, df = 9.9307, p-value = 0.04651) and in Performance Intelligence Quotients (PIQ) of the Wechsler Scale (t = 3.313, df = 7.5923, p-value = 0.01147).We did not find any significant sex-related difference ADOS total score (i.e. males and females display the same level of social communication impairment). However, results of the Principal Component Analysis applied on some index of ADOS (total score, Social Affect Area and Restricted and Repetitive Behavior) showed lower levels of restricted interests in females. .

Conclusions:

These preliminary results suggest the existence of cognitive and behavioral differences between females and males with ASD. These findings have important implication at a clinical level, as a more advanced understanding of the developmental trajectory in females with ASD would increases the possibility of adopting personalized management and defining treatment approaches specific for females with this disorder.

82 **183.082** Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R) Validation in Portugal: Preliminary Results

C. Almeida[1] *and D. L. Robins*[2]*, (1)PIN, Carcavelos, Portugal, (2)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA*

Background: Autism Spectrum Disorders (ASD) are lifelong developmental disorders, and early intervention is crucial for positive outcomes. ASD early screening in low-risk samples has been recommended as a strategy to promote early diagnosis, which facilitates early intervention. Screening procedures in Portugal are not yet common, which delays detection for many children. In order to increase ASD screening, a study using the Modified Checklist for Autism in Toddlers, Revised (M-CHAT-R) has been implemented in pediatric and childcare settings.
Objectives: The main goal of this study is to establish preliminary validity for the M-CHAT-R in Portugal as a screening tool for low-risk toddlers.

Methods: Toddlers are recruited from two sources: childcare centers and pediatric check-ups. To date, 563 toddlers between 15 and 31 months (*m*=22.84, *SD*=4.23) were screened with M-CHAT-R. Parents of toddlers at risk on M-CHAT-R completed the M-CHAT-R Follow-up as an interview, and those who continued to show risk completed an evaluation using Autism Diagnostic Observation Schedule (ADOS), Autism Diagnostic Interview Revised (ADI-R), and Griffiths Mental Development Scale.

Results: Pediatric providers were reluctant to join the study. The majority of participants (80%) were screened in the daycare setting. From the 451 screened in daycare, 41 were positive (9.1%). After the Follow-up, eight continued to screen positive and four were diagnosed with an ASD, two had other developmental delays, and two were typically developing. From the 112 toddlers screened in pediatricians' settings, ten were positive (8.9%), after the Follow-up three continued to screen positive; one was diagnosed with ASD, one had a developmental delay, and one was typically developing. In both groups, the prevalence of ASD detected was 1 in 112.

Conclusions: Professionals from daycares were more receptive to screen for ASD than pediatricians during check-ups. Across the two groups, the M-CHAT-R performed similarly (9.1 vs 8.9% screened positive initially, similar ASD rate detected), suggesting that the setting does not impact the performance of the screening tool. ASD rates were consistent with other screening studies (Robins et al., 2014). Given the reluctance of many pediatric providers to incorporate routine ASD screening into well-child check-ups, daycare is a viable alternate setting. Portugal continues to require more information and awareness about ASD screening as an essential way to detect ASD and start early intervention as young as possible in order to improve children's outcomes. Additional education for pediatric providers may help doctors understand the value of ASD screening in low-risk samples.

83 **183.083** On the Potential of Automated Emotional Facial Expression Recognition for Screening/Diagnosis of ASD: Evidence from Comparing Human Vs. Machine Detection of Emotional Expressions of High Functioning Young Children with ASD

M. Gyori[1]*, Z. Borsos*[2]*, K. Stefanik*[1]*, J. Csákvári*[1] *and F. Varga*[1]*, (1)ELTE University, Budapest, Hungary, (2)Eotvos Lorand University Barczi Gusztav Faculty of Special Needs, Budapest, HUNGARY*

Background: Improving early recognition of ASD has been a key focus of research and development in the last decades. Recently, technological developments seem to have given new impetus to it. Both clinical and experimental studies indicate differences between emotional facial expressions of neurotypical (NT) children and children with ASD. Although differences are often subtle and varying, screening/diagnostic technologies may potentially be able to exploit them.
Objectives: The present work was aimed at exploring whether commercially available emotional facial expression recognition technology has a potential for being a part of technologically-aided early screening/recognition of ASD, vis-á-vis recognizing emotional facial expressions by human coders. This work is a part of a larger research-and-development project with the objective of developing and validating a multi-modal, social serious game-based digital system for screening for ASD in 3-6 year old high functioning (HF) children.

Methods: Video recordings of 13 HF ASD children (mean age 58.4 months, range 43-70) and 13 NT children (mean age 57.15 months, range 43-68) were analyzed; all ASD children had a clinical diagnosis confirmed by ADOS and ADI-R; all NT children had negative ADOS and ADI-R results. There were no significant differences between the two groups along age and IQ. Each video-recording showed the face of a child while playing with the fully playable prototype of the screening serious game under development, but did not show any content of the game. Three sessions were selected from the recording for analysis: from the beginning the play session (140 secs), from the middle (195 secs), and from the closure of the game (15 secs). Each video-recording was analyzed by a machine system (Noldus FaceReader v5.1, Noldus Information Technology) and by two independent human raters. For human coding, we adapted the judgment-based emotion coding system of Kring és Sloan (2007; Facial Expression Coding System, FACES). Although sign-vehicle-based human emotion coding systems (such as the Facial Action Coding System by Ekman & Friesen, 1978) seem more accurate, their time and resource consumptiveness makes them imperfect tools in screening contexts. First, inter-rater reliability was calculated for human, test-retest reliability was calculated for machine codings. Secondly, we intended to compare the two groups along the intensities of the displayed emotions, based on human and machine codings, separately.

Results: Human coding of emotional facial expressions showed very poor inter-rater reliability, on both ASD and NT data, rendering any further analysis of this dataset methodologically unsupported. Machine coding, as expected, showed practically total test-retest reliability, and group comparisons showed significant differences in mean intensities of two emotions (scared, surprised), ASD group showing these more intensively.

Conclusions: While human emotional facial expressions coding has proven to be unreliable in this study, machine coding was practically totally reliable and was able to reveal ASD/NT differences. These are consistent with findings from earlier studies on emotion expressions in children with ASD. Although further confirmation and resolving methodological issues are needed for firm conclusions, our results suggest that automated facial expression recognition may potentially play a role in technologically-aided early screening/diagnosis of ASD.

84 **183.084** Peripheral Sympathetic and Parasympathetic Activity in ASD with and without Comorbid Anxiety

V. Parma[1] *and J. D. Herrington*[2]*, (1)William James Center for Research, ISPA - Instituto Universitário, Lisbon, Portugal, (2)Center for Autism Research, The Children's Hospital of Philadelphia, Philadelphia, PA*

Background: Anxiety disorders are one of the most common comorbidities among individuals with autism spectrum disorder (ASD). While anxiety disorders have been thoroughly characterized from a psychophysiological perspective, this is not yet true for the psychophysiological manifestations of anxiety in ASD. Both pathologies are underlined by abnormal physiological activity.
Objectives: To assess similarities and differences in the peripheral sympathetic (i.e., electrodermal) and parasympathetic (i.e., heart rate

variability) activity of children with ASD with and without comorbid anxiety and matched controls.

Methods: Seventy-five children and adolescents between 7 and 17 years of age were recruited. Thirty-seven were diagnosed with ASD, of which 22 with comorbid anxiety. Thirty-eight were typically developing controls (TDC), of which 16 were diagnosed with one or more anxiety disorders. All watched natural-scene movies while the physiological activity was recorded.

Results: Peripheral sympathetic activity within individuals with anxiety was found to be higher in TDC as compared to the ASD group. Higher vagal activity was reported in the TDC non-anxiety group as compared to both ASD groups. A multinomial regression model including such physiological measures and parent reports on anxiety (SCARED) and ASD symptoms (SCQ) allowed to classify 73% of cases across the 4 groups.

Conclusions: Besides supporting the inclusion of psychophysiological indicators when examining the relationship between anxiety and ASD, this study highlights the need for more research on how to best conceptualize, evaluate, and treat children with ASD with and without comorbid anxiety.

85 **183.085** Priorities Established By the Combating Autism Act for Improving ASD Identification: Looking Beyond Ideas and Instruments Towards Implementation

***P. Doehring**, ASD Roadmap, Chadds Ford, PA*

Background: The 2006 Combating Autism Act or CAA is the most ambitious ASD national research strategy to date. In response to growing concerns about ASD's prevalence and impact, CAA created the InterAgency Autism Coordinating Committee or IACC to establish priorities for federal research funding. Between 2008 and 2013, IACC helped to direct $1.8 billion towards these priorities. The lack of significant improvement in timely and accurate identification, especially for traditionally underserved groups, has led researchers and advocates to question these priorities. Would a greater focus on implementation, disparities, and capacity building be more effective in closing gaps in ASD identification?

Objectives: To establish how much federally-funded research addressing identification between 2008 and 2013, and the publications which resulted, sought to either (1) explore theoretically relevant factors, (2) validate instruments, or (3) test immediately applicable strategies to close gaps, improve implementation, or build capacity.

Methods: Using the Autism Research Database, we identified all federally-funded research grants between 2008 and 2013 that potentially addressed ASD identification. In addition to projects explicitly focused on ASD screening and diagnosis, we included potentially overlapping projects addressing services, lifespan issues, and infrastructure. We have also begun to assemble all publications arising from these grants, using existing federal databases supplemented by Pubmed/Psychinfo searches. We have begun to conduct title, abstract, and full-text reviews of these research projects and publications to identify the subset that clearly focused on identification. Within this subset, we have begun to distinguish between those addressing theoretically relevant factors, those validating instruments, and those testing specific and immediately applicable strategies. Within this last group, we are categorizing articles according to population, focus, and setting.

Results: Almost $500 million of federal research funding addressed the IACC priorities related to Diagnosis, Services, Lifespan, and Infrastructure between 2008 and 2013. Preliminary analyses indicate substantial variability in the extent to which federal funding was directed towards specific and immediately applicable tools or approaches to improve identification. For example, at least 25% of federal research funds targeting Diagnosis addressed questions only of theoretical importance (for example, examining potential biomarkers of ASD). IACC also fell far short of certain key targets related to diagnosis (for example, successfully allocating less than 5% of the desired funding towards improved identification of ASD in adults). Projects clearly intended to immediately improve identification are much more likely to focus on validating tools than addressing disparities or barriers to implementation. Additional analyses are underway to establish whether similar patterns are evident among the research publications generated by these projects.

Conclusions: Available analyses indicate that a relatively small proportion of the research funded by the NIH between 2008 and 2013 tested a specific and immediately applicable tool or approach to improving ASD identification. The paucity of research addressing disparities and implementation barriers limits the immediate impact of the knowledge gained thus far. Implications for future research and policy are discussed.

86 **183.086** Prospective Validation of Molecular Subtype Diagnostics for Autism Spectrum Disorders and Neurodevelopmental Disorders

***R. Burrier**[1], D. G. Amaral[2], E. Donley[1], J. King[3], A. Smith[3], P. West[3], L. Feuling[3], M. Ludwig[3], D. B. Sugden[3] and B. Smart[3], (1)Stemina Biomarker Discovery, Madison, WI, (2)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (3)Stemina Biomarker Discovery, Inc., Madison, WI*

Background:

Autism is a complex neurodevelopment disorder with underlying genetic, metabolic, and environmental factors leading to individual differences in clinical presentation and response to therapies. Earlier diagnosis of children with autism spectrum disorder (ASD) improves outcomes through the early initiation of therapeutic interventions. Based on previous metabolic profiling of ASD in three clinical studies involving more than 500 subjects, we postulated that metabolites can define subpopulations or metabolic subtypes of ASD. These subtypes could then be used to stratify the ASD population based on metabolic differences. Initial analysis of metabolomic data were used to design the Children's Autism Metabolome Project (CAMP, ClinicalTrials.gov Identifier NCT02548442); the largest metabolomics study of autism conducted to date. CAMP has enrolled over 1,000 pediatric subjects, carried out metabolomic analyses of donated, fasting blood samples and is validating subtypes prospectively providing potentially actionable results. Metabolic subtypes have the potential to identify subjects that may benefit from specific dietary and pharmacological interventions.

Objectives:

The objective of this study is to prospectively validate metabolite-based diagnostics for neurodevelopmental disorders (ND), ASD and developmental delay (DD) where each subtype diagnostic identifies a subpopulation with high specificity. Evaluate the clinical performance of each diagnostic by testing plasma samples from subjects in the CAMP study consisting of ASD, DD and typically developing (TD) subjects.

Methods:

The CAMP study is being conducted at 8 locations. Diagnosis is based on Diagnostic and Statistical Manual of Mental Disorders (DSM-5) confirmed by research reliable Autism Diagnostic Observation Schedule (ADOS) for ASD and the Mullen scales of early learning for DD. Samples from 368 subjects (242 ASD, 40 DD, 87 TD) aged from 18 to 48 months were selected to set thresholds for each subtype diagnostic. Plasma from these subjects was analyzed using a quantitative assay for a panel of amine containing metabolites and these measurements were used to set thresholds for each subtype diagnostic. A second set of approximately 350 subjects that had not been previously measured were analyzed using the same quantitative method to determine the clinical performance of each subtype diagnostic.

Results:

Thresholds were set for five molecular subtype diagnostics for ASD or DD. Thresholds were also set for a subtype diagnostic for the diagnosis of ASD. A prospective analysis of 368 children aged from 18 to 48 months is underway and will be completed at the time of this presentation. We expect to validate several molecular subtypes of ND with a combined sensitivity exceeding 20% and a specificity of greater than 90%.

Conclusions:

The CAMP study provides the largest set of samples collected under procedures designed for the investigation of metabolic differences associated with NDs such as ASD and developmental delay (DD). This report focuses on the validation of a collection of molecular subtype diagnostics which reliably identify ASD and DD children in a prospective analysis. Each molecular subtype suggests altered levels of metabolites or an imbalance of metabolites which suggests possible interventions to improve outcomes.

87 **183.087** Psychometric Analysis of the Autism Spectrum Quotient Using Diagnostic Classification Modeling

E. G. Keenan[1]*, M. J. Madison*[2]*, J. J. Wood*[1] *and M. D. Lerner*[3]*, (1)Human Development & Psychology, University of California, Los Angeles, Los Angeles, CA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Psychology, Stony Brook University, Stony Brook, NY*

Background:

The Autism Spectrum Quotient (AQ), a widely-used self-report questionnaire measuring autism traits in adults, has reported good predictive validity and moderate to high internal consistency for its five subscales (Baron-Cohen et al., 2001). Factor analyses have not shown the AQ to be unidimensional; its use as a raw score measuring a single latent variable has been criticized (Lundqvist & Lindner, 2017). Items demonstrated a need for revision due to redundancies and negative point-measure correlations. To facilitate greater understanding of the AQ, examination of how each item contributes to its estimation of the latent variables it measures is needed.

To evaluate the psychometric properties of the AQ items and subscales, we used a diagnostic classification model (DCM), psychometric models designed to classify respondents according to specified categorical latent traits (Ravand & Robitzch, 2015). The categorical classifications of each latent trait provide maximum separation between groups based on item responses. While classical test theory models weight each item equally in raw scores, DCMs account for variable test item quality.

Objectives:

We aim to characterize psychometric properties of the AQ items and subscales using a DCM. We also aim to evaluate predictive validity of subscale classifications in comparison to raw subscale scores.

Methods:

200 undergraduates completed questionnaires, including the AQ, Perseverative Thinking Questionnaire (PTQ), and Patient Health Questionnaire (PHQ; a depression measure).

First, a unidimensional DCM was estimated with AQ as the single latent trait. A second DCM was estimated using the five subscales as latent variables. The relation between AQ classifications and other variables were assessed using independent-samples t-tests. A moderated regression was constructed to determine the impact of classifications on the relation between PTQ and PHQ.

Results:

The unidimensional model characterized 31.5% of participants as high traits (HT). HT participants had significantly higher PTQ and PHQ compared to those with lower traits (LT; both $p = .03$). The mean difference in probability for HT and LT participants endorsing an item was .16 (see Table 1 for details of the first 20 items).

In the five-attribute model, correlations between attributes varied, from negative correlations with Attention to Detail and all others, to positive correlations with Social Skills and Communication/Imagination (both $r > .9$), suggesting the AQ is not a unidimensional measure. Comparing the relative fits of unidimensional and five-attribute models using a chi-squared test, the five-attribute model had better fit ($p < .0001$).

While neither overall raw score (p=.17) nor HT grouping (p=.55) was significant in the moderated regression, classifications (but not raw scores) of Attention Switching and Attention to Detail subscales were significant (p=.004 and .02, respectively). Figure 1 illustrates Attention Switching as a moderator.

Conclusions:

Due to varied specificity in AQ items – “I tend to notice details that others do not” versus “I usually notice car number plates or similar strings of information” – the DCM model showed greater predictive validity in our moderated regression (illustrating attention as a moderator in the relation between perseveration to depression) than raw scores. Future research should examine the impact of item parameters on classical test theory.

88 **183.088** Quality of Life in Autism: A Systematic Literature Review

K. Evers[1,2,3]*, J. Maljaars*[1,2,3] *and I. Noens*[1,4]*, (1)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (2)Parenting and Special Education Research Unit, KU Leuven, Leuven, Belgium, (3)Child Psychiatry, UPC-KU Leuven, Leuven, Belgium, (4)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium*

Background: ASD is a life-long neurodevelopmental disorder with substantial impact on various aspects of daily-life functioning. However, the first articles evaluating quality of life in individuals with ASD were only published quite recently. Since then, the interest has grown tremendously, yielding highly diverse publications, both in terms of addressed research questions and ASD characteristics, but also in terms of quality of life measurements and results. Several researchers have reviewed quality of life publications in autistic individuals. The number of articles included

in each of those previous reviews varied between 11 and 16.
Objectives: We wanted to perform an extensive systematic review on quality of life in individuals with ASD, aiming to provide responses on the following questions: (1) Do autistic individuals have a lower quality of life?; (2) Which factors are associated with a lower (or higher) quality of life in individuals with ASD?; (3) How can we measure quality of life in those with ASD?.

Methods: This literature review consisted of multiple stages with a final set of 48 included publications: (1) the literature search, (2) screening all publications using a set of inclusion and exclusion criteria, and (3) extraction and coding of the relevant data.

Results: Quality of life appeared lower in individuals with ASD compared to normative samples, typically developing controls, but also in comparison to a broad range of clinical control populations. More problem behavior, higher ASD severity and lower adaptive functioning were clearly associated with poorer quality of life, but evidence on the effects of age and gender was highly mixed. Intelligence did not correlate with quality of life. A broad range of measurements was used, but mostly questionnaires were administered from autistic individuals themselves, or a proxy. Parents or other proxies reported lower quality of life compared to the individuals with ASD themselves, but moderate intra-class correlations were found between proxy- and self-reports.

Conclusions: Quality of life gained increasing importance, both as treatment goal and in the context of treatment evaluation. The concept has proven its value in other clinical populations, in shifting the attention from problems to individuals' strengths and in emphasizing their subjective perspectives. This extensive literature review has demonstrated the relevance in the context of individuals with ASD, but also pointed towards some pitfalls. An ASD-specific QoL instrument has not been developed yet, and the currently used measurements include a highly diverse set of quality of life domains.

89 **183.089** School Psychologists Use of Evidence-Based Assessment Practices for the Examination of Autism Spectrum Disorder

M. Fraser[1] *and L. J. Dilly*[2]*, (1)Marcus Autism Center, Children's Healthcare of Atlanta and Emory University School of Medicine, Atlanta, GA, (2)Marcus Autism Center, Atlanta, GA*

Background: Within the United States, public school assessments first identify a significant portion of children with ASD (Pettygrove et al., 2013). While the use of Evidence-Based Assessment (EBA) practices for the examination of ASD are widely accepted and endorsed by leadership organizations such as the National Association of School Psychologists (NASP) (Falkmer, Anderson, Falkmer, Horlin, 2013; Esler, & Ruble, 2015), emerging research examining the practices of school psychologists in the assessment of ASD indicates disparate practices (Aiello, Ruble, & Eslerc, 2017).
Objectives: This study examined the number of school psychologists' who utilize comprehensive, evidence-based assessment (EBA) practices for ASD, which was defined as assessments including an interview, cognitive/developmental measure, adaptive measure, and the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2). Additionally, the use of the ADOS-2 was of particular interest. Use of the ADOS-2 across geographical locations, school district population size, evaluator training level, and evaluator years of experience was considered.

Methods: The survey created for this research study was developed by a team of clinicians and researchers in order to collect demographic information and school psychologists' assessment procedures for students with ASD. The survey was emailed to 557 school psychologists in Georgia. The response rate was 61%. IDEA Section 618 data records indicate in 2013 there were 720 school psychologists, indicating the respondents represent approximately 47% of school psychologists in Georgia.

Results: Thirteen respondents (3.82%) reported adherence to EBA. Related to the ADOS-2, 71 respondents reported regular use. There was a significant effect of the geographical location on the use of the ADOS-2 [$F(2, 287) = 6.70$, $p = 0.001$, $d = 1.843$]. There was a significant difference for participants located in suburban ($M=2.55$, $SD=1.448$) and rural areas ($M=1.89$, $SD=1.298$).

There was a significant effect of the student population size on the use of the ADOS-2 at the $p<0.05$ level [$F(5, 284) = 4.61$, $p = 0.000$, $d = 0.972$]. There was a significant difference for a student population size of 75,001-100,000 ($M=3.35$, $SD=1.496$) from a population of less than 10,000 ($M=1.88$, $SD=1.333$), 25,001-50,000 ($M=2.11$, $SD=1.319$), and of over 100,000 ($M=2.19$, $SD=1.210$).

There was not a significant effect of evaluator level of training or evaluator years of experience on the use of the ADOS-2 ($p = 0.514$; $p = 0.618$).

Conclusions: Few respondents indicated adherence to EBA, suggesting further investigation into the barriers impacting use, need for professional development, and practicality of current EBA in the school setting. Specifically, use of the ADOS-2 appears to differ slightly in Georgia across geographical locations and population size, while evaluator level of training and years of experience did not influence the use of the ADOS-2. Evaluators in larger, suburban districts tended to use the ADOS-2 more frequently where there may be more financial resources. Results suggest barriers may be present at the systems-level that impact the likelihood of regular use. Professional development and consultation with leadership personnel regarding the use of the ADOS-2 as part of EBA may be warranted.

90 **183.090** Screening for Autism Spectrum Disorder in a Naturalistic Home Setting Using the Systematic Observation of Red Flags (SORF)

D. Dow[1]*, T. N. Day*[2]*, C. Nottke*[2] *and A. Wetherby*[2]*, (1)UCLA Semel Institute for Neuroscience & Human Behavior, Los Angeles, CA, (2)Florida State University Autism Institute, Tallahassee, FL*

Background: While early detection of autism spectrum disorder (ASD) is critical for timely initiation of intervention, development of more effective screening tools is necessary to warrant a recommendation for routine universal screening (Campos-Outcalt, 2011). Time and resource constraints also limit screening procedures (Daniels et al., 2014), leading to delays in diagnosis until 4 ½ years of age (Baio, 2014). This is further exacerbated for non-white children in low-resource areas (Daniels & Mandell, 2013) due to limitations in accessibility of clinical services. Improved screeners are needed that not only effectively identify children at risk, but also offer increased feasibility for widespread use across community settings.
The Systematic Observation of Red Flags (SORF) is an observational measure that can be used by non-experts (e.g., paraprofessionals, undergraduate students) to detect risk for ASD in young children (Dow et al., 2016). Studying this measure in the home context could improve community-viable screening options accessible to more families, especially those with more limited resources.

Objectives: To examine psychometric properties of the SORF home measure for 18-24 month olds, including item-level performance and overall sensitivity, specificity, and recommended cutoff scores.

Methods: Preliminary analyses were conducted on a sample of 61 participants (31 with ASD, 14 developmental delayed, 16 typically developing) recruited by the FIRST WORDS® Project at Florida State University. A sample size of 217 will be completed at the time of presentation. The sample was randomly selected, stratified by race to optimally represent minority groups (i.e., 13% Black, 11% Hispanic, 9.5% Biracial). Receiver operating characteristic (ROC) curves and analysis of variance (ANOVA) were used to evaluate individual items and summary scores.

Results: Preliminary results based on the Composite summary score composed of best performing items suggest good discrimination between ASD and nonspectrum groups (AUC=.89), with high sensitivity and specificity (sensitivity=.90, specificity=.83). Group differences with large effect sizes were found between ASD and nonspectrum groups for all summary scores and social communication domain scores. Best performing items include *showing and pointing* (AUC=.83), *eye gaze* (AUC=.81), *nonverbal communication* (AUC=.81), and *more interest in objects than people* (AUC=.81).

Conclusions: Preliminary results support the utility of the SORF as an effective observational screening tool for ASD that can be used in a naturalistic home setting by non-experts. Data on individual item utility and required length of observation will be further analyzed in an effort to create a briefer measure to improve feasibility. Future studies will also examine the SORF's utility in a younger sample at 12-18 months, and in combination with parent report. Applying the SORF to the home context could provide a community-viable screening option accessible to more families, aiming to improve services for minority and low resource children and decrease delays in diagnosis of ASD.

91 **183.091** Sensitivity and Specificity of the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) in Acute Care Settings

N. Noonan[1,2]*, G. Righi*[3]*, R. McLean*[4]*, R. L. Gabriels*[5]*, M. Siegel*[6]*, K. Pedersen*[7] *and S. J. Sheinkopf*[8]*, (1)Department of Psychiatry and Human Behavior, The Warren Alpert Medical School of Brown University, Providence, RI, (2)E. P. Bradley Hospital, Providence, RI, (3)Brown Center for the Study of Children at Risk, Emma Pembelton, Providence, RI, (4)Brown University, Providence, RI, (5)Psychiartry & Pediatrics, University of Colorado School of Medicine, Aurora, CO, (6)Maine Medical Center - Tufts School of Medicine, Westbrook, ME, (7)Department of Psychiatry, Maine Medical Center, Portland, ME, (8)Brown Center for the Study of Children at Risk, Women and Infants Hospital, Providence, RI*

Background: ASD affects an estimated 1 in 68 children in the US (CDC, 2015) increasing substantially since the 1990s. Children with ASD often develop co-morbid psychiatric conditions (Simonoff et al., 2008), and often require acute psychiatric services (Mandell et al., 2008). Despite the need for specialized psychiatric services, this population is often hospitalized in general pediatric psychiatry units (Gabriels et al., 2012). These units may include assessment services, especially to guide disposition planning and service access (Mandell et al., 2005). Consequently, assessment measures designed for use in outpatient settings are used in acute care settings, at times with limited guidance from neurodevelopmental specialists. These tools may capture a unique snapshot of extreme behaviors related to a psychiatric crisis, calling into question the validity of the clinical findings, particularly for long term/developmental diagnoses.

Objectives: This study investigates the sensitivity and specificity of the ADOS-2 when administered in an acute psychiatric care setting.

Methods: Participants were selected from the Rhode Island Consortium for Autism Research and Treatment (RI-CART), a state-wide registry of individuals diagnosed with ASD or related neuro-developmental disorders. Selected RI-CART participants (n = 80; 70% male, Mean Age = 11.5, sd = 2.9) were enrolled in the registry while admitted to either a pediatric psychiatric inpatient unit (n = 11) or partial hospital program (n = 69); assessment was acquired during admission. Assessments included an ADOS-2 administered by a research-reliable examiner, and other cognitive (K-BIT 2), emotional/behavioral (SRS-2), and adaptive measures (VABS). Parents completed a demographics form. A confirmed diagnosis of ASD was indicated if participants medical charts contained an active diagnosis of ASD and ADOS-2 results were positive for ASD (n = 34). Additional data derived from the Autism and Developmental Disorders Inpatient Collaborative (ADDIRC; n = 736 with confirmed ASD diagnosis and positive ADOS-2; n = 178 with discordant clinical diagnosis and ADOS-2 scores) is being prepared and subsequent analysis will include: 1) more in-depth examination of demographics characteristics, 2) second sensitivity and specificity analysis with the full sample, 2) an examination of individual ADOS-2 items that reliably distinguish between ASD positive and ASD negative participants and, 3) a receiver operating characteristic (ROC) curve to examine how alternative algorithm cut-offs may increase the sensitivity and specificity of the ADOS-2 when used in acute care settings.

Results: Participants presented with numerous psychiatric comorbidities (mean = 2.7, range 1-5 psychiatric dx). Preliminary data include 51 Module 3 and 29 Module 4 ADOS-3 results. In this sample, the Module 3 algorithm produced a sensitivity of 36% and a specificity of 79%; Module 4 algorithm produced a sensitivity of 83% and a specificity of 71%. No differences in sensitivity and specificity were attributed to participants' gender (p = 0.17).

Conclusions: Results from these analyses suggest that sensitivity and specificity of the ADOS-2 may be lower in acute care compared to previous findings in outpatient samples. This, combined with upcoming analysis examining alternative algorithm cut-offs, aim to provide clinical diagnostic guidelines to improve the accuracy of the ADOS-2 when used in acute care.

92 **183.092** Sub-Dimensions of Impairments in ASD, Referring to Age, IQ and Gender – a Factor Analytical Analysis of the ASD-Net Database

N. Wolff[1]*, I. Kamp-Becker*[2]*, S. Köhne*[3]*, L. Poustka*[4]*, S. Roepke*[5]*, S. Stroth*[6]*, A. Langmann*[7] *and V. Roessner*[8]*, (1)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus Dresden, Dresden, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany, (3)Berlin School of Mind and Brain, Humboldt University Berlin, Berlin, Germany, (4)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (5)Department of Psychiatry, Charite Berlin, Berlin, Germany, (6)Philipps University Marburg, Marburg, Germany, (7)Department of Child and Adolescent Psychiatry, , Psychosomatics and Psychotherapy, Medical Clinic, Philipps-University Marburg,, Marburg, IA, Germany, (8)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Dresden, Germany*

Background: Developmental Disorders, like Autism Spectrum Disorders (ASD) have their onset in early childhood and are characterized by a delay and a deviation in the development. It is further assumed that different autistic disorders (F84.0, F84.5, F84.1) cannot be categorially distinguished from one another, but should rather be arranged on one dimension. Therefore the question is raised how dimensions of different symptoms of ASD differ from each other depending on the applied Autism Diagnostic Observation Schedule (ADOS) module, age, gender, intelligence quotient (IQ) and the concrete ASD diagnose of the patient.

Objectives: Aim of the present talk is to specify separable dimensions of ASD by examining scores of the ADOS.

Methods: Using one of the largest internationally available samples, which is uniformly diagnosed according to gold standard (www.asd-net.de), data from N= 2613 patients (age 13.3± 10.4, IQ 97.4 ± 20.02) were analyzed. We applied factor-analytical analyses for each ADOS module and associate the observed factors with age, gender, IQ and diagnose of the patient. Further logistic regression analyses were applied to specify the forecasting power of the observed dimensions (factors).

Results: We observed that the numbers of factors vary depending on the applied module. In addition factors were very specifically associated with age, gender or IQ of the patients: while module 1 and 4 are for example multi-dimensionally dependent on different factors, we observed no association between age, gender or IQ for modules 2 and 3. In addition gender seems to influence factors of module 4 solely, while no influence was observed for module 1-3.

Conclusions: Based on the ASD-net database module-dependent sub-dimensions of the ASD symptomology could be identified which seem to have huge influence on the diagnostic process.

93 **183.093** Symptoms of ASD in Children and Adolescents with a Diagnosed Mood or Anxiety Disorder

A. Langmann[1]*, I. Kamp-Becker*[2]*, S. Köhne*[3]*, L. Poustka*[4]*, S. Roepke*[5]*, V. Roessner*[6]*, N. Wolff*[7] *and S. Stroth*[8]*, (1)Department of Child and Adolescent Psychiatry, , Psychosomatics and Psychotherapy, Medical Clinic, Philipps-University Marburg,, Marburg, IA, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany, (3)Berlin School of Mind and Brain, Humboldt University Berlin, Berlin, Germany, (4)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (5)Department of Psychiatry, Charite Berlin, Berlin, Germany, (6)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Dresden, Germany, (7)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus Dresden, Dresden, Germany, (8)Philipps University Marburg, Marburg, Germany*

Background: Autism spectrum disorders (ASD) and mood/anxiety disorders are commonly diagnosed in children and adolescents. Differentiation between the two is a diagnostic challenge, as there are several clinical symptoms that occur in both groups of disorders. Current studies suggest that symptoms such as early onset of symptoms, fear of changes, abnormal social interaction and communication as well as stereotyped, repetitive behaviour do occur in both groups of disorders. Furthermore, ASD and internalizing disorders can occur as comorbid conditions. The diagnostic gold standard for ASD comprises standardized behavioural assessment with the Autism Diagnostic Observation Schedule (ADOS-2), a specific interview (Autism Diagnostic Interview, ADI-R) and thorough differential diagnostic assessments.

Objectives: The explorative study investigated the diagnostic accuracy of ADOS-2 and ADI-R as well as possible symptom constellations that might facilitate differentiation of the two groups on the basis of the diagnostic measures.

Methods: A subsample of the ASD-Net consortium (www.ASD-Net.de), comprising data from n=792 individuals (age mean 11.6±5.1, IQ mean 95.9±19.4, 74% male; n=792 ASD, n=146 internalizing disorders, i.e. ICD-10 diagnoses F 32; F 40.1; F 93.2 and others) was explored with respect to sensitivity, specificity, ROC-analyses of the ADOS-2 and ADI-R results considering age, IQ and gender differences. Discriminant analyses were conducted to explore similarities/differences in reported and observed symptoms on domain and item levels.

Results: First analyses show sensitivities of 72–89% and specificities of 72–93% for the ADOS-2, with 4.0 - 27.8 % false positive diagnoses with the ADOS and up to 55.4 % false positive diagnoses with the ADI-R.

Conclusions: Due to high symptom overlap between the investigated disorders a thorough diagnostic assessment conducted by experienced clinicians is crucial.

94 **183.094** The Autism Diagnostic Interview-Questionnaire (ADI-Q)

M. Huerta[1]*, S. Bishop*[2]*, L. A. Croen*[3] *and C. Lord*[4]*, (1)Felicity House, New York, NY, (2)University of California San Francisco, San Francisco, CA, (3)Division of Research, Kaiser Permanente, Oakland, CA, (4)University of California Los Angeles, Los Angeles, CA*

Background: The Social Communication Questionnaire (SCQ-L; Rutter, Bailey, & Lord, 2003) is a parent-rated autism screener that has been widely used in research. However, the SCQ-L is based on past behavior and like many ASD screeners, the utility of the instrument has been found to be affected by age and developmental level (Eaves et al., 2006; Chandler et al., 2007; Charman et al., 2007; Wiggins et al., 2007). Moreover, recent analyses of NDAR data has found the SCQ's sensitivity and specificity scores to be lower than originally reported; at the recommended cutoff score of 15, a sensitivity value of .64 (CI_{95} : 0.57; 0.69) and a specificity value of .72 (CI_{95} : 0.62; 0.81) were reported by Barnard-Brak and colleagues (2015). To address the limitations of the SCQ, a new caregiver-reported screening questionnaire was developed.

Objectives: The goals of this study are to develop and test an ASD research screening instrument that can be used to rapidly screen verbal children and adolescents, ages 5 to 18 years.

Methods: Previously collected ADI-R scores from two large samples of children and adolescents with ASD and non-ASD diagnoses, available through the University of Michigan Autism and Communication Disorders Center (UMACC) and Kaiser Permanente Northern California (KPNC), informed initial item development. To test the new instrument, named the Autism Diagnostic Interview-Questionnaire (ADI-Q), a new sample of 977 males and 287 females with ASD and non-ASD diagnoses was collected at UMACC, KPNC, and Cincinnati Children's Hospital Medical Center (CCHMC). Data were split into an initial test sample and a final validation sample. ADI-Q items were rank ordered by odds ratios and item distributions were examined to inform final item selection. Sensitivity and specificity values were analyzed using ROC analyses.

Results: The resulting instrument, the Autism Diagnostic Interview-Questionnaire (ADI-Q), consists of a 20-item measure. AUC values and sensitivity and specificity values were comparable to those of the SCQ-Lifetime. Results from the current analyses supported the use of unique algorithms and cutoffs for each sex.

Conclusions: The study presents a new ASD screening instrument, based on current behavior, that can have applicability to the participant recruitment efforts of a wide variety of research endeavors. Study results are discussed in light of the sex differences in the behavioral phenotype of ASD.

95 **183.095** The Female Phenotype of ASD – Same or Different to the Male Phenotype?

T. Schad-Hansjosten[1]*, I. Kamp-Becker*[2]*, S. Köhne*[3]*, L. Poustka*[4]*, S. Roepke*[5]*, V. Roessner*[6]*, N. Wolff*[7] *and S. Stroth*[8]*, (1)Department of Child and*

Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim, Mannheim, Germany, (2)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Philipps University Marburg, Schutzenstr 49, Germany, (3)Berlin School of Mind and Brain, Humboldt University Berlin, Berlin, Germany, (4)Child and Adolescent Psychiatry and Psychotherapy, University Medical Center Goettingen, Goettingen, Germany, (5)Department of Psychiatry, Charite Berlin, Berlin, Germany, (6)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus, Dresden, Germany, (7)Department of Child and Adolescent Psychiatry, University Hospital Carl Gustav Carus Dresden, Dresden, Germany, (8)Philipps University Marburg, Marburg, Germany

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Background: One of the most remarkable features of autism spectrum disorders (ASD) is the relation of male and female affected patients, which refers to 4-5:1 on average. In ASD *without* cognitive impairment the male:female relation is reported to be 10:1, while it is 1-2:1, in patients *with* cognitive impairment. With this in mind, a discussion arises scrutinizing whether the female ASD phenotype is identical with the male one and whether diagnostic instruments maybe underdiagnose female participants.

Objectives: The present talk aims to analyze this question by the help of a huge data base and with matched sample comparisons.

Methods: Using one of the largest internationally available samples, which is uniformly diagnosed according to gold standard (www.asd-net.de), data from N= 2613 patients (age 13.3± 10.4, IQ 97,4 ± 20.02) were analyzed, focusing on sensitivity and specificity values of the diagnostic algorithms (ADOS und ADI-R). Due to the huge sample size, an additional sample was generated, which was matched according to gender, diagnosis, the applied ADOS module, age and intelligence (resulting in 454 pairs). We determined items for both genders, which differentiate best between groups (ASD vs Non-ASD) via discrimination analysis.

Results: Comparisons across the whole sample resulted in the following pattern: females with ASD are significantly older than males with ASD, at the time of diagnosis. We observed no IQ differences between both gender groups. Differences according to the intensity of the ASD symptoms were solely observed for older patients (module 3 and 4): female participants show reduced impairments with respect to domains, which are relevant for diagnosis. This effect was especially pronounced during the application of module 3 with moderate effect size. But in the exactly matched sample no differences concerning intensity of symptoms were found between female and male ASD participants. Sensitivity measures of the ADOS cut-off values are reduced in female as compared to male patients, while specificity values are increased. Discriminant analyses show further that there are items like for example, eye contact, which discriminate between ASD and non-ASD independently of gender, while other items discriminate between ASD and non ASD as well, but are dependent on gender.

Conclusions: Interestingly, gender has no influence on specific domains of ASD, when patients are matched, suggesting that gender-depending differences on the ASD symptom-level may be rather attributed to age- and development-related factors and the IQ, than to a specific gender-related phenotype.

96 **183.096** The Stanford Social Motivation Scale: Preliminary Support for a Measure of Social Motivation in ASD

R. K. Schuck[1], *S. Schapp*[2], *E. Solomon*[2], *E. E. Salzman*[3], *L. Allerhand*[2], *R. Libove*[1], *T. W. Frazier*[4], *A. Y. Hardan*[1] *and J. M. Phillips*[1], *(1)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (2)PGSP-Stanford Psy.D. Consortium, Stanford, CA, (3)Psychiatry, UCSF, San Francisco, CA, (4)Autism Speaks, New York, NY*

Background: It has been hypothesized that deficits in social motivation may play a significant contributory role in the social deficits of individuals with autism spectrum disorder (ASD; Dawson et al., 1998; Grelotti et al., 2002; Chevallier et al., 2012). Though some measures assess social motivation as a component of social functioning (such as the Social Responsiveness Scale [SRS-2; Constantino & Gruber, 2005] and Multidimensional Social Competence Scale [Yager & Iarocci, 2013]), there is currently no tool available to specifically measure the drive to engage socially.

Objectives: The current study aimed to create a valid measure of social motivation for individuals with ASD.

Methods: After extensive literature review and consultation with experts in the field, a 71-item questionnaire, the Stanford Social Motivation Scale (SSMS) was developed. The questionnaire includes four content areas derived from theoretical models of social domains: social drive, quality of overtures, behaviors that sustain an interaction, and social recognition. A 28-item subset was identified by experts as being extremely relevant to social motivation. The questionnaire was given to parents of children with ASD and typically developing (TD) controls to determine the validity of the measure. Other measures that included questions about social functioning, such as the SRS, were also collected in order to compare parents' responses with the SSMS.

Results: To date, data have been collected from parents of 62 children with ASD and 14 TD controls. The majority of both groups were male and either Caucasian or Asian. There was a significant difference between the mean SSMS score between the ASD and TD groups ($p < .001$) for both the full 71-item scale and the 28-item scale. There was no significant difference in SSMS performance based on either IQ or age, suggesting that the measured behavior is independent of age or level of cognitive functioning. The 71-item scale was correlated with the 28-item SSMS ($r = .942$, $p <.001$), as well as each of the four content areas (range $r = .997$ to $.563$, $p <.001$). Amongst content scales, strong correlations were found between the 28-item scale and the social drive and behaviors that sustain an interaction scales ($r = .997$; $r = .818$). Moderate correlations were found for the quality of social interactions and social recognition scales ($r = .688$; $r = .563$). The total SSMS score was also highly correlated with the SRS-2 total T-score ($r = .836$; $p <.001$).

Conclusions: Preliminary findings show support for the SSMS as a valid means of characterizing social motivation in children with ASD. It also has the potential to provide a useful tool for measuring this construct across diagnoses, and has implications for phenotyping, treatment planning, and progress monitoring. Further psychometric analysis is currently underway, including the addition of psychiatric and developmental disability comparison groups, as well as a larger sample.

97 **183.097** The Utility of Parent Completed Questionnaires in Age-Specific Protocols Designed to Identify Children at Risk for Autism Spectrum Disorders at an Early Age

N. Chericoni[1], *V. Costanzo*[1], *R. Lasala*[2], *M. L. Scattoni*[3], *F. Apicella*[1] *and F. Muratori*[4], *(1)IRCCS Fondazione Stella Maris, Calambrone (Pisa), Italy, (2)IRCCS Fondazione Stella Maris, Calambrone, Italy, (3)Research Coordination and Support Service, Istituto Superiore di Sanità, Rome, Italy, (4)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy*

Background: Despite increased awareness, many children are still not diagnosed with Autism Spectrum Disorders (ASD) until they are four or older, when the syndrome has been clearly established. Since early intervention has been proved to alter the course of symptoms and the severity of the disorder, numerous lines of research have been focusing on ways to anticipate the age of diagnosis. As the diagnosis of autism is currently based on the observation of the child's behaviour, the development of age-specific protocols for early diagnosis might help clinicians in the process of identifying children at risk for ASD at an earlier age.
Objectives: This study investigated the utility of parent completed questionnaires in identifying toddlers at risk for ASD, as part of a larger ongoing project on the validation of age-specific protocols, specifically designed to identify and diagnose children with ASD at an early age.

Methods: Three groups of children were enrolled in this study and followed longitudinally from 12 to 24 months of age: 30 siblings of children with a diagnosis of ASD; 30 clinically referred children, who were receiving medical attention at a local hospital; 30 typically developing children recruited at local kindergartens. Parents of all three groups were administered a set of age-specific questionnaires (FYI, ITSEA, QUIT, PSI, EMQ, CDI, QBUL, M-CHAT, CBCL, SCQ, RBS-R, Sensory Profile), and children underwent clinical assessment with the Autism Diagnostic Observation Schedule –ADOS and the Griffiths Developmental Scales – GMDS-ER. Parent ratings across groups were compared using an ANOVA with Bonferroni's post hoc tests, and correlation and regression analyses were performed to evaluate to what extent they predicted diagnostic outcome.

Results: The analyses that have been performed so far indicate that some questionnaires might be particularly helpful in clinical decision-making. For example, the Competence domain of the ITSEA at 12 months significantly differentiated all three groups ($p \leq .01$) and significantly correlated with clinical outcomes ($p \leq .05$), with higher scores being more frequently associated with lower cognitive functioning and higher scores on the ADOS at 24 months. The Withdrawn scale of the CBCL at 18 months significantly differentiated siblings with an ASD outcome both from typically developing toddlers and siblings with a familial risk but no ASD outcome ($p \leq .05$). Regression analysis showed that higher scores on the Withdrawn scale predicted an outcome of ASD ($p \leq .003$).

Conclusions: These preliminary results suggest that some subscales of broadband questionnaires investigating the acquisition of interpersonal and social-communication competences may be used in clinical practice to guide clinicians in the challenging task of performing an early diagnosis of ASD. This result appears consistent with findings from previous studies, which show that between 12 and 24 months red flags should be looked for in gaps in the acquisition of normal evolutionary skills, rather than in the presence of specific behavioural symptoms.

98 **183.098** Unseen, but in Plain Sight: Looking Beyond the Camouflage in Women Challenged By Social Interactions, Regardless of Autism Diagnosis

J. S. Beck[1], *R. A. Lundwall*[2], *T. P. Gabrielsen*[3], *J. Cox*[4], *E. I. Anderberg*[1], *S. Kamhout*[1], *A. M. Dixon*[1], *K. Christensen*[1], *L. Peacock*[1], *M. Ekins*[1] *and M. South*[2], *(1)Psychology, Brigham Young University, Provo, UT, (2)Psychology & Neuroscience, Brigham Young University, Provo, UT, (3)Counseling & Special Education, Brigham Young University, Provo, UT, (4)Counseling and Career Center, Brigham Young University, Provo, UT*

Background: There is increasing recognition that girls and women with autism do not fit standard symptom profiles and may be overlooked for diagnosis or misdiagnosed. Some women may consciously "camouflage" their impairments in order to appear more capable during social interactions and during formal assessments such as administration of the ADOS-2. Nonetheless, many of these women, including those with an ASD diagnosis as well as those in diagnostic "gray zones," experience a variety of clinical concerns (e.g., failure to make friends and severe levels of anxiety) that lead to substantial distress and impairment in everyday life.
Objectives: We aimed to capture broad measures of social, emotional, and adaptive function in order to more deeply profile strengths and difficulties of women who find social situations challenging and distressing, who may be confused, anxious, or exhausted by social situations. Alongside standard measures such as the ADOS-2, SRS-2, and BAPQ we developed a rich battery of emotional, developmental, behavioral and interview measures administered to women and to their parents. Our goal is to inform clinical diagnosis including usual diagnostic tools and beyond.

Methods: Initial recruitment through university counseling centers, private practices, and social media identified 55 women who report symptoms associated with ASD per elevated scores (>3) on the BAPQ screening. About half of participants had an existing ASD diagnosis (diagnosed at age 3 to 35 years). Self-report questionnaires included multiple measures of social and emotional function (SRS-2, DASS-21, TSCS-2, Suicidal Behaviors Questionnaire, Gender Group Identification Scale, extensive developmental history) and additional questionnaires for parents. A subset of women (n=24) completed in-person follow-up interviews, ADOS-2, and an objective video-based measure of social cognition (TASIT-S).

Results: Preliminary analyses show extensive levels of distress across all areas of function, independent of previous diagnosis and with little convergence of ADOS scores. The sample shows consistently elevated scores for anxiety, depression and stress, with about 1/3 of the sample falling into the "severe" range. Self-concepts scores almost universally fall into the range of extreme concern, below the 3rd percentile, and there is frequent uncertainty around gender issues. We are currently analyzing qualitative interview data. For example, the comments of one undiagnosed participant described that she has no friends, despite constantly "filtering my quirks to fit in" and repeatedly engaging in a "three-step process" she believes is a failsafe formula for friendship. Questionnaire data from her mother confirmed chronic social difficulties as well as unusual interests and rigidity. Taken together, her symptoms are consistent with a diagnosis of ASD, yet she scored well below diagnostic cut-offs on the ADOS-2.

Conclusions: Beyond short-term, structured tools, multi-informant and multi-measure approaches that assess for social and emotional difficulties may be essential for assessing women for ASD, especially when there is evidence for conscious "camouflaging." Many women with clinically-significant symptoms of ASD may not manifest them during the ADOS-2 or other structured contexts. Given the severity of internalizing disorders in this population, the need for accurate assessment and subsequent informed intervention is urgent.

99 **183.099** Utility and Feasibility of Using the Autism Symptom Interview: A Replication Study.

S. Guttentag[1], *S. Bishop*[2], *R. Doggett*[1], *R. Shalev*[3], *M. Cohen*[4], *C. Lord*[5] *and A. Di Martino*[6], *(1)NYU Child Study Center, New York, NY, (2)University of California San Francisco, San Francisco, CA, (3)Child Study Center at NYU Langone Health, New York, NY, (4)Weill Cornell Medicine, White Plains, NY, (5)University of California Los Angeles, Los Angeles, CA, (6)The Child Mind Institute, New York, NY*

Background: The Autism Symptom Interview (ASI) school-age was developed as a brief phone parent interview about current ASD symptoms to facilitate recruitment and characterization of large-scale research samples. Its first validation study showed that the ASI distinguishes verbal children with ASD from those with other neurodevelopmental disorders with high sensitivity (0.82) and low specificity (0.62). The latter increased to 0.92 when combined with the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2) (Bishop et al., 2017).
Objectives: We aimed to examine 1) the ASI feasibility in the context of an ongoing neuroimaging study, 2) its ability to distinguish those with ASD from those without, and 3) the individual variables that contribute to ASI elevated scores.

Methods: One clinician administered the ASI during an in-person interview, followed by a thorough developmental and psychiatric history. This was paralleled by a child assessment including an ADOS-2 and IQ testing conducted by an independent evaluator. The parent interviewer had knowledge of previous diagnoses/concerns, the child evaluator was “blind” to prior history/concerns. Following assessment/scoring, these independent evaluators discussed their observations and clinical impressions to reach a diagnostic consensus based on DSM-5 criteria. We examined data from 76 verbal children between the ages of 5.5 to 11.9 years (M=8.4±1.7) enrolled in an ongoing study. ASI sensitivity and specificity were assessed, both alone and in conjunction with the ADOS-2. Parent ratings on core ASD and associated symptoms were used to compare groups defined based on diagnostic consensus as well as on those based on the ASI total diagnostic cutoff score.

Results: Per diagnostic consensus, of the 76 children, n=36 were classified as ASD and n=40 as non-ASD, while n=42 met diagnostic criteria on the ASI (ASI+). The ASI distinguished children with ASD from non-ASD with relatively high sensitivity (0.78) and moderate specificity (0.67). When used with the ADOS-2, specificity increased to 0.85. As expected, on average the ASD group had higher ASI total scores than the non-ASD group, as well as elevated ADOS-2 scores and other parent ratings of ASD core symptoms. The diagnostic groups did not differ in parent ratings of associated psychopathology indexed by the Child Behavior Checklist (CBCL). Notably, dividing the children in those with and without elevated ASI scores, regardless of diagnosis (ASI+ and ASI-, respectively), indicated elevated internalizing, externalizing and total CBCL T scores in ASI+ vs ASI- with no differences in ADOS-2 and other ASD core symptom ratings.

Conclusions: Our results suggest the feasibility of administering the ASI in-person in the context of a research study. Our findings are consistent with prior results of ASI moderately high sensitivity and increased specificity when combined with the ADOS-2. Differences in ratings of comorbid psychopathology between groups defined by ASI cutoff, but not in those defined by ASD diagnosis, indicate that comorbid psychopathology may confound results from parent interviews and should be accounted for in the diagnostic process.

100 **183.100** ‘Investigating the Diagnostic Utility of Pathological Demand Avoidance to Better Understand the Educational Experiences of Autistic Children Who Display Extreme Demand Avoidance’.

ABSTRACT WITHDRAWN

Background:
‘Pathological Demand Avoidance’ (PDA) is a term increasingly used by practitioners and parents in the United Kingdom to describe a distinct subgroup of autistic children, who purportedly differ from the typical autistic presentation in their anxiety-driven avoidance of demands. These children are held to warrant distinct educational strategies and supports, yet many educational authorities do not recognise PDA as a diagnostic category. This raises questions about the educational experiences of autistic children who receive this additional diagnosis compared to those who do not. There is, however, a dearth of research on such experiences – and therefore the utility of the PDA diagnosis – in this subgroup of children.

Objectives:

This research sought to: (1) compare directly the educational experiences of autistic children with and without an additional diagnosis of PDA and/or PDA behaviours, and (2) determine the perceived effects of the PDA diagnosis on families’ ability to access appropriate support for their children.

Methods:

216 UK-based parents or carers of autistic children (152 male, 60 female, 4 ‘other’ gender identity - aged between 4 and 19 years) participated in this study. They completed an online questionnaire which included questions about their child’s diagnostic history, measures of their educational experiences (Educational Experiences Questionnaire; Gore-Langton and Frederickson, 2016), in addition to measures of their child’s autistic features (the Social Responsiveness Scale; Constantino, 2005), demand-avoidant behaviours (the Extreme Demand Avoidance Questionnaire (EDA-Q); O’Nions et al., 2014) and behavioural problems (Strengths and Difficulties Questionnaire; Goodman, 1997). Parents were also asked to complete a final, open question inviting them to add any comments about their child’s experience of education.

Results:

To address our aims, participants were divided into three groups, depending on whether their autistic children: (1) had an additional diagnosis of PDA and obtained high scores on the EDA-Q (reflecting elevated PDA behaviours), (2) did not have an additional diagnosis of PDA but obtained high scores on the EDA-Q; and (3) did not have an additional diagnosis of PDA and obtained low scores on the EDA-Q. Higher scores on the EDA-Q were associated with a more negative experience of school. Yet, children who had a formal PDA diagnosis, in addition to their autism diagnosis, reported significantly more negative educational experiences during their child’s most challenging term at school, relative to children with similar EDA-Q scores who did not have an additional diagnosis of PDA.

Conclusions:

These initial findings suggest that a PDA diagnosis is not necessarily supporting children to access positive educational experiences. More in-depth qualitative research is needed to understand why this is the case and whether the diagnostic category has utility for parents and practitioners beyond the context examined in the current study.

102 **183.102** "Evaluation of Support Needs in School Children with ASD in Spain"

P. Jiménez[1], *M. A. Verdugo*[2] *and B. Arias*[3], *(1)INICO.University of Salamanca, Salamanca, Spain, (2)Personality, Assesment and Treatment, INICO. University of Salmanca, SALAMANCA, Spain, (3)Department of Psychology, University of Valladolid (Spain), Valladolid, Spain*

Background:

The constructs about support and support needs have been one of the axes of development in research and implementation of actions aimed at improving the quality of life of people with intellectual or developmental disabilities. Assessing the support needs and the intensity of these supports is a crucial strategy for adults with intellectual disabilities and children in school ages.

Objectives:

The purpose of this research is an evaluation of the support needs and their intensity in children in school ages with Autism Spectrum Disorder (ASD) in Spain, and compared with the intensity of support need showed in other groups with intellectual disability, but without ASD. Besides we wanted to do a first analysis of the support needs in school children with ASD, but without intellectual disability.

Methods:

Management of a support intensity scale (SIS-C) in its first adaptation to the Spanish context. The scale has two sections: (1) exceptional support needs (medical and behavioral) and (2) scale of support needs in representative activities, grouped into seven factors, home life, community life, school participation, school learning, health and safety, social activities and defense or self-representation. The intensity of support is evaluated through three parameters: type of support, frequency of support and daily support time. We evaluated 249 schoolchildren with ASD and intellectual disability, as well as 44 children and adolescents with ASD without intellectual disabilities aged 5 to 16 years. The mean values obtained were compared with a sample of 565 children and adolescents with intellectual disability without ASD from Spain.

Results:

The means obtained showed significant differences in the intensity of support among children and adolescents with intellectual disability without ASD and with ASD; and also when the values of the age groups are contrasted: 5-10 years and 11-16 years. In all the representative activities of the scale, the sample with ASD presents more intense support needs. The sample with ASD without intellectual disability has presented needs of support in diverse areas of support, especially in social activities, defense (self-representation) and school learning.

Conclusions:

The SIS-C scale is a useful tool for assessing support needs in daily life activities in school children with ASD and intellectual disability. The data suggest that the intensity of support needs of students with ASD is greater than that shown by other students with intellectual disabilities who do not have ASD. There are activities in which support intensity is significantly different for the group with ASD, which may be of interest for the processes of: (1) reflection and planning of individual supports, (2) organization of resources and services, and (3) for the development of strategies of educational administration.

103 **183.103** : Investigation of a New Social Communication Observation Schedule for Assessment of Autism Spectrum Disorder (ASD) in Young Children with Profound-Severe Visual Impairment

N. J. Dale[1,2]*, E. Sakkalou*[3]*, S. Glew*[3]*, H. Clarkson*[3]*, M. H. Eriksson*[3]*, D. H. Skuse*[4] *and A. Salt*[5]*, (1)Great Ormond Street Hospital NHS Foundation Trust, London, United Kingdom, (2)Clinical Neurosciences, UCL Great Ormond Street Institute of Child Health, London, United Kingdom, (3)UCL Great Ormond Street Institute of Child Health, London, United Kingdom, (4)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom, (5)Great Ormond Street Hospital for Children, London, United Kingdom of Great Britain and Northern Ireland*

Background: Children with congenital profound or severe visual impairment (VI) are at high risk of ASD and social communication difficulties; prevalence of ASD ~30% in several studies. Existing tools used to measure socio-communicative development are highly vision-dependent and not valid for children with VI. A novel visual impairment-social communication observational schedule (VISCOS), drawing on principles of ADOS but specifically designed for 4-7 year olds with profound-severe VI, was developed and initial validation against expert clinician formulation is presented.

Objectives: To investigate the performance of the VISCOS in differentiating children with VI at high risk of ASD and social communication difficulties from those without ASD according to independent expert clinician formulation.

Methods: Preliminary data (45% of planned sample) from forty-five 4-7-years-olds (mean age 5 years 5 months), with congenital disorders of the peripheral visual system with profound VI (PVI, n=7; light perception at best),to severe VI (SVI, n=38, mean 1.00 logMAR).The children engaged in social interaction and play including symbolic play, conversation, auditory story and non-visual theory of mind materials with a trained psychologist assessor, using standard presses designed specifically for children with very low or no vision (VISCOS). Verbal cognition (WPPSI) and vision level (near detection, acuity) were also assessed. The VISCOS assessment was rated by the assessor on the Social Communication difficulties Scale (SCS) and Restricted and repetitive Behaviour Scale (RRBS). A paediatrician with expertise in VI and autism used the video assessments and parent-reported Development and Well-Being Assessment (DAWBA, Goodman et al) to reach a diagnostic formulation (ASD, Social communication difficulties (SCD), Non-ASD) according to DSM-5 criteria.

Results: WPPSI Vocabulary and Information subscales were within the normal range; no significant difference between PVI and SVI subgroup scores. The SCS scores did not differ significantly between PVI and SVI subgroups (U=76.00 p=08), although the scores of the PVI group were more elevated. Negative and stereotyped behaviours (RRBS) were higher in the PVI than SVI group (U=47.50 p=005). The clinician formulation led to 44 children classified as Non ASD (32; 73%), SCD (8; 18%) and ASD (4; 9%). Five out of 7 (71%) children with PVI showed ASD or SCD compared with 9/39 (23%) with SVI. Children rated as ASD or SCD scored significantly higher scores on the SCS (median ASD/ SCD = 14.00; median Non ASD = 6.50; U=44.50, p=.003) and RRBS (median ASD/ SCD = 10.00; median Non ASD = 1.50; U=19.00, p=0001) compared to those with Non ASD. Good sensitivity and specificity was also found (SCS = .70/.71; RRBS = .80/.92 respectively).

Conclusions: This is the most systematic investigation to date developing a new tool for assessing ASD in young children with congenital profound-severe VI. Without involving behaviours or measures that are vision dependent, the new VISCOS showed promising results in relation to identification and diagnosis of ASD or SCD in the context of VI according to expert clinician formulation. Construct validity and the algorithm to identify the most pertinent behaviours related to ASD in young children with VI will also be presented.

104 **183.104** Differences between Multiplex and Simplex Autism: Does Parent Experience Contribute to Differences in Cognitive and Behavioural Development?

D. Berends[1], C. Dissanayake[1] and ***L. P. Lawson***[2,3]*, (1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, Australia, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia*

Background: It has been suggested that multiplex (MPX) and simplex (SPX) cases of Autism Spectrum Disorder (ASD) may originate from separate genetic aetiologies. Previous research examining differences between these groups has found that MPX children may possess and advantage in cognition and behaviour compared to SPX children suggesting that MPX and SPX groups represent different phenotypes. However, there are a number of limitations within the existing literature. In particular, samples have been biased by the inclusion of singleton children in the SPX group or the recruitment of MPX children from high-risk sibling cohorts, where only the second affected child is included. Further, research has also demonstrated that parental experience and knowledge contributes to improved outcomes for children with ASD. Existing studies examining MPX/SPX differences have not accounted for MPX parent's previous experience with older diagnosed siblings, which may improve outcomes for these second affected MPX probands.

Objectives: The aim in this study was to expand on the literature regarding MPX/SPX differences by not only investigating the possible MPX advantage in a large database sample, but also evaluating if parent experience was a contributor. It was hypothesised that MPX children would demonstrate higher cognitive and adaptive behaviour scores and less ASD symptom severity than SPX counterparts. In addition, it was hypothesised that if parent experience was contributing to the apparent MPX advantage, MPX second affected children would demonstrate better cognitive and adaptive skills, and fewer ASD symptoms compared to their MPX first affected counterparts.

Methods: Four hundred and twenty-nine children from the Autism Genetic Resource Exchange (AGRE) were stratified into first- and second-affected MPX (MPX^1; *n*=152, MPX^2; *n*=143), SPX (*n*=111), and only-child SPX (SPX^{OC}; *n*=23) groups. Group differences were examined using scores from the Stanford-Binet 5th edition, Mullen Scales of Early Learning, Vineland Adaptive Behaviour Scale, and the Autism Diagnostic Observation Schedule. Significant ANCOVA results were followed by post hoc comparisons between groups.

Results: No differences were found between MPX^1 and MPX^2 groups on any of the dependent variables. However, both MPX groups had significantly higher cognitive scores compared to the SPX group. Initially findings showed a significant difference between the MPX and SPX group for adaptive behaviour, such that the MPX group had higher scores compared to the SPX group. However, when cognition was included as a covariate in the analysis the difference was no longer significant. There were no significant differences between the groups on ASD symptom severity.

Conclusions: The current finding of a MPX advantage in cognitive functioning supports the view that MPX and SPX cases may represent different phenotypes of ASD. Further, the null findings between MPX^1 and MPX^2 infer parent experience is less likely to contribute substantially to differences between MPX and SPX groups. Overall, these results suggest that research regarding cognitive functioning in ASD should take into account MPX and SPX status as these groups appear to differ in their cognitive abilities and thus represent separate phenotypes of ASD.

Poster Session
184 - Epidemiology
11:30 AM - 1:30 PM - Hall Grote Zaal

105 **184.105** A Comparison of ASD Screening in Toddlers By Global Developmental Screening and the Modified Checklist for Autism in Toddlers (M-CHAT)

O. Kerub[1]*, E. J. Haas[2], G. Meiri[3,4], N. Davidovitch[5] and I. Menashe[6], (1)Ben-Gurion University, Ministry of Health, Be'er Sheva,, Israel, (2)Ministry of Health, Beer Sheva, Israel, (3)Soroka Medical Center, Beer Sheva, Israel, (4)Soroka Medical Center, Beer Sheba, Israel, (5)Ben Gurion University in the Negev, Beer Sheva, Israel, (6)Public Health Department, Ben-Gurion University, Beer Sheva, Israel*

Background:
Early diagnosis of autism spectrum disorder (ASD) improves long-term outcomes of existing interventions. Systematic screening for early ASD symptoms can considerably reduce the age of diagnosis of the disorder. The most widely used ASD screening tool is the Modified Checklist for Autism in Toddlers (M-CHAT) which has been shown to have high sensitivity and specificity in populations of various ethnic backgrounds.

In Israel, there is no ASD-specific screening program, but rather toddlers undergo serial health visits at government-funded maternal child health centers (MCHCs), which include global developmental screening (GDS) for age appropriate developmental milestones. While GDS may detect a variety of developmental problems, its efficiency in detecting ASD at early ages is unknown.

Objectives: To assess the screening efficiency for ASD of the GDS and M-CHAT among toddlers from an ethnically diverse population in south Israel.

Methods:

We applied both GDS and M-CHAT screening tests to 1,600 toddlers of ages 18-30 months in 35 randomly selected MCHCs in southern Israel. Toddlers who failed in either the M-CHAT or the GDS were referred to child neurologist or child psychiatrist for a more rigorous developmental evaluation based on DSM-5 criteria. In addition, we assessed the current GDS-based referral procedure by asking eleven experienced MCHC nurses to review and provide a referral decision for 200 toddlers based on their full GDS result history.

Results: Of the 1600 toddlers in our study, 84 were referred for further developmental evaluation. Of these, 26 toddlers were identified only by the M-CHAT, 34 only by the GDS, and 24 by both of these tests (Kappa=0.52; p<0.001). Of these, ten toddlers had a confirmed diagnosis of ASD and another 30 toddlers were diagnosed with other forms of developmental delays (DD). Notably, the M-CHAT had a remarkably better sensitivity than the GDS in detecting toddlers with ASD (70.0% vs. 50.0% respectively), and slightly better specificity (98.2% vs. 96.6% respectively). These differences were translated to 2.3 fold difference in positive predictive value (PPV) between these two screening tools. Both methods had an equivalent efficiency in detecting other forms of DD (i.e. sensitivity= 63%; and specificity=98%). There was a remarkable variability between the nurses regarding toddler referral. However, a significant correlation was found between the total number of failed items and the number of referral nurses (Spearman r=0.65; P<0.001) with ≥5 failed items serving as the referral cutoff for the majority (≥6) of the nurses. No association was found between nurses' referral and the age, sex or race of the toddlers.

Conclusions:

Use of the M-CHAT is more effective in detecting children with ASD compared to the GDS approach. Thus, combining these two approaches in the developmental check-up at the MCHCs will improve early detection of ASD and other developmental problems.

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184.106 A Population-Based Study of Traffic-Related and Outdoor Air Pollution during Pregnancy and Autism in Denmark

B. Ritz[1]*, Q. Yan*[1]*, Z. Liew*[2]*, X. Cui*[3]*, M. Ketzel*[4] *and O. Raaschou-Nielsen*[5]*, (1)Department of Epidemiology, UCLA Fielding School of Public Health, Los Angeles, CA, (2)Department of Environmental Health Sciences, Yale School of Public Health, New Haven, CT, (3)UCLA Fielding School of Public Health, Los Angeles, CA, (4)Department of Environmental Science, Aarhus University, Roskilde, Denmark, (5)Danish Cancer Society Research Center, Danish Cancer Society, Copenhagen, Denmark*

Background:

A number of previous studies reported that perinatal exposure to air pollutants may increase the risk of autism in offspring. However, most of these studies were conducted in the United States, especially in California. Here we are reporting on the first large European study of autism and traffic related air pollution in Danish children.

Objectives:

Establish the largest nationwide population and record based case-control study of childhood autism and air pollution worldwide, and test the hypothesis that exposure to traffic-related air pollution or PM air pollution is associated with childhood autism.

Methods:

We identified 20,538 autism cases from the National Hospital Registry and the Psychiatric Central Registry among all persons born between 1989 and 2013 in Denmark. For each case, we randomly selected 5 controls without autism matched by birth year and sex. Relying on AirGIS modelling, we estimated outdoor air pollution at the mother's home NOx and particulates – for the 9 months before, during, and after her pregnancy. We calculated odds ratio (OR) and 95% confidence interval (CI), adjusting for birth year, sex, maternal and paternal age, and maternal smoking during pregnancy using conditional logistic regression analysis.

Results:

Using NO2 as a marker of traffic-related air pollution, we estimated an adjusted OR of 1.23 (95% CI: 1.19, 1.26) for autism associated with an inter-quartile-range (IQR) increase in NO2. For an IQR increase in PM2.5 the adjusted OR for autism was 1.13 (95% CI: 1.07, 1.19). Pre and post pregnancy exposure estimates were highly correlated with exposure estimates during pregnancy.

Conclusions:

Our data indicated that exposure to air pollution, especially traffic-related air pollution during pregnancy, is associated with elevated risk of autism in Danish children.

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184.107 Adapting the Eleat (Early Life Exposure Assessment Tool) to Portugal – a Pilot Study to Tackle Gene-Environment Interactions in Autism Spectrum Disorder

C. Rasga[1]*, J. Santos*[2]*, A. L. Lopes*[3]*, A. R. Marques*[2]*, J. Vilela*[3]*, M. Asif*[4]*, C. K. Walker*[5]*, R. J. Schmidt*[6] *and A. M. Vicente*[7]*, (1)INSA, lisboa, Portugal, (2)INSA, Lisbon, Portugal, (3)BioISI, Lisbon, Portugal, (4)Faculdade de Ciências da Universidade de Lisboa , Lisbon, Portugal, (5)University of California, Sacramento, CA, (6)Public Health Sciences, University of California Davis, Davis, CA, (7)Instituto Nacional Saude Doutor Ricardo Jorge, Lisbon, PORTUGAL*

Background: Genetic factors account for 50 to 80% of Autism Spectrum Disorder (ASD) risk, suggesting that modifiable non-genetic factors may play an important role in ASD. Pre-, peri and post-natal exposure to a variety of environmental factors have previously been implicated in its etiology. However, the comprehensive assessment of environmental exposure in ASD in large datasets from variable environmental settings is still lacking.

Objectives: To examine the role of environmental exposures in a population of Portuguese children with ASD, we translated, adapted and are piloting the Early Life Exposure Assessment Tool (ELEAT).

Methods: The ELEAT was originally developed at the University of California Davis to assess environmental factors in studies of neurodevelopmental disorders. It is a questionnaire completed by mothers of children with ASD, enquiring about Demographic Information, Maternal Conditions/Medical Interventions, Breastfeeding and Child Diet, Maternal Diet, Supplements, Lifestyle, Home and Environment, Environment, Occupation and Exposures. The ELEAT gathers information about environmental exposure along key phases for early neurodevelopment, including 3 months prior to conception, pregnancy, labor and delivery and the first year of life. Given cultural similarities, an ELEAT version adapted to the UK was translated into Portuguese. Cross-cultural problems that might compromise its validity are minimized by European similarities regarding lifestyle, habits, dietary, household and other daily items, comparable access to healthcare and education, as well as employment and infrastructure, and no major cultural adaptations were made. After translation, the ELEAT was piloted in a group of mothers of typically-developing and ASD children, ranging from 1 to 8 years. All mothers had a university degree, and were between 35 and 44 years old. Feedback was obtained from the mothers regarding clarity, length and relevance of the questions, using the inbuilt Evaluation Instrument.

Results: Concerning length, 55% of the mothers considered the ELEAT very long, and 45% considered it slightly long. In a Lickert-type scale, 54% and 36% of the mothers agreed/slightly agreed that the instructions were clear. 36% and 64% agreed/slightly agreed that they were sure about their answers. In four modules (Maternal Condition/Medical Interventions, Breastfeeding, Maternal Diet and Home Environment) between 72% and 91% of the mothers reported high certainty concerning their given answers. Only in Occupation and Exposures did the mothers express lower confidence, with only 36% reporting high certainty. Finally, 64% agreed/slightly agreed that the questions were important, but 27% were neutral. In group discussions similar concerns were reported regarding the length and complexity of the questionnaire, but the main positive conclusions were that the questions were direct and well written.

Conclusions: Integration of the pilot feedback will allow us to enhance the tool for use in Portuguese-speaking communities, improving its capacity to assemble accurate environmental data from diverse cultural settings, and to extend to larger population datasets. Combined with genetic and clinical data, the ELEAT will contribute to the identification of modifiable lifestyle and environmental risk factors for ASD. Such evidence may eventually provide the opportunity for disease prevention or reduced severity by mitigating exposure when genetic susceptibility is identified early in life.

108 **184.108** Exploring Gender Ratio Time Trends in Australian Children with Autism Spectrum Disorder Using Medicare Data

T. May[1] *and K. Williams*[2]*, (1)Deakin University Australia, Burwood, Australia, (2)University of Melbourne and Royal Children's Hospital, Melbourne, Australia*

Background: Many more males are diagnosed with Autism Spectrum Disorder (ASD) than females, with male to female ratios being on average around 4 to 3:1. Some research suggests that milder female cases of ASD have not been identified in the past or are identified later than males. This awareness and the release of the DSM-5 in 2013 acknowledging possible under-diagnosis of females with ASD may have influenced more recent gender ratios. There has also been an increase in ASD prevalence over the last 20 years worldwide. Understanding changes over time in the gender ratio and gender differences in age of diagnosis may inform on various theories relating to why males outnumber females with ASD and the increased prevalence of ASD.

Objectives: This study aimed to use Australian health system Medicare data which captured new ASD diagnoses from 2008-2016 to understand gender trends over time.

Methods: Secondary data analyses from the Australian Medicare system were explored. Two Medicare items that can only be used once when paediatricians/psychiatrists diagnosed a child aged under 13 years with ASD were utilised. Descriptive statistics and regression analyses were used to understand trends over time.

Results: There were a combined total of N=73,463 unique cases identified via the Medicare ASD diagnostic items from 1 July 2008 to 30 June 2016. There were significant increases in new cases of older boys and girls (aged 5-12 years) but not younger children (aged 0-4 years) from 2010/11 through 2015/16. The M:F ratio significantly decreased from 4.1 to 3.0 (p<.001) in this time period in the older children, but the decrease was not statistically significant in younger children (p=.059; 4.2 to 3.5). When using yearly age groups there was a significant decrease in the M:F ratio with increasing age in the years 2014/15 (p=.011) and 2015/16 (p<.001) but no significant decrease in the earlier years (2012/13, 2013/14). Using combined data from 2012/13 to 2015/16, five years of age was the most frequent age of diagnosis for both girls and boys.

Conclusions: Identification of older boys and girls aged 5-12 rather than younger children is contributing to the increased number of ASD cases in Australia. Since 2014 the M:F ratio is decreasing with increasing child age with more older higher functioning females being identified. This could relate to better awareness of milder female cases of ASD following DSM-5 changes which highlight this group. Appropriate services for newly diagnosed primary school aged children should be a focus.

109 **184.109** Classifying Autism Spectrum Disorder By Severity of Functional Limitations: Results from a Large Population-Based Study

M. S. Durkin[1,2]*, M. J. Maenner*[3]*, S. Furnier*[4]*, P. Imm*[5]*, D. Christensen*[3]*, E. Rubenstein*[6] *and N. Dowling*[3]*, (1)Population Health Sciences, University of Wisconsin School of Medicine and Public Health, Madison, WI, (2)Waisman Center, University of Wisconsin-Madison, Madison, WI, (3)Centers for Disease Control and Prevention, Atlanta, GA, (4)Population Health Sciences, University of Wisconsin-Madison, Madison, WI, (5)University of Wisconsin-Madison, Madison, WI, (6)Waisman Center at UW Madison, Madison, WI*

Background: With the shift to DSM-5 criteria for autism spectrum disorder (ASD) and adoption of the World Health Organization's *International Classification of Functioning, Disability and Health*, there is increased interest in characterizing severity of functional limitations for individuals with ASD and other disabilities. Yet most epidemiologic studies of ASD incorporate little or no information to allow monitoring of the severity of functional limitations of individuals meeting diagnostic criteria for ASD. Adaptive behavior tests, which measure functioning in communication, daily living and motor and social skills, have been shown to be inversely correlated with both the DSM-5 ASD severity categories and the Autism Classification System of Functioning – Social Communication.

Objectives: The aims of this study were to evaluate: (a) the potential to classify ASD cases identified by the Autism and Developmental Disabilities Monitoring (ADDM) Network by severity of functional limitations based on routinely collected adaptive behavior test results; and (b) whether the increase in ASD prevalence among U.S. children between 2000 and 2012 occurred equally across levels of severity of functional limitations.

Methods: We combined cross-sectional data from all ADDM Network sites contributing ASD surveillance data for the period 2000-2012. The ADDM Network is a multiple source surveillance system incorporating health and educational records and clinician reviews to determine the number of 8-year-old children in the population meeting DSM criteria for ASD. Among 22,802 ASD cases, the records of 12,739 (55.9%) included composite and domain scores from one or more adaptive behavior tests. Based on composite score categories from the latest adaptive behavior test administered, we classified cases into three levels of adaptive functioning: (1) no significant limitations; (2) mild limitations; and (3) moderate to profound limitations.

Results: Among 12,739 ASD cases with adaptive behavior information, composite scores indicated no significant functional limitations for 37.1%, mild limitations for 44.2%, and moderate, severe or profound limitations for 18.8%. The percentage classified as having no significant functional limitations increased each surveillance year, from 21.3 in 2000 to 44.5 in 2012, while the percentage with at least moderate functional limitations decreased from, 31.3 in 2000 to 10.6 in 2012 (test for trend p<0.001). Applying the percentages in each functional category to the overall prevalence of ASD, we estimate that the prevalence of ASD per 1,000 8-year-old children with no significant functional limitations increased over time from 1.4 in 2000 to 6.5 in 2012, the prevalence of ASD with mild functional limitations increased from 3.2 in 2000 to 6.6 in 2012, and the prevalence of ASD with moderate to profound functional limitations remained relatively constant over time (2.1 in 2000, 1.6 in 2012). Analyses with imputation of missing data will also be presented.

Conclusions: Tests of adaptive behavior provide an existing source of data for classifying severity of specific functional limitations in epidemiologic studies of ASD. Available data suggest the increase in ASD prevalence between 2000 and 2012 is explained by increases in cases with mild or no significant functional limitations. Additional research could assess limitations not measured by adaptive tests.

110 **184.110** ASD Screening Using Social Communication Questionnaires (SCQ) in 93 Primary Schools in Qatar

F. Alshaban[1]*, E. Fombonne*[2]*, M. Aldosari*[3] *and I. Ghazal*[4]*, (1)Qatar Biomedical Research Institute, Doha, Qatar, (2)Psychiatry, Pediatrics & Behavioral Neurosciences, Oregon Health & Science University, Portland, OR, (3)Center of Pediatric Neurology, Cleveland Clinic Foundation, Cleveland, OH, (4)King Faisal Specialist Hospital and Research Center, Riyadh, SAUDI ARABIA*

Background: There is a scarcity of validated autism screening and diagnostic tools for Arabic-speaking individuals which presents a major challenge to clinicians and researchers in many countries around the world.

Objectives: to evaluate the sensitivity and specificity of the Arabic Version of the Social Communication Questionnaire (SCQ).

Methods: We started by translating the English version of the Social Communication Questionnaire (SCQ) to Arabic language. The back-translation was reviewed by the publisher-assigned reviewer. Then we validated the questionnaires using a sample of 206 ASD cases with 206 age and gender matched controls. The screening cohort are children between the ages 5-12 years attending 93 main stream primary schools in Qatar randomly selected. The Arabic SCQ version sent to be filled by parents.

Results: 9074 SCQ filled, 56% females and 44% males, analysis showed 773 (9%) scored above cut-off (15), 165 (21%) were interviewed, out of which 16 cases were diagnosed with ASD using the ADOS-2 and DSM-5 criteria as a diagnostic tools. while 300 of those who scored below cut-off were interviewed, of which 2 were diagnosed with ASD.

ASD prevalence rate among students between the age 5-12 years attending main stream school found to be 1.4%.

Conclusions: SCQ found to be a reliable screening tool in detecting ASD in general population.

111 **184.111** Assessment of Racial and Ethnic Bias in Autism Spectrum Disorder Prevalence Estimates from a U.S. Surveillance System

P. Imm[1]*, T. C. White*[2] *and M. S. Durkin*[3]*, (1)University of Wisconsin-Madison, Madison, WI, (2)Center for Health and Environmental Data, Colorado Department of Public Health and Environment, Denver, CO, (3)Population Health Sciences, University of Wisconsin School of Medicine and Public Health, Madison, WI*

Background: The Autism and other Developmental Disabilities Monitoring (ADDM) Network is a multiple-source, population-based, active surveillance system for monitoring Autism Spectrum Disorder (ASD) in the U.S. Children with ASD are included in the surveillance system only if their residence in specific geographic areas can be confirmed in a given surveillance year. Since 2000, the Network has consistently reported disparities in ASD prevalence by race and ethnicity, with the ASD prevalence higher among non-Hispanic white relative to both non-Hispanic black and Hispanic children.

Objectives: The purpose of this study was to assess potential under-ascertainment of ASD in Hispanic and black children due to differential missing information in the surveillance system on residency and race/ethnicity. Two hypotheses tested were: 1) relative to children included in prevalence estimates, those excluded based on inability to confirm residence within the surveillance area were more likely to be black or Hispanic; 2) imputation of missing information on residency and race/ethnicity will result in less racial and ethnic disparity in ASD prevalence than when prevalence estimation is restricted to cases with complete information.

Methods: The Colorado and Wisconsin ADDM Network sites reviewed combined records from Surveillance Years 2012 and 2014. For hypothesis 1, we conducted a case-control analysis to determine whether race/ethnicity of children excluded due to missing residency information (and determined likely to be classified as ASD cases based on a confirmed diagnosis or evaluation/treatment at an Autism Clinic) differed from ASD cases included in the surveillance system. For hypothesis 2, we evaluated the impact on racial and ethnic disparities in ASD prevalence of various approaches to imputation of missing information, such as race/ethnicity imputation based on notes in records, surname data, and/or census block demographics.

Results: Compared to randomly selected ASD cases included in the surveillance system (N=81), those excluded due to missing residency (N=27) were significantly less likely to be white non-Hispanic (48% vs 69%; $p < 0.05$) and more likely to be Hispanic (44% vs 15%; $p < 0.01$). Additionally, inclusion of children with unconfirmed residency and imputation of race/ethnicity information for confirmed cases resulted in slight increases in ASD prevalence overall (from 12.4 to 12.6), but did not affect the ratio of ASD prevalence in white non-Hispanic versus other groups. For example, the ratio of prevalence in white compared to black children was 1.5 (95% CI: 1.25-1.73) in the complete case-only analysis and was unchanged after inclusion of cases with missing residency confirmation and imputed race/ethnicity.

Conclusions: Although potential ASD cases excluded from the surveillance system due to missing residency information were significantly more likely to be from under-represented racial/ethnic groups than the included cases, the strength of this bias and the number of excluded cases were insufficient to account for the observed racial and ethnic disparities in ASD prevalence. This evaluation provides evidence of the robustness of the surveillance system while suggesting the need for continued research into the disparities in ASD prevalence.

112 **184.112** Autism Diagnostic Timeline: No Disparities between Hispanic and Non-Hispanic White Populations in Western New York

J. Herrera[1]*, M. Anto-Ocrah*[2] *and S. Hyman*[1]*, (1)Pediatrics, University of Rochester School of Medicine, Rochester, NY, (2)Public Health Sciences, University of Rochester School of Medicine, Rochester, NY*

Background: Early autism spectrum disorder (ASD) diagnosis and treatment improves developmental outcomes. National data describes disparities between Hispanic and non-Hispanic white (NHW) children regarding access to early intervention (EI) and diagnostic services - Hispanic children are less often evaluated for ASD by age 36 months, and more likely to be diagnosed after age 4 years, than are NHW children. New York State has the fourth largest Hispanic population in the country, yet the northeastern U.S. is underrepresented in national data.

Objectives: Describe ages of entry to EI services, referral, initial evaluation, and first ASD diagnosis according to child's ethnicity/race (Hispanic, NHW) and primary language (English, bilingual English-Spanish, or Spanish) in a northeastern U.S. tertiary care clinic sample. This clinic is the primary source for ASD diagnosis in the western New York region.

Methods: We reviewed 493 medical records of children ages 24-60 months with an ASD diagnosis seen in clinic between September 1, 2015-February 28, 2017. Subjects were selected on the basis of receiving an ASD diagnosis during that time and self-identified ethnicity and race. Exclusion criteria were non-Hispanic race other than white, gestational age <37 weeks, genetic diagnosis with known increased ASD risk, primary language other than English or Spanish, and missing data on variables of interest.

Results: Of 493 patients reviewed, 177 (36%) met criteria and were included in the analyses. Fifteen percent (n=27) identified as Hispanic, 85% (n=150) as NHW. Of Hispanic patients, 63% (n=17) were English-speaking (Hisp-E), 15% (n=4) were bilingual (Hisp-B), and 22% (n=6) were Spanish-speaking (Hisp-S).

Significantly more Hispanic children had public health insurance compared to NHW (70 v. 45%, respectively, p=0.017). Hispanic children were referred for evaluation earlier than NHW (Hispanic 28.62±7.21 v. NHW 32.66±9.77, p=0.045). EI participation rate was similar between groups (Hispanic 85 v. NHW 80%, p=0.549), with no difference by age at entry to EI services (Hispanic 22.23±4.88 v. NHW 22.64±5.84, p=0.756). No differences existed by ages at initial evaluation (Hispanic 36.07±8.22 v. NHW 38.57±9.96, p=0.221) or first ASD diagnosis (Hispanic 36.81±8.53 v. NHW 39.60±10.14, p=0.181). Ages reported in months.

Considering Hispanic language subgroups, there were no statistically significant differences between these and NHW on all outcomes of interest. Although not significant, Hisp-S had highest EI participation (100%), compared to Hisp-E (82%), NHW (80%), and Hisp-B (75%). Hisp-S also had earliest mean ages of referral, evaluation, and diagnosis.

Conclusions: Contrasting with published literature, Hispanic children in this sample participated in EI services at similar rates as NHW patients. They also were evaluated for and diagnosed with ASD on average by age 36 months, comparable to NHW counterparts. Variation from the literature may be due to regional differences in screening, referral, and availability of services, as well as differences in the Hispanic population sampled. Reasons for differences between this sample and national data should be further explored. Higher utilization of public health insurance among Hispanics may have resulted in earlier age of referral for patients in this sample because of mandated developmental screening; barriers preventing their timely evaluation must be considered.

113 **184.113** Autism Prevalence in Union County New Jersey, 2000-2014

J. Shenouda[1] *and W. Zahorodny*[2]*, (1)Pediatrics, Rutgers NJ Medical School, Newark, NJ, (2)Rutgers New Jersey Medical School, Newark, NJ*

Background: Centers for Disease Control and Prevention (CDC) estimates from the most comprehensive Autism surveillance network indicate that Autism Spectrum Disorder (ASD) prevalence rates have increased dramatically since 2000. New Jersey (NJ) had the highest baseline ASD rates among the ADDM sites and showed significantly higher estimates, over all cycles of monitoring. Among the 4 counties constituting the NJ surveillance region, ASD estimates and case characteristics from Union County NJ were based on the most complete access to source information, so we endeavored to understand more about ASD and the increase in prevalence from a consideration of ASD in Union County.
Objectives: To compare ASD prevalence estimates based on the number of children confirmed with ASD by ASD surveillance activities, at age 8 years from 2000 to 2014. To describe the ASD distribution by sex, race/ethnicity, ASD diagnosis age and by severity of ASD (impairment), to specify any disparities, and to evaluate the possibility that increasing ASD prevalence was driven by greater identification of children with mild levels of ASD.

Methods: Standard ADDM case finding, ASD case description and prevalence determination procedures were conducted across 7 cycles of ASD monitoring in all twenty-one municipalities. Population denominators were obtained from CDC's National Center for Health Statistics (NCHS) most recent vintage postcensal bridged-race population estimates. Poisson approximation to the binomial distribution was used to calculate 95% confidence intervals for prevalence rates.

Results: We identified 1,071 ASD cases (8 year-old children) in Union County, NJ, from 2000 to 2014 by consistent population-based monitoring according to the CDC/ADDM method. ASD prevalence increased 130% during that period (12.63 (95%CI: 10.3-15.4) per 1000 8 year-olds to 29.01 (95%CI: 25.4-33.1). Diagnosis of ASD (by community providers) increased by 165% (7.38 (5.6-9.5) to 19.56 (16.6-23)), while Special Education eligibility under the Autism classification increased by 172% (4.56 (3.2-6.3) to 12.41 (10.1-15.2)). Male to Female ratio (5 to 1) was consistent throughout, but the rate of increase was higher among girls. ASD increased significantly across all categories of race/ethnicity and early observed race-based differences in ASD prevalence were not evident in 2014. The median age of ASD diagnosis in 2000 was 53 months (SD 21.2, 19-104), while in 2014, median age of ASD diagnosis was 48 months (SD 22.2, 14-105). When stratified by severity of impairment and intellectual ability, the greatest increase in ASD prevalence was among children with severe impairment, rather than among those with mild ASD. Similarly, ASD prevalence increase was greater among children with cognitive impairment (CI) or borderline CI, than among children with average or above average cognitive functioning.

Conclusions: All NJ indicators of ASD prevalence increased significantly between 2000 and 2014. We did not observe significant improvement in the age of first ASD diagnosis over time or disproportionate increase in the identification of mildly impaired children or children with average or higher cognitive ability, casting doubt on the hypothesis that increasing ASD prevalence was substantially due to factors reflecting better awareness.

114 **184.114** Autism Spectrum Disorder Prevalence in Immigrant Communities in Minnesota

J. Poynter[1]*, E. Hallas-Muchow*[2]*, J. A. Hall-Lande*[3]*, A. N. Esler*[2]*, A. Gulaid*[2] *and A. Hewitt*[4]*, (1)Pediatrics, University of Minnesota, Minneapolis, MN, (2)University of Minnesota, Minneapolis, MN, (3)UCEDD, University of MN, Minneapolis, MN, (4)U of MN, Minneapolis, MN*

Background:
Children of immigrants may have higher rates of autism spectrum disorder (ASD) (Crafa and Warfa 2015). This appears to be especially pronounced in children from countries with a low human resource index (Barnevik-Olsson et al. 2008; Keen et al. 2010; Magnusson et al. 2012). In our previous ASD surveillance project in Minneapolis, we compared prevalence of autism in Somali children and children from other racial/ethnic groups ages 7-9 years. We found that Somali and white children had a similar prevalence of ASD, which was higher than that of non-Somali black and Hispanic children (Hewitt et al. 2016). Notably, Somali children with ASD were far more likely to have co-occurring intellectual disability (ID) than children with ASD in other racial/ethnic groups.

Objectives:

In this analysis, we will compare ASD prevalence in 8 year olds across racial/ethnic groups using data from the Minnesota site of the CDC Autism and Developmental Disabilities Monitoring (ADDM) Network, with a particular focus on two large racial/ethnic groups in MN: Somali and Hmong. Minnesota is home to the largest population of Somali immigrants, with an estimated 57,000 Somalis, and the second largest population of Hmong, more than 66,000 (American Community Survey 2015). We will also compare the co-occurrence of ID in children with ASD across racial and ethnic groups.

Methods:

Prevalence calculations will utilize standardized ADDM methods (Christensen et al. 2016; Hewitt et al. 2016) involving systematic record review of health and special education records of 8 year old children within our defined surveillance area. The area includes four school districts in two large urban counties in MN. Population denominators will be obtained from CDC's National Center for Health Statistics vintage 2016 postcensal bridged-race population estimates for 2014 and adjusted to include only children living in the surveillance area. A child is classified as Somali or Hmong based on reported home language in education and health records.

Results:

Prevalence estimates will be compared across racial/ethnic groups assuming a Poisson distribution. Chi squared and Fisher's exact tests will be used to identify differences between populations. We will also compare rates of ASD for children in MN with overall U.S. prevalence reported by the CDC. Finally, we will compare the prevalence of co-occurring ID in children with ASD to compare with previous findings.

Conclusions:

Because ASD early identification can improve outcomes, identifying subgroups of children with a higher prevalence or more severe forms of ASD can help inform public health policy and improve outcomes for individuals with ASD and their families. Differences in prevalence by racial/ethnic group may suggest that culturally sensitive methods for outreach and diagnosis are warranted.

115 **184.115** Autism-Associated DNA Methylation at Birth from Multiple Tissues Is Enriched for Autism Genes in the Early Autism Risk Longitudinal Investigation (EARLI)

K. M. Bakulski[1], *M. D. Fallin*[2], *A. P. Feinberg*[3], *J. I. Feinberg*[2], *I. Hertz-Picciotto*[4], *L. A. Croen*[5], *C. J. Newschaffer*[6], *S. Brown*[3], *J. Dou*[7] *and M. Aung*[7], *(1)University of Michigan, Ann Arbor, MI, (2)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Johns Hopkins University, Baltimore, MD, (4)University of California at Davis, Davis, CA, (5)Division of Research, Kaiser Permanente, Oakland, CA, (6)AJ Drexel Autism Institute, Philadelphia, PA, (7)University of Michigan, School of Public Health, Ann Arbor, MI*

Background: Risk for autism spectrum disorders (ASD) is conferred through genetic and environmental exposures, and emerging evidence suggests DNA methylation is altered in ASD. Few studies have considered prospective designs with DNA methylation measured in multiple tissues.
Objectives: To determine the relationships between DNA methylation in maternal blood, cord blood, and placenta with ASD diagnosis.

Methods: In the Early Autism Risk Longitudinal Investigation (EARLI), an ASD-enriched birth cohort, genome-scale maternal blood (early n=140 and late n=75 pregnancy), infant cord blood (n=141), and placenta (maternal n=106 and fetal n=107 compartments) DNA methylation was assessed on the Illumina 450k HumanMethylation array and compared to ASD diagnosis at 36 months of age. We tested for differences in site-specific and global methylation and for enrichment of single sites for ASD risk genes from the Simons Foundation Autism Research Initiative (SFARI) database.

Results: No individual DNA methylation site was associated at genome-wide significance, however individual DNA methylation sites associated with ASD ($P<0.05$) in each tissue were highly enriched for SFARI genes (cord blood $P = 2.6\text{x}10^{-30}$, maternal blood early pregnancy $P = 1.6\text{x}10^{-29}$, maternal blood late pregnancy $P= 4.1\text{x}10^{-12}$, maternal placenta $P= 2.4\text{x}10^{-27}$, fetal placenta $P=1.2\text{x}10^{-13}$). Analyses of additional behavioral phenotypes will be presented, as well as results for overall (global) methylation comparisons across cord, maternal blood, and placenta.

Conclusions: Across multiple tissues, DNA methylation sites nominally associated with later ASD diagnosis were enriched for ASD risk genes. Our blood and placenta tissue study demonstrates the utility of examining DNA methylation prior to ASD diagnosis.

116 **184.116** Changes in the Prevalence of Autism Spectrum Disorder in Utah: A Cohort Approach

A. V. Bakian[1], *C. A. Palmer*[1], *C. Kingsbury*[2], *N. Taxin*[2], *W. M. McMahon*[1] *and D. A. Bilder*[1], *(1)Psychiatry, University of Utah, Salt Lake City, UT, (2)Bureau of Children with Special Health Care Needs, Utah Department of Health, Salt Lake City, UT*

Background: Accurate autism spectrum disorder (ASD) prevalence estimates are critical for driving policy decisions such as planning for ASD-related services. U.S.-based efforts to identify children with ASD and estimate ASD prevalence often use cross-sectional study designs that are limited to a specific age (e.g. age 8). Recent research suggests that approximately 1/3 of children with ASD are not identified until after age eight. Delayed identification may be related to ASD severity, race/ethnicity and/or socioeconomic status. Hence, some prevalence estimates may be overly-conservative and biased. A cohort study design in which children from specific birth cohorts are ascertained for ASD at different ages may yield more accurate and unbiased ASD prevalence estimates.
Objectives: 1) Estimate ASD prevalence bi-annually in the 1994 birth cohort in Utah starting at age 8 through age 16, and 2) compare ASD prevalence across study years.

Methods: Data for this study was acquired from the Utah Registry of Autism and Developmental Disabilities (URADD), a passive, population-based ASD surveillance system. Children born in 1994 in a four county (Davis, Salt Lake, Utah and Tooele) Utah surveillance region were ascertained biannually for ASD starting at age 8 through age 16 based on a community medical ASD diagnosis and/or autism special education eligibility. Overall ASD prevalence and ASD prevalence by gender were estimated in surveillance years (SY) 2002, 2004, 2006, 2008, and 2010; the adjusted Wald method based on a normal approximation was used to estimate 95% confidence intervals. Chi-square tests were used to compare the prevalence of ASD across years.

Results: 159 and 557 children from the 1994 birth cohort were identified with ASD at age 8 (SY2002) and age 16 (SY2010), respectively. The female to male ratio was 1:6 in SY2002 and 1:4 in SY2010. ASD prevalence increased 237% between SY2002 (age 8) and SY2010 (age 16) and was 6.1/1000 8-year-old children in SY2002 and 18.8/1000 16-year-old children in 2010 (Figure). In comparison, the prevalence of ASD among 8-year-old children in SY2010 was 19% lower (prevalence =15.8/1000; 95% confidence interval (CI): 14.5-17.1; p = 0.004) than that of 16-year-olds. The odds of being identified with ASD was three times greater among 16-year-olds compared to 8-year-olds from the 1994 birth cohort (Odds ratio: 3.14; 95% CI: 2.63-3.74; p<0.0001).

Conclusions: Utah's ASD prevalence increased significantly between SY2002 and SY2010 within the 1994 birth cohort. The current study demonstrates that ASD prevalence continues to increase following early childhood and well into adolescence. This pattern may be the result of multiple factors including improved ASD awareness, recognition, referral and access to services. Further research is needed to identify the specific drivers of within cohort increases in prevalence. ASD prevalence among 8-year-old children in Utah is a conservative estimate; policy makers should consider basing decisions on prevalence estimates that incorporate a wider age range including adolescents.

117 **184.117** Demographic, Diagnostic, and Clinical Characteristics of Adult Participants in the SPARK ASD Cohort

***H. Zaydens**, L. A. Green Snyder, A. Daniels, P. Feliciano and W. K. Chung, Simons Foundation, New York, NY*

Background:

It is well recognized that there is a dearth of research on adults with Autism Spectrum Disorders (ASD) in the United States[1]. The absence of research not only impedes our ability to understand causes of ASD[2], but also limits the development of adequate supports and services for the adult ASD community[3]. Due to the heterogeneity of ASD, large numbers of individuals are needed in research, including adults for whom challenges differ[4].

Objectives:

The aim of the current study is to summarize the characteristics of adults with ASD in the SPARK cohort.

Methods:

From December 2015 through October 1, 2017, ASD adults enrolled online at sparkforautism.org, completed brief medical history and demographic surveys. Adults included dependents enrolled by their legal guardians and independent adults, many of whom are parents themselves. Data analyses, including measures of central tendency (means) and proportions, were performed using Stata, version 12.0.

Results:

During the study period, SPARK enrolled a total of 2,787 adults, of whom 1,654 were registered by a legal guardian and 1,133 are legally independent. Almost 80% of the registered dependent adults are male, as compared to 54% of the independent adults. The mean age at diagnosis was 6 years (SD 5.3) for dependent adults and 20.5 years (SD 16.8) for independent adults. Twenty-four (24) and 19 percent of dependent and independent adults, respectively, have neurological conditions; 11% of dependent adults reported seizure disorder or epilepsy as compared to 4% of independent adults. With regard to psychiatric and developmental conditions, 52% of dependent adults and 70% of independent adults, respectively, reported having anxiety disorder, obsessive-compulsive disorder or mood disorders including depression. Sixty-three percent of dependent adults as compared to 15% of independent adults reported having developmental, language or learning disorder. Ninety-one (91) percent of dependent adults as compared to 42% of independent adults reported having IEPs for autism services; 88% of dependent adults versus 54% of independent adults reported using ASD therapies.

Conclusions:

Data collected from adult participants in SPARK indicate a high frequency of psychiatric co-morbidities in both dependent and independent adults, particularly mood and anxiety disorders. Although dependent adults are expected to have more severe challenges, independent adults showed a similar, high rate of co-morbid neurological disorders. At the same time, far fewer independent adults received proper diagnosis or services for ASD in their childhood[3]. Ultimately, these findings underscore the importance of continued, longitudinal research in adults with ASD as a way of better understanding the life course of the condition and to develop better services and systems of support.

118 **184.118** Does Maternal Prescription Opioid Use during Pregnancy Increase a Child’s Risk of ASD or Developmental Disability?

***E. Rubenstein**[1], J. C. Young[2], L. A. Croen[3], C. DiGuiseppi[4], N. Dowling[5], L. C. Lee[6], L. Schieve[5], L. Wiggins[5] and J. Daniels[7], (1)Waisman Center at UW Madison, Madison, WI, (2)Epidemiology, University of North Carolina, Chapel Hill, NC, (3)Division of Research, Kaiser Permanente, Oakland, CA, (4)Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, (5)Centers for Disease Control and Prevention, Atlanta, GA, (6)Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (7)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background: Opioid use among pregnant women has increased along with the stark rise in US opioid prescribing rates from 1999 to 2015. While opioid use during pregnancy has been associated with poor pregnancy outcomes, including neonatal abstinence syndrome, preterm birth and some congenital malformations, little is known about maternal opioid use during pregnancy and the child’s risk of neurodevelopmental conditions, such as autism spectrum disorder (ASD) or non-ASD developmental disability (DD).

Objectives: Examine associations between maternal prescription opioid use during pregnancy (from three months preconception to delivery), and ASD, DD without ASD features, or autism traits (either ASD or DD with ASD features) in children enrolled in the Study to Explore Early Development (SEED).

Methods:

: SEED is a multi-site case-control study of ASD risk factors and phenotype in children aged 3-5 years, from 2003 to 2011. Children with ASD or other DDs were identified from schools and healthcare providers. Population controls (POP) were randomly sampled from birth certificates at each site. ASD case status was confirmed with a developmental evaluation that included the Autism Diagnostic Interview-Revised and Autism Diagnostic Observation Schedule. Children receiving the ASD evaluation but not meeting SEED criteria for ASD were identified as having DD with ASD features. Children with DD diagnoses who did not have a SEED ASD evaluation were considered to have DD without ASD features. To evaluate autism traits independent of meeting a diagnostic threshold for ASD, we combined the ASD and the DD with ASD features groups. Maternal prescription opioid use and timing of use were determined by prescriptions abstracted from maternal prenatal care medical records. Study children included 1369 with ASD, 1414 with other DDs (938 without ASD features), and 1577 POP. We calculated odds ratios (ORs) using logistic regression adjusted for confounders affecting estimated ORs by >10% (maternal race/ethnicity, maternal education, smoking, depression, and study year) comparing cases (ASD, DD without ASD features, autism traits) to POP by prescription opioid exposure (any use, use in three months preconception, by trimester).

Results:

Overall, mothers of 7.7% (N=336) of study children were given prescription opioids just before or during pregnancy. In unadjusted analyses, prescription opioid use, preconception or during pregnancy, was associated with ASD (OR 1.56, 95% confidence interval [CI]: 1.19, 2.06) and autism features (OR: 1.61, CI: 1.24, 2.08), driven largely by exposure prior to and during the first trimester. After adjustment, ORs for use during any period were attenuated for the ASD (OR: 1.27, CI: 0.95, 1.69) and autism features (OR: 1.31, CI: 1.00, 1.72) groups. In all groups, adjusted ORs for prescription opioid use preconception were greater than 1.95 but only statistically significant for the autism features group (OR: 2.58, CI: 1.08, 6.16).

Conclusions: Maternal prescription opioid use just before or early in pregnancy led to increased odds of ASD, a statistically significant association with autism features, and no association with DD without ASD features. Findings may suggest etiologic pathways involving placental or fetal exposure that lead to ASD and DD, but may also be attributable to unmeasured or residual confounding.

119 **184.119** Advanced Maternal Age Is Not Independently Associated with Age at First Evaluation That Notes Autism Traits Among Children with ASD.

E. Rubenstein[1]*, M. S. Durkin*[2]*, R. A. Harrington*[3]*, R. S. S. Kirby*[4]*, L. Schieve*[5] *and J. Daniels*[6]*, (1)Waisman Center at UW Madison, Madison, WI, (2)Population Health Sciences, University of Wisconsin School of Medicine and Public Health, Madison, WI, (3)Johns Hopkins University, Baltimore, MD, (4)Community and Family Health, University of South Florida, Tampa, FL, (5)Centers for Disease Control and Prevention, Atlanta, GA, (6)University of North Carolina at Chapel Hill, Chapel Hill, NC*

Background:
Advanced maternal age (AMA), defined as childbirth at 35 years or older, is a well-known risk factor for poor pregnancy and child health outcomes, including increased risk of autism spectrum disorder (ASD). Many mothers of AMA are aware of their higher risk for suboptimal pregnancy outcomes compared to younger mothers. Whether this awareness results in earlier age at identification of ASD in children of AMA mothers has not been studied.

Objectives: Our objective was to estimate effects of AMA on timing of the child's first evaluation that notes ASD traits using data from the Autism and Developmental Disabilities Monitoring (ADDM) Network, independent of confounding socio-economic factors.

Methods: The ADDM network systematically collects data to determine ASD prevalence among 8-year-old children in multiple sites across the United States. The active surveillance process involves review of medical and health records against a standardized ASD case definition by trained experts. We utilized data on ASD cases with available birth certificate data from surveillance years 2008, 2010, and 2012. Age at first evaluation that noted autism traits was determined by systematic record review of all child evaluations, looking for trigger words that indicated ASD. Linear regression and Cox proportional hazard models were adjusted for maternal education, race/ethnicity, prior live births, study site, and child year of birth. We additionally stratified by intellectual disability (ID) status.

Results: Over the three surveillance years, 10,358 children met surveillance criteria for ASD and had maternal age data from the birth certificate, of which 19.7% had mothers of AMA. These mothers had higher levels of education, more prior live births, and older age of the child's father at childbirth than non-AMA mothers. In crude analyses, children with AMA mothers had an earlier first evaluation that noted ASD traits (41.3 months compared to 46.5 months, mean difference -2.43 months, 95% Confidence Interval [CI]: -3.43, -1.43) with significantly different distributions (Hazard ratio [HR]: 1.12, 95% CI: 1.06, 1.18). However, after adjusting for maternal education, race and other covariates, these associations were attenuated (mean difference -0.11 months, 95% CI: -1.24, 1.03, HR 1.02, 95% CI: 0.96, 1.10). When stratifying by child ID status, age at first evaluation that noted ASD traits was later for those without ID, but there were no significant difference by AMA status in either ID stratum (Mean difference with ID: 0.11, 95% CI: -1.73, 1.93; without ID: -0.03, 95% CI: -1.68, 1.61).

Conclusions: AMA was not associated with earlier age at first evaluation that noted ASD traits after adjustment for confounders. Older maternal age may act as a proxy for greater educational achievement, socio-economic status, and having had more children, all of which are associated with younger age at child's first evaluation. It is important to target early evaluations and screenings to children at high risk of ASD from lower socio-economic demographics to improve age at diagnosis.

120 **184.120** Green Space Exposure Predicts Anxiety and Conduct Problems in Youth with ASD

B. Barger[1]*, L. Larson*[2]*, S. Ogletree*[3]*,* ***D. Roberts***[4]*, J. Torquati*[5]*, S. Rosenberg*[6]*, C. Johnson-Gaither*[7]*, J. M. Bartz*[8]*, E. Moody*[9]*, A. Gardner*[10] *and A. Schutte*[11]*, (1)Georgia State University, Atlanta, GA, (2)LRLarson@ncsu.edu, NC State, Raleigh, NC, (3)Parks, Recreation, and Tourism Management, Clemson University, Clemson, SC, (4)GA State University, Atlanta, GA, (5)U of Nebraska, Lincoln, NE, (6)University of Colorado Anschutz Medical Campus, Aurora, CO, (7)USDA Forest Service, Southern Research Station, Athens, GA, (8)Educational Specialities, Northern Arizona University, Flagstaff, AZ, (9)University of Colorado, Denver, Aurora, CO, (10)U. of Arizona, Tuscon, AZ, (11)U. of Nebraska, Lincoln, NE*

Background:
Exposure to green space confers an array of physical, mental, and health benefits. However, most studies examining relationships between green space, health, and well-being focus on adults, typically developing children, and children with ADHD. Currently, there is no research on the effects of green space on the mental health and behavior of youth with autism spectrum disorders (ASD).

Objectives:

We sought to determine whether green space exposure predicts decreases in the severity of co-morbid anxiety symptoms in children with ASD. We hypothesized that anxiety and conduct problems symptoms would be less severe for youth in settings dominated by "gray" space (e.g., roads, buildings) (H1) and less severe for youth in settings characterized by higher green space (H2).

Methods:

We used national Zip-code level data from the National Survey of Children's Health (NSCH, 2012) and the National Land Cover Database (NLCD) to investigate connections between proximity to green space, gray space, and severity of anxiety and conduct problems (low versus moderate to high), in youth diagnosed with ASD) (n=1284). All analyses include weighted and stratified binary logistic regression models. Respectively, green space and grey space were quantified as the percentage of the tree canopy coverage and built environment at the Zip-code level; the NLCD and NSCH were merged and analyzed on-site at the Centers for Disease Control in Atlanta. All models statistically controlled for the following variables: Severity (low/moderate-high) of co- morbid intellectual disability, learning disability, attention deficit disorder, and autism symptoms; gender; federal poverty level; age bracket (early childhood, middle childhood, and adolescence); race/ethnicity (White, Black, Hispanic, Other); maternal education; insurance status (private, public, and none); and English Language status (English speaking, non-English speaking).

Results:

Results of the logistic regression models supported small effects of environmental variables on anxiety and conduct problem severity. Impervious surface (aOR = 1.03, $p < .05$) and tree canopy (aOR = 1.03, $p < .05$) significantly predicted higher odds of moderate to high levels of anxiety problems in youth with ASD, supporting H1 but refuting H2. Furthermore, tree canopy coverage was associated slightly lower odds of moderate to severe conduct problems (aOR = 0.98, $p < .05$), supporting H1; grey space was not associated with conduct problem severity refuting H2.

Conclusions:

Our study, the first of its kind to examine the relationship between nature exposure and anxiety and conduct problems in youth with ASD. Both impervious surface coverage and tree canopy coverage increased the risk of severe anxiety in youth with autism, who might experience the stress-reducing benefits of nature differently than their typically developing peers. Furthermore, proximity to green space predicted slightly lower odds of conduct problems. This analysis is limited primarily by its reliance on zip code level environmental variables and rough parent report estimates of anxiety and conduct problem severity. More research using objective diagnostic metrics at finer spatial scales would help to illuminate complex relationships between green space, anxiety, and conduct problems in youth with ASD.

121 **184.121** Incomplete Vaccination and Risk of Autism Spectrum Disorder

B. Kim[1]*, M. Ha*[2,3]*, Y. S. Kim*[4]*, Y. J. Koh*[5]*, H. J. Kwon*[2,3]*, M. H. Lim*[3,6]*, K. C. Paik*[3,7]*, P. S. Hong*[8] *and B. L. Leventhal*[4]*, (1)University of California, San Francisco (UCSF), San Francisco, CA, (2)Department of Preventive Medicine, Dankook University College of Medicine, Cheonan, Korea, Republic of (South), (3)Environmental Health Center, Dankook University Medical Center, Cheonan, Korea, Republic of (South), (4)University of California San Francisco, San Francisco, CA, (5)5The Korea Institute for Children's Social Development, Rudolph Child Research Center, Seoul, Korea, Republic of (South), (6)Psychology, Dankook University College of Public Services, Cheonan, Korea, Republic of (South), (7)Psychiatry, Dankook University College of Medicine, Cheonan, Korea, Republic of (South), (8)PSYCHIATRY, UCSF, San Francisco, CA*

Background: The recent decline in childhood vaccination has resulted in outbreaks of infectious diseases with public health and economic consequences in the US. Such vaccine hesitancy partly stems from parental fear that vaccines increase risk for Autism Spectrum Disorder (ASD).
Objectives: We examined the relationship between completion of 6 types of vaccinations in childhood and higher risk for ASD, using an internal replication design.

Methods: Two large South Korean epidemiologic samples were used to: 1) Generate hypotheses about completion of all 6 types of vaccination and increased risk for ASD in a Discovery Sample (DS: N=10,006); and, 2) Replicate the initial findings in a Replication Sample (RS: N=29,381). Mothers reported completion of 6 types of vaccination, including BCG, HepB, MMR, JEV (Japanese Encephalitis Vaccination), DTaP and Polio. Completion of the vaccinations were categorized into three groups: <3 , 4-5 , and 6 vaccines. Three levels of risks for ASD diagnosis was estimated with the Autism Spectrum Screening Questionnaire(ASSQ): low (ASSQ<10), intermediate (ASSQ=10-14), and high (ASSQ≥15) risk. Multivariate ordinal regression was performed: model 1 controlled for demographic factors and model 2 controlled for demographic and confounders (family history of psychiatric disorders, prematurity, and birth order).

Results: 84.3 % of DS and 80.1% of RS were fully vaccinated. After adjusting for demographic covariates and confounders, children who were vaccinated incompletely were at increased ASD risk when compared to those fully vaccinated in the DS (adjusted odds ratio [aOR] = 2.33, 95% CI, 1.53-3.56 in vaccination less than 3; aOR=1.42, 95% CI, 1.17-1.73 in 4-5 vaccination). This initial finding was replicated in the RS (aOR=2.19, 95% CI, 1.80-2.67 in vaccination less than 3; aOR=1.44, 95% CI, 1.32-1.58 in 4-5 vaccination).

Conclusions: Our data suggest that vaccination does not increase risk for ASD but may carry protective effects against ASD. Vaccination has proven to be a successful and effective public health strategy to prevent life-threatening infectious disease in childhood, and to improve the well-being and health of children. When replicated in other populations, the benefit of vaccination might extend to its protective effect for common childhood neurodevelopmental disorders, like ASD.

122 **184.122** Infection and Fever during Pregnancy and Risk for Autism: A Systematic Review and Meta-Analysis

A. Silberman[1]*,* ***N. Tioleco***[1]*, K. Stratigos*[1]*, S. Banerjee-Basu*[2]*, M. Spann*[1]*, A. Whitaker*[1] *and J. B. Turner*[1]*, (1)Department of Psychiatry, Columbia University / New York State Psychiatric Institute, New York, NY, (2)MindSpec Inc., McLean, VA*

Background:

A multifactorial model for ASD causation is increasingly recognized. Epidemiological family and twin studies have firmly established a genetic component underlying ASD with overall heritability estimates of approximately 50%. At the same time, these heritability estimates suggest the importance of non-genetic or environmental factors. Of the possible environmental risk factors for ASD, none has been studied as extensively as prenatal maternal infection, the subject of this review.

Objectives:

The objective of this study is to determine the association between maternal infection and fever and the risk of ASD through a meta-analysis of the extant literature.

Methods:

We conducted a comprehensive search of the PubMed and Google Scholar databases for peer-reviewed case-control studies and cohort studies written in English that examined the association between maternal infection during pregnancy and/or fever and/or antibiotics and the risk of ASD. The reference lists of retrieved articles were hand-searched for additional relevant articles. A total of 35 papers were ultimately included in the meta-analysis. From each paper, we extracted information pertaining to study design, the population under study, total number of subjects in each group, information regarding the type and timing of infection exposure, diagnostic criteria, outcome measures, and statistical adjustments. ORs were combined across studies using Comprehensive Meta-Analysis software (Borenstein et al. 2009). When individual articles examined multiple types of exposure, we collapsed both the effects to obtain study-level effects sizes (any infection or fever), and examined the exposure types separately in order to determine if there is heterogeneity of effect across infectious agents or across infections sites.

Results:

Study-level analyses revealed a modest, but significant effect of exposure to infection/fever on autism risk [OR=1.20;95%CI,1.07-1.35]. There is little or no heterogeneity by either infectious agent or infection site. Some heterogeneity exists across trimester of exposure, with first trimester exposures have slightly weaker effects than those occurring later, but these differences are not statistically significant. In rare instances when investigators considered variation in exposure severity (e.g. length of maternal exposure to fever) severity was often strongly related to effect size.

Conclusions:

Maternal exposure to infection confers a modest, but statistically reliable, average increase in risk of autism in offspring. The modest size of the increase risk suggests that the impact of maternal infection may need to be understood in terms of its interaction with other risk factors (e.g. genetic vulnerability). Although severity of exposure is under-studied, the larger odds ratios associated with lengthy bouts of fever, for example, suggests that these more severe exposures require fewer additional vulnerabilities to result in ASD. The absence of heterogeneity across infectious agent and site is consistent with the idea of a common mediator (e.g. markers of inflammation). The absence of heterogeneity across trimester could be the result of measurement error, or due to the relevant neurodevelopmental processes straddling these divisions.

123 **184.123** Interaction between Manganese and GSTP1 in Relation to Autism Spectrum Disorder While Controlling for Exposure to Mixture of Lead, Mercury, Arsenic, and Cadmium

M. H. Rahbar[1], *M. E. Samms-Vaughan*[2], *M. Lee*[1], *M. A. Bach*[3], *J. Bressler*[4], *M. Hessabi*[3], *M. L. Grove*[5], *S. Pellington*[2], *C. Coore Desai*[6], *J. A. T. Reece*[6], *K. A. Loveland*[7] *and E. Boerwinkle*[8], *(1)Division of Clinical and Translational Sciences, Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (2)Department of Child & Adolescent Health, The University of the West Indies, Mona Campus, Kingston, Jamaica, (3)Biostatistics/Epidemiology/Research Design (BERD) core, Center for Clinical and Translational Sciences (CCTS), The University of Texas Health Science Center at Houston, Houston, TX, (4)Human Genetics Center, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (5)Department of Epidemiology, Human Genetics, and Environmental Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (6)Department of Child & Adolescent Health, The University of the West Indies, Kingston, Jamaica, (7)Department of Psychiatry and Behavioral Sciences, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (8)Department of Epidemiology, Human Genetics, and Environmental Sciences, Human Genetics Center, University of Texas School of Public Health at Houston, Houston, TX*

Background: Humans are regularly exposed to a combination of environmental chemicals, including heavy metals and metalloids, which have potentially neurotoxic effects. Although neurotoxic effects are known for some individual metals, there is limited published information on the combined neurotoxicity of heavy metals. It is possible that even when individual metals are below their ecotoxicological benchmark levels, interactions among a mixture of metals could result in more severe health effects. Several metals are known to induce oxidative stress, which has previously been linked with autism spectrum disorder (ASD). Glutathione S-transferase (GST) enzymes, encoded by genes in the *GST* gene family, play a protective role against oxidative stress. We have previously reported a significant interaction between polymorphisms of *GSTP1* and blood manganese concentrations (BMC) in relation to ASD in Jamaican children. However, we did not control for the potential confounding effect of the mixture of other metals.

Objectives: To investigate whether the interaction between *GSTP1* and blood manganese concentrations in relation to ASD will remain statistically significant after controlling for exposure to a mixture of four other metals, including lead, mercury, cadmium, and arsenic.

Methods: We used data from 163 pairs of Jamaican children 2-8 years of age enrolled in the Epidemiological Research on Autism in Jamaica (ERAJ) or ERAJ- Phase II matched case-control studies. To minimize any potential multicollinearity between blood concentrations of lead, mercury, arsenic, and cadmium, we used generalized weighted quantile sum (WQS) regression. Then, we used conditional logistic regression models to assess the interaction effect between *GSTP1* and manganese in relation to ASD, controlling for the weighted score of the four metals (i.e., WQS) and other potential confounders. In this analysis, we considered the co-dominant genetic model previously used to assess the interaction of *GSTP1* genotype and BMC in relation to ASD.

Results: We found that the interaction between *GSTP1* and blood manganese concentration remained significant after adjusting for the mixture of lead, mercury, cadmium, and arsenic and additional potential confounders. Using the co-dominant model for *GSTP1*, results indicated that among children with the Ile/Ile genotype, those with BMC ≥ 12µg/L had 4.6 times higher odds of ASD compared to those with BMC < 12µg/L (adjusted Matched Odds Ratio (MOR) = 4.6, 95% CI: 1.21 – 17.42).

Conclusions: Our previously published finding that *GSTP1* genotype may be an effect modifier for the association between binary blood manganese concentrations and ASD in Jamaica remained statistically significant after adjusting for the mixture effect of lead, mercury, cadmium, and arsenic. It is important to consider mixtures of environmental exposures when investigating their associations with ASD since exposures do not occur in isolation.

124 **184.124** Maternal Anxiety and Depression Are Associated with Autism Spectrum Disorder Phenotypes in Preschol Children

L. Wiggins[1], *E. Rubenstein*[2], *J. Daniels*[3], *C. DiGuiseppi*[4], *M. Yeargin-Allsopp*[1], *L. Schieve*[1], *L. Tian*[1], *K. R. Sabourin*[5], *E. Moody*[6], *J. A. Pinto-Martin*[7], *N. Reyes*[8] *and S. E. Levy*[9], *(1)Centers for Disease Control and Prevention, Atlanta, GA, (2)Waisman Center at UW Madison, Madison, WI, (3)University of North Carolina at Chapel Hill, Chapel Hill, NC, (4)Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO, (5)University of Colorado Anschutz Medical Campus, Aurora, CO, (6)University of Colorado, Denver, Aurora, CO, (7)University of Pennsylvania, Philadelphia, PA, (8)JFK Partners, University of Colorado Anschutz Medical Campus, Aurora, CO, (9)Division of Developmental and Behavioral Pediatrics, Center for Autism Research, Children's Hospital of Philadelphia; Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA*

Background:

Anxiety and depression are common among individuals with autism spectrum disorder (ASD), and a number of studies have found maternal anxiety and depression to be associated with the development of ASD in offspring. Several studies highlighted an association between maternal depression and specific ASD phenotypes characterized by higher adaptive and cognitive functioning and increased rates of problem behaviors in the child with ASD.

Objectives:

We explored whether a history of maternal anxiety and depression was associated with ASD phenotypes in the child. We hypothesized that maternal anxiety or depression would be associated with a profile in children with ASD characterized by increased rates of anxiety and depression, average learning abilities, and mild language and motor delays.

Methods:

The Study to Explore Early Development (SEED) is a multisite, community-based study of children 30-68 months of age. SEED was designed to describe ASD phenotypes and investigate how genetic and environmental factors are associated with ASD profiles. Participants were 672 children with ASD and their mothers. Children with ASD were classified after a comprehensive developmental evaluation with gold-standard diagnostic instruments. Child ASD phenotypes were derived from latent class analysis of extensive behavioral, developmental, and medical data. Four phenotypes best described children with ASD: (1) *Mild Language Delay with Cognitive Rigidity,* (2) *Significant Developmental Delay with Repetitive Motor Behaviors,* (3) *General Developmental Delay,* and (4) *Mild Language and Motor Delay with Dysregulation (e.g., anxiety/depression) or "Dysregulated ASD*." Mothers completed a medical history questionnaire and reported whether a doctor diagnosed them with anxiety or depression before the birth of their child. To assess associations between maternal anxiety or depression and child phenotypic class, we conducted a multinomial logistic regression weighted for classification error and adjusted for confounding. Type 2 ASD (i.e., *Significant Developmental Delay with Repetitive Motor Behaviors)* was chosen as the reference category for regression analyses.

Results:

22.6% of mothers reported being diagnosed with anxiety or depression before the birth of their child. Type 4 or *Dysregulated ASD* was associated with a reported history of maternal anxiety or depression (Odds ratio 2.73, 95% confidence interval: 1.23, 5.46); and the association was stronger when both conditions were present (Odds ratio 4.73, (95% confidence interval: 1.35, 16.5). Maternal anxiety or depression was not associated with other ASD phenotypes.

Conclusions:

We conclude that maternal anxiety and depression are significantly associated with an ASD phenotype characterized by increased rates of anxiety and depression, typical learning abilities, and mild delays in language and motor skills in preschool children. Our findings highlight the potential for shared etiologic pathways between anxiety, depression, and *Dysregulated ASD* that can be explored in future research studies.

125 **184.125** The Influence of Diagnostic Criteria on Autism Spectrum Disorder Classification: Findings from the Metropolitan Atlanta Developmental Disabilities Surveillance Program, 2012

L. Wiggins*, D. Christensen and J. Baio, Centers for Disease Control and Prevention, Atlanta, GA*

Background:

The Centers for Disease Control and Prevention (CDC) has consistently applied a rigorous and reliable surveillance method to estimate the prevalence of autism spectrum disorder (ASD). This method employs a record-based coding scheme based on criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition – Text Revision (DSM-IV-TR). The American Psychiatric Association made considerable changes to ASD diagnostic criteria in 2013 (i.e., DSM-5) that influence CDC ASD surveillance methods.

Objectives:

The objectives of this study were to: (1) evaluate agreement between the DSM-IV-TR and DSM-5 surveillance definitions for ASD, (2) quantify the percentage of children who met only the DSM-IV-TR surveillance definition and the percentage of children who met only the DSM-5 surveillance definition, and (3) evaluate differences in characteristics of these latter two groups of children.

Methods:

A child was eligible for ASD surveillance if he/she: 1) was eight years old during the 2012 surveillance year, 2) had a legal guardian who resided in metropolitan Atlanta, GA, and 3) was served for a developmental condition as evidenced by a discharge diagnosis, billing code, reason for referral, or education eligibility noted in evaluation records. Surveillance staff reviewed health and education records of eligible children for social deficits characteristic of ASD (e.g., limited interest in other children). All records that contained a social deficit were abstracted to collect accounts of developmental history, ASD symptoms, developmental tests, and co-occurring conditions diagnosed by the community professional who evaluated the child. Clinicians with advanced degrees and specialized training and experience in ASD then applied two standardized coding schemes to the abstracted data: one based on DSM-IV-TR criteria that has previously been used to estimate ASD prevalence, and another based on DSM-5 criteria that was developed for this project and future surveillance efforts.

Results:

Results found substantial agreement between the DSM-IV-TR and DSM-5 surveillance classifications of ASD (kappa=0.80). There were no differences in child race/ethnicity, child sex, or intellectual disability between children who met only the DSM-IV-TR surveillance definition and those who met only the DSM-5 surveillance definition. Children who met the DSM-IV-TR but not the DSM-5 surveillance definition (4% of the sample) were more likely to have developmental concerns and evaluations in the first three years. Children who met the DSM-5 but not the DSM-IV-TR surveillance definition (6% of the sample) were more likely to have been receiving autism-related services or previously diagnosed with ASD.

Conclusions:

The ASD surveillance definition based on DSM-5 criteria is largely comparable to that based on DSM-IV-TR criteria, and both identify children with similar demographic and intellectual characteristics. DSM-IV-TR surveillance criteria may detect few children with long-standing social-communication concerns that do not meet the number and pattern of deficits specified in DSM-5. DSM-5 surveillance criteria may detect few children who have an ASD diagnosis and are not captured with DSM-IV-TR surveillance. CDC record-review surveillance is uniquely equipped to continue to evaluate the influence of diagnostic criteria on ASD classification and prevalence estimates in large and diverse samples of children.

126 **184.126** Maternal Cannabis Use in Pregnancy and Autism Spectrum Disorder in the Charge Study

P. Krakowiak[1]*, R. J. Schmidt*[2]*, D. Tancredi*[3]*, R. L. Hansen*[4]*, S. Ozonoff*[5]*, I. Hertz-Picciotto*[6] *and C. K. Walker*[7]*, (1)UC Davis, Sacramento, CA, (2)Public Health Sciences, University of California Davis, Davis, CA, (3)UC Davis School of Medicine, Sacramento, CA, (4)University of California Davis, Davis, CA, (5)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (6)University of California at Davis, Davis, CA, (7)University of California, Sacramento, CA*

Background: Cannabis use has been associated with deficits in verbal and memory domains, as well as inattention, impulsivity and hyperactivity in young children evaluated in historical cohorts likely to underestimate the impact of current fetal cannabis exposure.
Objectives: To determine whether maternal cannabis use in pregnancy is associated with adverse neurodevelopment in a case-control study designed to evaluate the effects of environmental and genetic factors on autism spectrum disorder (ASD) and developmental delay (DD).

Methods: The Childhood Autism Risks from Genetics and the Environment (CHARGE) study is a population-based, case-control investigation of ASD and/or DD origins. Children from 20 California counties aged 24 to 60 months and living in catchment areas with a biological parent fluent in English or Spanish were enrolled from 1/29/2003 to 1/23/2017. Children with ASD (n = 725) and DD (n = 288) were recruited through the California Department of Developmental Services, the Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, and referrals. Controls with typical development (TD) (n = 494) were randomly selected from birth records and frequency matched on age, sex, and broad geographic region. Maternal self-report of prenatal cannabis use and other exposures were drawn from a telephone interview conducted in English or Spanish. The Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview–Revised (ADI-R) were used to confirm ASD, whereas children with DD and TD were confirmed by Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales (VABS) and were free of autistic symptoms. Multinomial logistic regression models that controlled for maternal factors were developed to examine the association between cannabis and developmental outcomes.

Results: Of women who reported cannabis use, nearly all (93%) used marijuana, with only 7% using cannabinoids. Reported use in CHARGE controls reflected published prevalence: 6.1% during the 3 months prior to conception and 2.0% at any time during pregnancy, with frequencies declining across the three trimesters (1.8%, 0.9%, 0.7%). Cannabis use was most prevalent among mothers of children with ASD (4.6%) followed by mothers of children with DD (2.6%) and controls (2.0%). After adjusting for maternal race/ethnicity, education, and tobacco use during pregnancy, cannabis use was not significantly associated with ASD risk (1.76; 95%CI, 0.78, 3.97). Further preliminary analyses revealed that tobacco use operated in models both as a confounder and effect modifier (p=0.01). There was evidence of a multiplicative effect between tobacco and cannabis use on the likelihood of ASD; exposure to both substances during pregnancy compared to neither significantly increased the risk of ASD whereas exposure to either one alone did not. However, the stratified data are sparse and results are preliminary. Cannabis use was not associated with DD.

Conclusions: Widespread legislation decriminalizing cannabis use and enhancing availability has led to dramatic increases in use and a growing perception that cannabis exposure – both overall and in pregnancy – is safe. Our findings suggest that fetal exposure to cannabis alone does not increase ASD risk. However, the combined use of cannabis and tobacco may be hazardous to fetal neurodevelopment.

127 **184.127** Maternal Metabolic Conditions and ASD: Comparing Associations from High-Risk and General Populations

P. Krakowiak[1], *D. Tancredi*[2], *R. L. Hansen*[3], *I. Hertz-Picciotto*[4] *and C. K. Walker*[5], *(1)UC Davis, Sacramento, CA, (2)UC Davis School of Medicine, Sacramento, CA, (3)University of California Davis, Davis, CA, (4)University of California at Davis, Davis, CA, (5)University of California, Sacramento, CA*

Background: The association between maternal metabolic dysfunction – in the form of obesity, hypertensive disorders, diabetes or specific physiologic biomarkers – and autism spectrum disorder (ASD) is one of the most consistent findings in ASD epidemiology.
Objectives: To compare associations between maternal metabolic conditions and ASD in children in the MARBLES (cohort of high-risk mothers and CHARGE population-based case-control studies in California.

Methods: Participants included 156 mother-child pairs (45 with ASD) from the MARBLES prospective cohort of pregnant women who have a biological child with ASD and followed until the child reaches 36 months; and 676 ASD cases and 467 controls from the CHARGE population-based case-control study. Metabolic conditions in both studies were ascertained using medical records and structured telephone interviews with the mother, and conditions included diabetes (type 2 or gestational), hypertension (chronic or gestational, preeclampsia), and prepregnancy obesity (body mass index ≥30). In both studies, ASD diagnosis was assessed with Autism Diagnostic Observation Schedule (ADOS) and Autism Diagnostic Interview–Revised (ADI-R); typical development was determined using the Mullen Scales of Early Learning (MSEL) and Vineland Adaptive Behavior Scales (VABS), with composite scores ≥70 on both assessments.

Results: Preliminary findings showed a higher prevalence of metabolic conditions in MARBLES compared with CHARGE among mothers whose child was diagnosed with ASD. Overall, 47% of MARBLES mothers were burdened with metabolic conditions (diabetes, hypertensive disorder, and/or obesity) in contrast to 35% of CHARGE mothers. Twenty-two percent of MARBLES mothers, compared to 9.8% of CHARGE mothers, had diabetes (mainly the gestational form). Metabolic conditions were also more prevalent in MARBLES mothers of typically developing children in contrast to CHARGE, with 38% compared to 25% affected. Time trends, population composition, and the choices in comparison groups will be evaluated and discussed.

Conclusions: These comparisons are unique in that the two analyses employ the same extensive exposure and outcome ascertainment techniques. This allows an analysis focused on the influence of study design, population and time frame on the association between maternal metabolic conditions and ASD. The CHARGE case-control design enrolled children with specific diagnoses who may or may not have had siblings, while the MARBLES enriched cohort design recruited families with a ASD-affected child and assessed neurodevelopmental outcomes in subsequent offspring. Compared with CHARGE, MARBLES pregnancies occurred later temporally; mothers were likely to be older; and children diagnosed with ASD became part of multiplex families, which are more likely to have shared genetic risk factors. Analyses restricted to overlapping birth years and adjusted for maternal education, and race/ethnicity are planned, as is a comparison of multiplex and simplex CHARGE families.

128 **184.128** Maternal Exposures Associated with Autism Spectrum Disorder in Jamaica

M. A. Bach[1], *M. E. Samms-Vaughan*[2], *M. Lee*[3], *J. Bressler*[4], *M. Hessabi*[1], *M. L. Grove*[5], *S. Pellington*[2], *C. Coore Desai*[6], *J. A. T. Reece*[6], *K. A. Loveland*[7], *E. Boerwinkle*[8] *and M. H. Rahbar*[3], *(1)Biostatistics/Epidemiology/Research Design (BERD) core, Center for Clinical and Translational Sciences (CCTS), The University of Texas Health Science Center at Houston, Houston, TX, (2)Department of Child & Adolescent Health, The University of the West Indies, Mona Campus, Kingston, Jamaica, (3)Division of Clinical and Translational Sciences, Department of Internal Medicine, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (4)Human Genetics Center, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (5)Department of Epidemiology, Human Genetics, and Environmental Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX, (6)Department of Child & Adolescent Health, The University of the West Indies, Kingston, Jamaica, (7)Department of Psychiatry and Behavioral Sciences, McGovern Medical School, The University of Texas Health Science Center at Houston, Houston, TX, (8)Department of Epidemiology, Human Genetics, and Environmental Sciences, Human Genetics Center, University of Texas School of Public Health at Houston, Houston, TX*

Background: Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder with poorly defined etiology. Many genetic and environmental factors may be involved in the manifestation of ASD, and most cases are thought to result from gene-environment interactions. Since neurodevelopment begins during the first few weeks of pregnancy and continues after birth, exposures experienced by the mother during pregnancy or breastfeeding have the potential to interrupt fetal and infant neurodevelopmental mechanisms and possibly contribute to disorders such as ASD. Maternal exposures that are believed to have adverse effects on neurodevelopment include bacterial and viral infections, physical trauma, and pesticides and other products containing volatile organic compounds.

Objectives: To investigate the associations of ASD in Jamaican children with maternal exposures, including fever over 101ºF or infection requiring antibiotics, physical trauma such as a car accident or fall, degreasers, oil-based paints, paint solvents, and pesticides or herbicides.

Methods: We used data from 298 pairs of Jamaican children 2-8 years of age enrolled in the Epidemiological Research on Autism in Jamaica (ERAJ) or ERAJ- Phase II matched case-control studies to assess the associations of maternal exposures with ASD in Jamaican children. Conditional logistic regression models were used for all crude and adjusted analyses. Potential confounders were included in the model if the magnitude of the adjusted matched odds ratio (MOR) differed from the crude MOR by ≥10% or if they are considered important potential confounders according to published literature. We also used conditional logistic regression models to investigate interactions between maternal exposures in relation to ASD in Jamaican children.

Results: After adjusting for potential confounders, maternal exposures to fever or infection (adjusted MOR = 3.12, 95% CI: 1.74 – 5.60), physical trauma (adjusted MOR = 2.02, 95% CI: 1.01 – 4.05), and oil-based paints (adjusted MOR = 1.99, 95% CI: 1.14 – 3.46) were significantly associated with ASD in the children. Further investigation revealed that maternal exposure to oil-based paints may be an effect modifier for the relationship between maternal exposure to pesticides or herbicides and ASD. Specifically, the association between maternal exposure to pesticides or herbicides and ASD in Jamaican children was stronger among those with maternal exposure to oil-based paints (MOR = 2.45, 95% CI: 1.41 – 4.26) compared to those without maternal exposure to oil-based paints (MOR = 1.74, 95% CI: 1.29 – 2.35).

Conclusions: Our findings suggest that maternal exposures to fever or infection, physical trauma, and oil-based paints occurring from 3 months before conception until the end of breastfeeding may be associated with ASD in Jamaican children. Additionally, maternal exposure to oil-based paints may modify the association between maternal exposure to pesticides or herbicides and ASD in Jamaican children. These findings require replication in other populations.

129 **184.129** Maternal Infection and Fever during Pregnancy and Risk of Autism Spectrum Disorder: Findings from the Study to Explore EARLY Development (SEED)

L. A. Croen[1], *Y. Qian*[1], *P. Ashwood*[2], *O. Zerbo*[3], *D. Schendel*[4], *J. A. Pinto-Martin*[5], *M. D. Fallin*[6], *S. E. Levy*[7], *L. Schieve*[8], *M. Yeargin-Allsopp*[8] *and K. R. Sabourin*[9], *(1)Division of Research, Kaiser Permanente, Oakland, CA, (2)MIND Institute, University of California, Davis, Davis, CA, (3)Kaiser Permanente, Oakland, CA, (4)Public Health, Aarhus University, Aarhus, Denmark, (5)University of Pennsylvania, Philadelphia, PA, (6)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (7)Division of Developmental and Behavioral Pediatrics, Center for Autism Research, Children's Hospital of Philadelphia; Perelman School of Medicine at the University of Pennsylvania, Philadelphia, PA, (8)Centers for Disease Control and Prevention, Atlanta, GA, (9)University of Colorado Anschutz Medical Campus, Aurora, CO*

Background: Evidence from animal and human studies indicates that in utero exposure to maternal immune activation can adversely impact neurodevelopment. Maternal infection and fever during pregnancy have been implicated in the etiology of autism spectrum disorder (ASD) in several studies; however, studies have not been able to separate the effects of fever itself from the impact of a specific infectious organism on the developing brain.

Objectives: To investigate specific types of infection during pregnancy, the timing of exposure, and the impact of fever associated with those infections, and their association with ASD and other developmental disorders (DD) in the child.

Methods: The study population was drawn from the Study to Explore Early Development, a multi-site case-control study conducted in six sites across the United States among children born between 2003-2006. Three groups of children were enrolled at 2-5 years of age. For each enrolled child, final study group classification (ASD, DD, general population control (POP)) was determined by an in-person standardized developmental assessment. Infection and fever during pregnancy were ascertained via maternal interview conducted over the telephone shortly after study enrollment and review of maternal medical records. For each infection reported, the mother was asked to specify the timing during pregnancy, the types of medications taken, and whether fever was present. Infection was classified according to microorganism type (e.g. bacterial, viral, etc.) and organ system affected. For each exposure definition, separate unadjusted and adjusted logistic regression models were run to estimate the association with ASD (vs. POP) and DD (vs. POP) by trimester of exposure. Covariates included in adjusted analyses were maternal race/ethnicity, education, age at delivery, psychiatric condition history, and hypertension, household income during pregnancy, child’s sex, and study site.

Results: The final analytic sample included 606 with ASD, 856 with DD, and 796 POP. Approximately 60% of mothers in each study group experienced an infection during pregnancy. Bacterial infection was the most common maternal infection type during pregnancy, occurring in roughly a third of the population, and significantly more often in mothers of children with ASD than mothers of POP controls (36.3% vs. 31.3%, P=0.05). After adjustment for covariates, maternal infection anytime during pregnancy was not associated with ASD or DD. No significant associations with ASD or DD were observed for infections with specific organ systems or specific microorganism types in any time period. However, second trimester infection accompanied by fever was associated with approximately 2-fold increase in odds of ASD (adjusted odds ratio=2.19, 95% confidence interval 1.14-4.23). Neither infection with fever nor infection without fever during pregnancy increased risk for DD.

Conclusions: Our findings suggest that maternal infection with fever in the second trimester is associated with ASD. These findings suggest that perhaps the immune response rather than the infectious agent is etiologically relevant. Future studies with increased sample size could help provide more detailed analyses on type and timing of maternal exposure to infection and fever and specific developmental outcomes in the child to elucidate potential biologic mechanisms underlying the associations reported here.

130 **184.130** Maternal Prenatal Vitamin Use and Risk for Autism Spectrum Disorder in the Marbles Prospective Study of Enriched-Risk Siblings

R. J. Schmidt[1,2], *A. M. Iosif*[1], *E. Angel*[1] *and S. Ozonoff*[3], *(1)Public Health Sciences, University of California Davis, Davis, CA, (2)MIND Institute, University of California, Davis, Sacramento, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA*

Background:

In population-based studies, maternal periconceptional folic acid intake has been inconsistently associated with reduced risk for autism spectrum disorder (ASD) in the child. No study to date has examined the association with recurrence risk in a prospective study of enriched-risk families having children with ASD.

Objectives:

To examine whether maternal prenatal vitamin supplementation was associated with decreased ASD risk in subsequent siblings of children with ASD.

Methods:

Design: MARBLES (Markers of Autism Risk in Babies: Learning Early Signs) prospective pregnancy cohort study of younger siblings of children with ASD who were born from 2006-2013 and followed up to 3 years of age.

Setting: Participants within driving distance to the University of California Davis MIND Institute in Sacramento, California recruited primarily from the families receiving services for children with ASD in the Department of Developmental Services.

Participants: 205 younger siblings at high risk for ASD born to 189 mothers in the MARBLES cohort study by December 31, 2013 and received algorithmic clinical diagnoses at 3-years.

Exposure: Prenatal vitamin use prospectively collected through maternal interviews, including information which months they were taken from 6 months before pregnancy, throughout pregnancy, and while breastfeeding, how often they were taken, and at what dose.

Primary Outcome: Algorithmic diagnosis of ASD, other non-typical development (Non-TD), or typical development was determined based on scores on the Autism Diagnostic Observation Schedule and the Mullen Scales of Early Learning.

Results:

Children whose mothers reported taking a prenatal vitamin during the first month of pregnancy were less likely to be diagnosed with ASD than children whose mothers did not report taking a prenatal vitamin in pregnancy month one ($RR_{adjusted}$ = 0.47 [95% CI, 0.25 to 0.78]).

Conclusions:

Taking prenatal vitamin supplements daily during the first month of pregnancy could reduce ASD in subsequent high-risk children. Additional research is needed to confirm these results and investigate mechanisms to inform public health recommendations for ASD prevention in affected families.

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184.131 Maternal Thyroid Anomalies and Risk of ASD

R. S. Rotem[1], *G. Chodick*[2], *M. Davidovitch*[3], *R. Hauser*[1], *B. A. Coull*[1], *G. Koren*[2] *and M. Weisskopf*[1], *(1)Harvard T.H. Chan School of Public Health, Boston, MA, (2)Maccabi Institute for Research and Innovation, Tel Aviv, Israel, (3)Medical Division, Maccabi Healthcare Services, Tel Aviv, Israel*

Background:

Thyroid hormones are essential for appropriate fetal brain development. The hormones play pivotal roles in numerous key neurodevelopmental processes, including fetal neural cells migration and synapse formation. Some preliminary evidence suggests that hypothyroidism or hypothyroxinemia is associated with autism spectrum disorders (ASD), but available data are inconsistent and rely heavily on cross-sectional observations. Moreover, the fetus is dependent on maternal supply of thyroid hormones during the first months of gestation. Very low levels of maternal thyroid hormones have been associated with reduced IQ and cretinism in the child, but the effects of more minor maternal thyroid conditions are less clear.

Objectives:

To evaluate the risk of ASD in children born to mothers with thyroid anomalies, and the relation between maternal thyroid hormone levels during pregnancy and risk of ASD.

Methods:

The study included 436,188 singleton pregnancies ending in a live birth occurring between January 1, 1999 through December 31, 2013 in a large sick fund in Israel. Data on ASD diagnoses, maternal thyroid conditions, drug dispensing information and lab results were obtained through December 31,2016. Mothers with thyroid conditions were identified through ICD-9 codes with subsequent validation of the diagnoses through review of medication dispensing data and laboratory results. ASD cases were identified through ICD-9 codes with further verification of case status through review of medical records. Analyses of thyroid abnormality diagnoses were performed using generalized estimating equation (GEE) logistic regression models with adjustment for potential confounders. Analysis of gestational lab test results was performed using general additive models using penalized splines.

Results:

Mothers who had ever experienced hypothyroidism were at a higher risk of giving birth to a child with ASD compared to women without thyroid conditions (OR=1.24, 95% C.I:1.08-1.41). Further stratification based on the time of first diagnosis relative to the birthdate of the child suggested that the effect was mostly driven by diagnoses given prior to birth (OR=1.27, 1.08-1.50), although borderline statistically significant effects were also seen with diagnoses first given post-birth (1.18, 0.98-1.42). Analysis of pregnancy TSH levels and ASD risk suggested an inverted U-shaped dose-response curve, with higher risks at moderately-elevated levels but not at the highest levels. Associations between hyperthyroidism and ASD were less consistent.

Conclusions:

The results suggest that maternal hypothyroidism could be a risk factor for ASD. The attenuated effects at the highest pregnancy TSH levels could be due to the higher prevalence of women subsequently treated with thyroid replacements, or indicate other differences in this subgroup. This attenuation may suggest that starting treatment for mothers with borderline low thyroid dysfunction could be beneficial and potentially indicate that thyroid screening in pregnant women, especially those with a history of thyroid anomalies, should be considered. Since thyroid levels are highly influenced by numerous environmental triggers, the possible role of maternal thyroid anomalies in ASD needs further exploration.

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184.132 Maternal Vitamin D Levels during Pregnancy and Autism Spectrum Disorders (ASD)

G. C. Windham[1], *M. Pearl*[1], *V. Poon*[2], *J. Carver*[2], *D. Eyles*[3], *K. Lyall*[4], *K. L. Jones*[5], *M. Kharrazi*[6] *and L. A. Croen*[7], *(1)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (2)Sequoia Foundation, La Jolla, CA, (3)Queensland Brain Institute, University of Queensland, St Lucia, Australia, (4)A.J. Drexel Autism Institute, Philadelphia, PA, (5)University of California at Davis MIND Institute, Davis, CA, (6)CA Department of Public Health, Richmond, CA, (7)Division of Research, Kaiser Permanente, Oakland, CA*

Background: Vitamin D deficiency has increased concurrently with the rise in prevalence of Autism Spectrum Disorder (ASD), and evidence for vitamin D's role in brain and immune function has led to interest in potential associations with ASD. Prior studies of ASD have examined surrogates of vitamin D or levels after diagnosis, not during critical fetal developmental periods. Published studies with Vitamin D measured during pregnancy have not been specific to ASD, but rather for broader aspects of neurodevelopment. We previously reported no association of newborn Vitamin D levels and ASD and here examine another susceptibility period.
Objectives: To examine maternal Vitamin D levels in mid-pregnancy in association with ASD in offspring, and to explore potential differences by phenotype (ASD with and without comorbid intellectual disability (ID)) or demographic sub-groups.

Methods: Data are drawn from a case-control study among children born 2000-2003 in Southern California who had banked biospecimens available from routine genetic screening. Autism cases were identified through the CA Department of Developmental Services and controls were selected from general population births in the same area and birth years. 25-Hydroxyvitamin D (OHD) was measured in serum (N=534 cases, 421 controls) collected at 14-20 weeks gestation using a sensitive assay (as OHD2 and OHD3, then summed). OHD levels were categorized as deficient (<50nmol/L), insufficient (50-74nmol/L) and sufficient (≥75nmol/L, referent category), and also examined continuously. Linearity was assessed through generalized additive models and addition of a quadratic term in logistic models. Crude and adjusted odds ratios (AOR) and 95% confidence intervals (95%CI) were calculated.

Results: OHD was deficient in 9.5% and insufficient in 25.6% of mothers, with AORs (95%CI) for ASD of 0.79 (0.49-1.3) and 0.94 (0.68-1.3) respectively. There was also no association of linear continuous OHD levels. Results were consistent for ASD with or without ID. However, when stratified by maternal race/ethnicity, non-Hispanic Whites had the expected protective association with higher OHD levels (AOR=0.92, 95%CI=0.85-0.99 per 10nmol/L OHD), but other race/ethnic groups did not. Upon further exploration, a non-linear pattern, inverted j-shape, was observed overall between OHD and ASD (adjusted beta for quadratic term = -0.0001, p=0.02), with the peak around 100 nmol/L. This pattern was similar when examining OHD3 separately or for ASD by comorbid ID. By maternal race/ethnicity, this pattern was attenuated in the non-Hispanic Whites and more apparent in "other" race/ethnic groups.

Conclusions: In one of the first large studies to examine prenatal Vitamin D levels in relation to clinical ASD, we saw no association overall with Vitamin D deficiency/insufficiency or continuous levels, in contrast to hypotheses. However a significant non-linear association was observed and high levels of Vitamin D appear to be protective, particularly among White mothers. Race differences may in part be due to variation in OHD levels, with White women having a distribution shifted to higher levels. The suggestive finding of protective effects as well at lower Vitamin D levels requires further investigation to explain. Future analyses will also examine co-exposures to organo-halogenated compounds and genetic interactions.

133 **184.133** Mental Comorbidities, Psychotropic Medication Use and Healthcare Resource Use in Autism Spectrum Disorder: A Matched Cohort Study in the United Kingdom.

R. Houghton[1], *C. Liu*[2] *and F. Bolognani*[3], *(1)Real World Data Science, F.Hoffman La-Roche Ltd, Basel, Switzerland, (2)Real World Data Science, Roche (China) Holding Ltd, Shanghai, China, (3)Neuroscience, Ophthalmology, and Rare Diseases (NORD), Roche Pharma Research and Early Development, Roche Innovation Center Basel, F. Hoffmann - La Roche AG, Basel, Switzerland*

Background: Psychiatric comorbidities and use of psychotropic medications are common among patients with autism spectrum disorder (ASD). Most previous work in this area used data from the United States, and few studies have compared medication use in ASD to control groups.
Objectives: The objective of this study was to investigate psychiatric comorbidities, psychotropic medication use and resource utilization in patients with ASD in the United Kingdom (UK), as well as to compare these outcomes to the general population and to patients with attention deficit hyperactivity disorder (ADHD). We also estimated associations between patient characteristics and the probability of being prescribed psychotropic medications in ASD.

Methods: We conducted a cohort study using primary care data from the Clinical Practice Research Datalink (CPRD) database. The main study period was the calendar year 2015. We identified a prevalent cohort of patients with ASD and two comparison cohorts -- namely, a general population and an ADHD cohort, both matched by age, sex and region. We described mental comorbidities, use of psychotropic medications, and healthcare utilization (GP visits and referrals to secondary care) in all three cohorts. For the ASD cohort we used regression models to investigate patient characteristics associated with psychotropic medication use, polypharmacy (2 classes of psychotropic medications at the same time) and the number of visits to the GP. Lastly, we compared medication and resource use in ASD to the control cohorts using conditional logistic regression models.

Results: A total of 10,856 ASD patients were included in the study. The majority were male (81%) and the mean (SD) age was 18.76 (11.86) years. Psychiatric comorbidities were recorded in 41.5% of all ASD patients, with sleep disturbances (14.9%) and ADHD (13.8%) being the most common. Thirty-two percent of ASD patients received a psychotropic medication prescription, with anxiolytics/sedatives/hypnotics (14.2%), antidepressants (12.8%) and antipsychotics/tranquilizers (8.3%) being the most common. Eighty-six percent of ASD patients had visits to primary care, while 18.9% were referred to secondary care. Increased age and female gender increased the likelihood of both psychotropic medication use and healthcare resource utilization, as did the majority of the psychiatric comorbidities studied.

ASD patients were more likely to take psychotropic medications and visit primary care more frequently than the general population. However they were less likely to have these outcomes compared to ADHD patients. For drug use, this was largely driven by the prescription of stimulants.

Limitations: The study is limited to data entered in primary care.

Conclusions: People with ASD were more likely to receive medication and use healthcare resources than the general population, but less likely, compared to people with ADHD. Psychiatric comorbidities and psychotropic medication use are common in ASD in the UK. In a 1-year period, 1/3 of ASD patients received a primary care prescription for a psychotropic medication.

134 **184.134** Migration and Risk of Autism and Intellectual Disability – Preliminary Findings from the Stockholm Youth Cohort

C. Magnusson[1]*, H. Heuvelman*[2]*, M. Morinaga*[1]*, A. C. Hollander*[1]*, C. Dalman*[3] *and D. Rai*[4]*, (1)Karolinska Institutet, Stockholm, Sweden, (2)University of Bristol, Bristol, United Kingdom of Great Britain and Northern Ireland, (3)Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden, (4)Population Health Sciences, Bristol Medical School, Centre for Academic Mental Health, Bristol, United Kingdom*

Background: Parental migration status is an emerging risk factor for autism spectrum disorder (ASD) and perhaps also for intellectual disability (ID). The foundation of any association is, however, not established.
Objectives: To elucidate whether migration status is universally linked to neurodevelopmental disorders or specifically to ASD or ID, and how any link varies with parental region of origin. In addition, to investigate how any relationships may be explained by migration-related by comparing risks between full siblings discordant for maternal migrant status (siblings being born in Sweden versus abroad).

Methods: Total population study based on linkages of health and administrative registers, including 545,648 individuals born in 1984-2007, who were resident in Stockholm County, Sweden for at least four years through 2011. Migration status was defined according to parental country of birth and timing of maternal immigration to Sweden in relation to the index persons' birth. Odds ratios (ORs) from total cohort analyses were adjusted for age, sex, maternal and paternal age, using generalized estimating equation models to account for family clustering. Sibling comparisons were adjusted for sex.

Results: In all, 11,163 and 6,845 individuals were respectively identified with diagnoses of ASD and ID during follow-up. Children of migrant parents had an increased risk of autism with co-morbid ID (aOR 1.69, 95% CI 1.54 - 1.85) and of ID only (aOR 1.74, 95% CI 1.61 - 1.87), but a decreased risk of ASD without ID (aOR 0.56, 95% CI 0.52 - 0.60).These associations were particularly pronounced in children of parents from low-income countries. Timing of maternal migration in relation to birth of the index child appeared to influence the risk of ASD (but not ID only), such that the risk increased with increasing nearness of immigration to the timing of pregnancy. Individuals born in Sweden had a twofold increase in risk of ASD regardless of comorbid ID compared to their full siblings born abroad, while no such discrepancy for ID only was observed.

Conclusions: Parental origin in low-income countries is strongly associated with ID, with or without ASD in Stockholm County – but the explanatory mechanisms may differ between ASD with ID and ID only. ASD without ID is comparatively less often diagnosed in children of migrants to Sweden.

135 **184.135** Neonatal Markers of Infant Behavior and Quantitative Traits Related to Autism Spectrum Disorders in a Longitudinal Birth Cohort Study

S. Sagiv[1]*, K. Kogut*[1]*, Y. S. Kim*[2]*, J. Deardorff*[1] *and B. Eskenazi*[1]*, (1)Center for Environmental Research and Children's Health, UC Berkeley School of Public Health, Berkeley, CA, (2)University of California San Francisco, San Francisco, CA*

Background: Identification of antecedent markers of neurodevelopmental disorders like autism spectrum disorders (ASD) can help to target interventions at earlier ages. Prospective cohort studies that assess children in infancy are uniquely positioned to examine early markers in relation to quantitative traits related to ASD later in childhood.
Objectives: To investigate associations of infant behavior, including the capacity to regulate internal state and respond to environmental stimuli, on quantitative traits related to ASD, measured in adolescence.

Methods: The CHAMACOS (Center for Health Assessment of Mothers and Children of Salinas) longitudinal birth cohort study investigates the health of pregnant women and their children living in a predominantly Mexican-American agricultural community. We recruited pregnant women ≥18 years old and <20 weeks gestation between October 1999 and October 2000 at prenatal clinics serving the Salinas Valley. Of the 528 live births in CHAMACOS, we administered the Brazelton Neonatal Behavioral Assessment Scale (NBAS) to 419 infants (median (25th-75%ile) age: 9 (1-25) days). The NBAS measures 27 behavioral and 18 reflex items; we used the Lester scoring method (Lester et al. 1982) to distill these items into seven clusters: Habituation, Orientation, Motor, Range of State, Regulation of State, Autonomic Stability, and Reflex. When the CHAMACOS children were age 14 years, parents of 212 children with an NBAS were administered the Social Responsiveness Scale, Second Edition (SRS-2), a rating scale that quantifies the frequency of traits in their children related to social behavior and stereotypic behavior/restricted interests. We fit multivariable regression models to estimate associations of NBAS cluster scores with SRS-2 scores, adjusting for infant's age (days) at NBAS, child's sex, number of years the mother lived in the U.S., language the mother used to complete the SRS-2, maternal depression and a measure of the home environment (HOME score).

Results: Mean (standard deviation) SRS-2 Total T-score for 212 children with an NBAS was 55.5 (7.4), with 23 children scoring at or above the cut-off at which screening for ASD is recommended (raw score of 70). We found associations of poorer regulation in infancy (e.g., less self-quieting, poorer consolability) with higher odds of maternal-reported adolescent ASD traits in the range recommended for ASD screening (OR=1.60; 95% CI: 1.02, 2.51). In contrast, infants with poorer motor performance (e.g. less physical maturity, lower tone) had lower odds of meeting the threshold for ASD screening in adolescence (OR=0.43; 95% CI: 0.19, 0.99).

Conclusions: We found that regulation of state and motor function in infancy were associated with quantitative traits related to ASD in adolescence. Data from this longitudinal cohort contribute to a growing literature suggesting that early life markers may help to identify children that will later develop symptoms consistent with a diagnosis of ASD. This can have important implications for targeting intervention earlier with the goal of improving the lives of individuals living with ASD.

136 **184.136** Placental Trophoblast Inclusions Do Not Predict Adverse Neurodevelopment in the Marbles High-Risk Pregnancy Cohort

C. K. Walker[1]*, K. Kim*[2]*, S. Ozonoff*[3] *and I. Hertz-Picciotto*[4]*, (1)University of California, Sacramento, CA, (2)Division of Biostatistics, Department of Public Health Sciences, University of California, Davis, Cavis, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (4)University of California at Davis, Davis, CA*

Background: Presence of placental trophoblast inclusions (TIs) has been shown to predict autism spectrum disorder (ASD) *risk* status, but there are no data to support its potential as a biomarker for *actual* adverse neurodevelopment.
Objectives: The purpose of this study was to determine whether the presence and/or frequency of placental TIs is associated with adverse neurodevelopmental outcomes in a population at enhanced risk for ASD.

Methods: Placental samples were obtained from 117 births in the MARBLES (Markers of Autism Risk in Babies – Learning Early Signs Study) longitudinal ASD-risk birth cohort between January 11, 2008 and January 10, 2011. Four slides per specimen were examined histologically in random order for TIs, identified as a central syncytiotrophoblast nucleus surrounded by one or more cytotrophoblasts. TIs were summed across slides. Child development was evaluated at 36 months of age with Autism Diagnostic Observation Schedule (ADOS) and Mullen Scales of Early Learning (MSEL). Outcome was established by two methods: 1) clinical best estimate (CBE), categorized as ASD (n=21), other developmental concerns (ODC, n=20), or typical development (TD, n=63); and 2) an algorithm incorporating multiple clinical assessments, ADOS and MSEL scores that classified diagnoses as ASD (n=29), non-typical development (NTD, n=9) and TD (n=55). Children with final outcomes were included for statistical analysis. The pathology team was blinded to outcome and those assessing neurodevelopmental function were blinded to TI status.

Multinomial logistic regression models were performed to assess the association between TI frequency (continuous and dichotomous [0-1 negative and ≥2 positive]) and child outcome defined by CBE and algorithm, with and without adjustment for important covariates. We explored each covariate in a stepwise fashion and retained only those that altered the TI coefficient by at least 20%, considering the sample size. Final models included maternal age, education, race/ethnicity and diabetes; paternal age, and child sex as covariates.

Results: TI presence did not predict child developmental outcome in any of the permutations analyzed. For example, results comparing odds of ASD v TD by number of TIs were null and did not vary by outcome categorization (CBE: 0.84, 0.61-1.15 and Algorithm: 1.02, 0.84-1.24]). Both univariate and covariate-adjusted statistical analyses failed to identify any significant association between TIs and either ASD or more subtle neurodevelopmental impairments.

Conclusions: Because TIs have been associated with being *at risk* for ASD in the same way that having an older affected sibling is a marker for increased susceptibility, TIs may identify a predisposition, genetic or otherwise, for ASD. However, placental TIs demonstrated no association with the development of ASD or of other non-typical neurodevelopmental outcomes. The evidence to date provides no justification for use of placental TI presence as a predictive biomarker for ASD in either at-risk or low-risk populations.

137 **184.137** Predictors and Impact of Non-Response in a Population-Based Case Control Study: Findings from the Georgia Study to Explore Early Development

*L. Schieve, S. Harris, M. J. Maenner, **A. Alexander** and N. Dowling, Centers for Disease Control and Prevention, Atlanta, GA*

Background: Participation in epidemiologic studies has declined over time, raising concerns about selection bias. While estimates derived from epidemiologic studies have been shown to be robust under a wide range of scenarios, additional empiric study is needed. Empiric assessments of non-response are inherently challenging given the lack of information available on non-responders in most studies, including those of autism spectrum disorder (ASD). We explore factors associated with non-participation and its potential impact on associations between ASD and various risk factors in the Georgia Study to Explore Early Development (GA SEED).
Objectives: N/A

Methods: GA SEED is a population-based case-control study of risk factors for ASD that recruited children at age 2-5 years residing in the metropolitan-Atlanta area. Children with ASD were identified from multiple schools and healthcare providers serving children with disabilities; children from the general population (POP) were randomly sampled from birth records. Recruitment was via mailed invitation letter with follow-up phone calls. Eligibility criteria included birth and current residence in study area and an English-speaking caregiver who could provide legal consent. Many children identified for potential inclusion could not be contacted. We examined demographic and perinatal factors associated with study completion using birth certificate data available for both participants and non-participants. Using the birth-certificate data, we also compared ASD-risk factor associations for the final sample of children who completed the study with the initial sample of all likely ASD and POP children invited to potentially participate in the study. Finally, we derived post-stratification sampling weights for participants who completed the study and compared weighted and unweighted associations between ASD and two maternally-reported factors collected post-enrollment.

Results: Maternal age >35 years and maternal education >12 years were independently associated with participation in the POP group. Maternal education >12 years was independently associated with participation in the ASD group. However, numerous other demographic and perinatal factors were not associated with participation. Moreover, unadjusted and adjusted odds ratios for associations between ASD and several demographic and perinatal factors were similar between the final sample of study completers and the total invited sample. Odds ratios for associations between ASD and maternally-reported reproductive health factors -- infertility and reproductive stoppage -- were also similar in unweighted and weighted analyses of the study completion sample.

Conclusions: We demonstrated empirically that while select demographic factors were directly associated with participation in a population-based case-control study of ASD risk factors, other demographic and biologic factors were not. Moreover, associations of biologic factors – both perinatal factors on the birth certificate and reproductive health history factors captured via maternal interview – were not impacted by differential participation. Additionally, while differential participation limited our ability to examine associations between ASD and two demographic factors – maternal age and education – this study demonstrated that the effect estimates for associations with several other demographic factors were unbiased. SEED is an important source of information on ASD risk factors. The findings from this analysis of GA SEED data indicate that the estimates from most SEED risk factor analyses are robust.

138 **184.138** Quantitative Autistic Traits Index Silently Transmitted ASD Risk across Generations

*M. V. Wong[1], D. Gray[2], N. Marrus[3] and **J. N. Constantino**[3], (1)Psychiatry, Washington University in St. Louis, St. Louis, MO, (2)Washington University in St. Louis, St. Louis, MO, (3)Washington University School of Medicine, St. Louis, MO*

Background: Multiple previous studies have demonstrated familial aggregation of quantitative autistic traits (QATs) in siblings and parents of individuals with ASD (Constantino et al, 2010, Lyall et al., 2014; Page et al., 2016).
Objectives: Here, we build upon the existing knowledge base via two new transgenerational studies examining the extent to which inherited behavioral phenotypes index causal influence for ASD.

Methods: The first transgenerational sample was comprised of epidemiologically-ascertained toddler twins and their parents. Measurement of QATs of parents and their children was implemented using the Social Responsiveness Scale-2 (SRS). Additionally, the toddlers were behaviorally phenotyped using eye-tracking measures of social visual engagement (SVE), which exhibit extremely high heritability and are strongly associated with the development of clinical autistic syndromes (Constantino et al., *Nature* 2017). In the second study, data from 150 multiplex ASD families enrolled in prior research were reviewed for transmission patterns strongly suspicious for silent maternal transmission of genetic risk, which is a putative mechanism for the so-called "female protective effect."

Results: Analyses in toddlers demonstrated that the biparental mean for QATs indexed by parental SRS scores predicted the SRS scores of their children at 36 months (r=.355, p<.001, n=142); heritability of the latter estimated from twin data was on the order of 0.85. Notably, QATs and SVE scores, based on total fixation time for looking at eyes, were uncorrelated (r=.037, p=.746) and equally heritable, indicating that SVE measurements constitute a separate quantitative behavioral phenotype indexing genetic risk for ASD.

In the second study, 15 of 150 multiplex families manifested an intergenerational transmission pattern in which all affected individuals were males and each mother of a son with ASD also had a male first degree relative (in her own generation or the preceding generation; i.e. among her brothers or father). Average SRS T-scores of such "suspected-silent-transmitter" mothers were 11 points greater than mothers in multiplex ASD families who did not fit this pattern of transmission, indicating a higher burden of autistic traits (t(9.3)=2.67, p=.025, effect size=.47) and corresponding to a raw SRS score 12 points greater than the general population mean. We note also that in an evolving prospective collection of second generation offspring of the sisters of males with ASD (who have previously been shown to manifest aggregations of sub clinical autistic traits), we have observed a rate of confirmed and suspected ASD in their male offspring of 24% in comparison to a rate of 10% in female offspring.

Conclusions: These data significantly expand upon the accumulated knowledge base on quantitative behaviors traits that index causal liability for ASD, and that might ultimately be utilized to identify females of childbearing age—particularly those in ASD-affected families—who are at elevated risk for silent transmission of ASD risk to their offspring.

139 **184.139** Recruitment Strategies for SPARK in Oregon

E. Fombonne[1], *L. D. Pacheco*[2]*, S. Mastel*[3]*, B. J. O'Roak*[4]*, L. Huang-Storms*[2]*, K. Headrick*[3] *and L. McMahan*[5]*, (1)Psychiatry, Pediatrics & Behavioral Neurosciences, Oregon Health & Science University, Portland, OR, (2)Oregon Health & Science University, Portland, OR, (3)Institute on Development and Disability, Oregon Health and Science University, Portland, OR, (4)Molecular and Medical Genetics, Oregon Health & Science University, Portland, OR, (5)Communications, Oregon Health and Science University, Portland, OR*

Background: Given the heterogeneity of the 'autisms,' very large sample sizes are required to research more homogeneous subgroups stratified by common clinical characteristics and/or by genetic profiles. Simons Powering Autism Research for Knowledge (SPARK) was launched in April 2016 with the goal of assembling a research cohort of 50,000 individuals with ASD recruited by 25 academic centers in the USA, including Oregon Health & Science University. The priority was set on recruiting trios (ASD individual + 2 biological parents) who can then be genetically characterized using whole genome sequencing.

Objectives: OHSU established a number of strategies to disseminate information and encourage ASD subjects and their relatives to sign up for this novel national registry. We targeted newly diagnosed/follow-up patients in the Autism Clinical Program (ACP-p), OHSU patients having a previous ASD ICD code in electronic medical records (OHSU-p), we connected and worked with community organizations, liaised with statewide special education professionals, ran local social media campaigns, and organized special events out of state (OOS) to reach out to a larger population base. Here, our objectives were to identify which recruitment strategies succeeded in achieving completed trio participation (completed registration process, self-reported phenotypic characterization, and successful collection of 3 saliva samples for ongoing genetic analysis).

Methods: Several metrics are regularly issued for each site including: 1) individual accounts created; 2) ASD probands having consented to genetic sample collection; 3) 'potential' trios (missing some consent data forms and/or biological samples); and 4) 'completed' trios (all trio data including usable biological specimen received centrally). Of note, some participants and trios may have joined SPARK without sites being properly credited for their recruitment.

Results: Over 18 months, 2,280 accounts were created and allocated to the OHSU site. Of these, 1,181 ASD probands did consent (or assent) for genetic analysis, including 963 children, 135 independent adults and 83 dependent adults. We could form 801 'potential' trios of whom 306 reached the final stage of full participation in SPARK. The process of registration lasted on average 110 days for 'completed' trios. The recruitment source for the 306 completed trios was: 33.2% for OHSU-p, 24.8% for OOS, 22.5% for ACP-p, and 19.5% for other sources. During the study period, approximately 375 patients were seen in the ACP for diagnosis/follow-up and individually targeted for SPARK participation. Less than 20% of those patients completed the registration despite repeated blast e-mails, systematic inclusion of flyers in family feedback sessions, banners posted in the hospital and in waiting rooms. By contrast, social media campaigns and out-of-state lectures/events accounted for a larger proportion of our recruitment (Figure). Recruitment analysis using other metrics and statistical models will be presented with longer run of data.

Conclusions: Considering Oregon epidemiological estimates (about 15,000 ASD subjects <20 years) and the pre-eminence of the OHSU ACP, relatively few ACP patients enrolled in SPARK. This is in marked contrast with research participation in other childhood diseases (e.g. cancer). Qualitative research to explore reasons for participation or not by our patient population is needed to address this gap.

140 **184.140** Testing the Limits of the SRS-2: Understanding Psychometric Limitations and How the Revised Short Form May Help in Some Ways

A. Kaat[1]*, C. Farmer*[2]*, V. Hus Bal*[3]*, A. Thurm*[2] *and S. Bishop*[4]*, (1)Nisonger Center, Columbus, OH, (2)National Institute of Mental Health, Bethesda, MD, (3)STAR Center for ASD & NDD; Dept of Psychiatry, University of California, San Francisco, San Francisco, CA, (4)University of California San Francisco, San Francisco, CA*

Background:

Because of its perceived dimensional, quantitative structure, the Social Responsiveness Scale (SRS; SRS-2) is widely employed in behavioral and biological studies of individuals with and without autism spectrum disorders (ASD). However, numerous studies have raised concerns that the degree of influence exerted by ASD-nonspecific factors like age, IQ, and behavior problems may affect the construct validity of the SRS. Recently, a short form of the measure was proposed (Sturm et al., 2017). Using an item response theory (IRT) approach, the authors determined that a shorter form may be a more valid unidimensional quantification of social-communication impairments. However, because this work combined samples of affected individuals and controls without testing key assumptions, it is possible that the item parameters were substantially biased. Further, additional evaluation in clinical samples is needed to determine whether short form scores successfully differentiate individuals with ASD from those with non-ASD diagnoses.

Objectives:

We sought to test the psychometric properties of the short form of the SRS proposed by Sturm et al. (2017).

Methods:

We used the IRT procedures employed by Sturm et al. (2017) to evaluate differential item functioning (DIF)-by-diagnosis in a subset of their data [affected individuals from the Simons Simplex Collection (n=2,630) and their unaffected siblings (n=2,273)]. We then evaluated the psychometric performance of the SRS short form in a clinically ascertained sample of children with ASD (n=670) or other neurodevelopmental disorders or psychiatric diagnoses (n=247), drawn from an existing databank (CADB/UMACC).

Results:

Initial examination of the *expected a posteriori* distribution revealed a multimodal distribution of the latent trait measured by the SRS short-form. The component distributions were not themselves normally distributed; although the proband distribution was relatively normal, the siblings comprised a zero-class and a right-skewed distribution. These results suggest that the short form is not valid for use as a quantitative measure in individuals *without* ASD. Further, we were unable to quantify DIF-by-diagnosis without eliminating further items from the SRS short form. In the clinical sample, children with (M±SD=28.58±8.57) and without (M±SD=18.23±9.88) ASD had significantly different SRS short form scores [F(1,890)=237.99, *p*<.0001]. Scores were moderately related to CBCL Internalizing (*r*=0.49, *p*<.0001) and Externalizing (*r*=0.41, *p*<.0001), and were not meaningfully related to nonverbal IQ (*r*=-0.15) or age (*r*=0.11). As previously documented with the SRS long form (Havdahl et al., 2016), children with significant emotional/behavioral problems who *did not* have ASD were indistinguishable from children *with* ASD but no other emotional/behavioral problems (*t*(471)=1.52, *p*=.13). Children with similar levels of emotional and behavioral problems were differentiated by the SRS short form (ASD versus non-ASD, *t*(471)=9.59, *p*<.0001). Further psychometric evaluation of the SRS short form in the clinical sample will be presented.

Conclusions:

As ASD symptoms are increasingly assessed in large-scale studies (e.g., ECHO), and as clinical psychology and psychiatry continue to ease reliance on categorical diagnoses, the appeal of quantitative instruments like the SRS becomes more apparent. However, to prevent misinterpretation, there is a clear need to understand more about the appropriate uses and limitations of this widely used tool.

141 **184.141** Time Windows of Exposure to Neonicotinoids in Parents of Autistic Children

E. Diamond[1] *and J. M. Diamond*[2,3]*, (1)The Wright Institute, Berkeley, CA, (2)Pediatrics, Kaiser Permanente, South San Francisco, CA, (3)Pediatrics, Kaiser Permanente Hospital, South San Francisco, CA*

Background:

Neonicotinoids were first synthesized in the 1980s and introduced into agricultural use and into pet products in the 1990s. Imidacloprid was the first neonicotinoid in widespread use. All are designed to target nicotinic acetylcholine receptors (nAChRs) and these are ubiquitous in humans as well as in insects. While differences between insect and mammalian receptors make them less acutely toxic to humans, effects of preconception and gestational exposures have been suspected. In particular, preconception exposures are understudied, even while the role of de novo (thus predominantly preconception) mutations in association with neurodevelopmental disorders has become increasingly apparent.

Our study nests within a larger study which asks parents of autistic children to answer questionnaires regarding geospatial exposure, health, occupational history, medication use, autism features and severity of their children.

Objectives:

Within our study population, we wanted to compare various time windows of in-home neonicotinoid exposure to each other. The five time windows studied are the three months prior to conception, the three trimesters of pregnancy and the three months postpartum.

Methods:

For broad outreach, we used social media to let parents know of the study. We invited birth mothers of autistic children to answer a questionnaire. Inclusion criteria were a diagnosis of ASD, child's birth in the year 2000 or later and valid consent. The questions regarding neonicotinoid exposure included imidacloprid-containing pet products for flea control. We felt mothers were likely to recall whether they were pet owners during pregnancy, and whether their pet received a flea product through application to the fur. We also asked about indoor pest control and home garden use. Lists of product names were supplied. Responses of "do not recall" or none were always options.

To analyze specific time window specificity of exposure, analysis was first restricted to those who reported exposure to a product in a single time window. We also analyzed exposures among the 32 possible patterns of multiple exposure. Importantly, here we are comparing time windows of exposure, with other time windows of exposure – not exposures of populations with and without autism.

Results:

The questionnaire was completed by 2212 mothers. For imidacloprid containing pet products, 670 (30.3%) recorded specific information regarding timing of exposure, of whom 242 recorded exposure in a single time window. Of these, 143 recorded exposure in only the pre-conception time window, 30 in the first trimester, 24 in the second trimester, 5 in the third trimester and 40 in the postnatal 90-day period. Importantly, this trend was also observed for other neonicotinoid home and garden exposures ($p < 0.001$).

Conclusions:

Our results show highest responses to exposures in the 90-day pre-conception time window. As parents are likely to share the same environment at the time of conception, paternal environmental exposures within this time period may be especially important since de novo mutations in autism are more frequently of paternal origin. Spermatogenesis takes place entirely within this time window. We believe neonicotinoids should be studied for their effects on gamete development in both sexes.

Poster Session
185 - Family Issues and Stakeholder Experiences
11:30 AM - 1:30 PM - Hall Grote Zaal

142 **185.142** A Qualitative Analysis of Psychological Strengths in Parents of Children with Autism Using the Five-Minute Speech Sample

A. L. Maughan *and J. A. Weiss, Psychology, York University, Toronto, ON, Canada*

Background: Despite growing recognition of the importance of taking a strengths-based approach to understanding families of children with autism (Bayat, 2007), research continues to focus on identifying, quantifying, and remediating deficits (Burnham Riosa et al., 2017). This negative focus extends to understanding parent-child relationships and parent functioning. The *Autism-Specific Five-Minute Speech Sample* (AFMSS) is a validated measure for this population that focuses on assessing expressed emotion in family members of children with autism (Benson, Daley, Karlof, & Robison, 2011). Expressed emotion in parents is an indicator of the degree of negative emotionality that is displayed when parents describe their child and the relationship they have with them (Morris, Silk, Steinberg, Myers, & Robinson, 2007). In contrast, the psychological processes of acceptance, mindful awareness and psychological flexibility, core concepts in the framework of Acceptance and Commitment Therapy (ACT; Hayes, Luoma, Bond, Masuda, & Lillis 2006), have been shown to be useful for understanding perspectives of parents of children with other chronic conditions (McCracken & Gauntlett-Gilbert, 2011). These strengths-based concepts in ACT may be relevant to observing positive change in parents of children with autism following intervention.

Objectives: The aim of this study is to assess change in parents' perceptions of their children with autism following participation in therapy, using the strengths-based concepts of acceptance, mindful awareness, and psychological flexibility.

Methods: Sixty parents of children with autism participated in cognitive behaviour therapy with their children. The AFMSS procedure, in which a parent is asked to speak about their child and the relationship they have with them for five uninterrupted minutes, was completed prior to and immediately post-intervention. Speech samples will be qualitatively analyzed using the interpretive phenomenological analysis approach (IPA; Smith, Jarman & Osborn, 1999), in which narrative data is coded for insights into participants' experiences and perspectives, and codes are catalogued and explored for themes. This approach will be used to identify strengths-based themes, including those related to acceptance, mindful awareness and psychological flexibility, and to observe and describe differences between pre- and post-intervention samples.

Results: Speech samples have been collected and transcribed, and qualitative data analysis is ongoing. Based on early data collection, emerging codes that can be identified related to ACT processes include: flexibly reframing their child's difficulties; awareness and insight into their child's emotions; and celebrating small improvements. These codes will continue to be catalogued and mined for overarching patterns or themes as analysis continues.

Conclusions: Results will be discussed in the context of evaluating interventions using a more positive understanding of strengths and change in a population whose experiences are typically only considered from a deficits perspective.

143 **185.143** Associations between Parenting Hassles and Depressive Symptoms in Hispanic and Non-Hispanic Mothers and Fathers of Children with Autism Spectrum Disorder

L. Nichols[1]*, N. Ekas*[2] *and M. Alessandri*[3]*, (1)University of Miami, Psychology, Miami, FL, (2)Texas Christian University, Fort Worth, TX, (3)University of Miami, Coral Gables, FL*

Background:

Parenting stress is associated with increased depressive symptoms in mothers and fathers of children diagnosed with Autism Spectrum Disorder (ASD), but mothers report higher levels compared to fathers (Ozturk, Ricadonna, & Venuti, 2014). The effects of everyday parenting hassles on parental mental health have not been studied. Parenting hassles may have varying effects on depressive symptoms across mothers and fathers. Furthermore, parents' perception of their quality of life is moderated by factors such as ethnicity (Schertz, Karni-Visel, Tamir, Genizi, & Roth, 2016). Thus, ethnicity may demonstrate similar moderating effects on depressive symptoms.

Objectives:

The goal of the current study was to examine whether parenting hassles were associated with depressive symptoms in mothers and fathers of children with ASD, and whether ethnicity (i.e., Hispanic versus Non-Hispanic) moderated this association.

Methods:

Participants included mothers and fathers of 117 children between 2 and 10 years of age with ASD (Hispanic M = 6.49, SD = 2.38; non-Hispanic M = 6.75, SD = 2.28). Participants were recruited from a regional autism center providing resources and support to families of children with ASD across the lifespan. Mothers' ages ranged from 20 to 55 (M = 38.33, SD = 6.05) while fathers' ages ranged from 30 to 62 (M = 41.96, SD = 6.53). Parents were assessed for depressive symptoms using the Center for Epidemiological Studies Depression Inventory (CES-D; Devins et al., 1988; Radloff, 1977). The Parenting Daily Hassles (PDH) scale assessed daily hassles. Although this measure has four subscales, only Frequency and Challenging Behavior subscales were used in this study (Crnic & Greenberg, 1990).

Results:

PROCESS macro moderation analyses were conducted in SPSS for mothers and fathers to determine the effect of parenting hassles, ethnicity, and their interaction on depressive symptoms. For mothers, increases in depressive symptoms were predicted by frequency of hassles (b= .35, t(244) = 5.82, p = .0000) and challenging behaviors (b = .65, t(241) = 6.69, p = .0000), but ethnicity was not a significant moderator of those symptoms (b= .0075, t(244) = -.18, p = .86; b = .00, t(241) = .0007, p = 1.00). In fathers, increases in the frequency of hassles predicted an increase in depressive symptoms (b = .25, t(153) = 3.75, p = .0003) as did increases in challenging behaviors (b = .63, t(144) = 5.07, p = .0000), but ethnicity was not a significant moderator (b = -.021, t(153) = -.47, p = .64; b = -.015, t(144) = -.18, p = .86).

Conclusions:

Frequency of parenting hassles and the presence of challenging behaviors predicted increases in depressive symptoms for both mothers and fathers of children with ASD. Although these associations were not significantly moderated by ethnicity, our findings suggests that parents, regardless of gender or ethnicity, are impacted negatively by everyday parenting-related hassles. These findings underscore the need to conduct further research aimed at better understanding the parental experience and developing interventions that effectively target these symptoms across diverse parent groups.

144 **185.144** Associations between Stress and Resourcefulness Among Parents of Children Exhibiting Risk for Autism Spectrum Disorder

M. Khowaja[1,2]*, D. L. Robins*[3]*, E. C. Tully*[1] *and L. B. Adamson*[4]*, (1)Georgia State University, Atlanta, GA, (2)Developmental Pediatrics, Children's Hospital Colorado, Denver, CO, (3)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (4)Psychology, Georgia State University, Atlanta, GA*

Background: Parents who are rearing children with a developmental disability have higher stress than parents raising typically developing children. Protective factors, such as optimism and social support, are associated with psychological well-being among parents of children with and without disabilities. However, little is known about when elevated stress among parents with developmental disabilities emerges; associations between parents' level of stress and resilience prior to their child's initial diagnostic evaluation has not been thoroughly researched. Resourcefulness refers both to internal processes to handle stress and external help-seeking behaviors that contribute to resilience. It is related to psychological adjustment in adults, but it has yet to be examined among parents whose children demonstrate risk for developmental disability. **Objectives:** This study utilizes a strengths-based approach to investigate associations between child functioning, parents' stress, and parents' resourcefulness just prior to an evaluation. In particular, this study sought to understand whether resourcefulness plays a buffering role against stress for parents.

Methods: The sample consisted of 119 parents of toddlers (mean age=21.0 months; *SD*=4.0) who demonstrated risk on an autism-specific screening questionnaire and had no prior DSM-5 diagnoses. Prior to the child's diagnostic evaluation, parents completed the Perceived Stress Scale and Resourcefulness Scale. During the evaluation, the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) was completed. Diagnostic outcomes included autism spectrum disorder (ASD; *n*=37), language disorder and other developmental disorder (DD; *n*=55), and no diagnosis (*n*=27). A moderation analysis was conducted to examine whether resourcefulness moderates the relation between child symptom severity (i.e., ADOS-2 comparison score) and parents' stress.

Results: Parent perceived stress levels measured before their child's evaluation were not significantly elevated (*M*=15.9, *SD*=7.5). Parent stress was significantly correlated with parent resourcefulness (*r*=-.267, *p*<.01). Moderation results indicated a significant moderating effect of resourcefulness on the relation between children's autism symptom severity and parents' stress, *b*=-.034, *SE*=.013, β=-.241, *p*=.009. Among parents with low levels of resourcefulness, high severity of autism symptoms was associated with high stress. Exploratory analyses examining ADOS-2 Social Affect subscale as the predictor also yielded significant moderation with significant simple slopes at both low (*b*=.977, *p*=.009) and high (*b*=-.839, *p*=.049) levels of resourcefulness. This demonstrates a buffering effect against stress associated with greater impairments in child social communication skills (i.e., having high resourcefulness may be a protective buffer). With ADOS-2 Restricted and Repetitive Behaviors score as the predictor in this model, the moderation was significant; however simple slopes were only significant at low levels of resourcefulness.

Conclusions: Although parent perceived stress levels were within normal limits, parents with low levels of resourcefulness may be vulnerable to stress related to severity of child's very early symptom presentation. However, greater resourcefulness may be a protective factor against parent stressors associated with their child's impairments in reciprocal social interaction and communication skills in particular. In the future, screening parents at risk for elevated stress and poor mental health functioning during the diagnostic evaluation of their child's developmental disability may be helpful to promote positive well-being in parents after diagnosis of their toddler.

145 **185.145** Autistic People's Perspectives on Stereotyping: An Interpretative Phenomenological Analysis.

C. Treweek[1]*, C. Wood*[2]*, J. Martin*[2] *and M. Freeth*[3]*, (1)The University of Sheffield , Sheffield , United Kingdom of Great Britain and Northern Ireland, (2)Psychology, The University of Sheffield, Sheffield, United Kingdom, (3)Psychology Department, University of Sheffield, Sheffield, United Kingdom*

Background:
Autistic stereotypes are on the most part negative, where autistic people are perceived as having a number of negative traits such as being: disruptive and distracting to others (White, Hillier, Fry & Makrez, 2016), unsocial, quiet and emotionless (Harnum, Duffy & Ferguson, 2007). The only exception to this is the autistic savant, where autistic people are seen as having superior abilities in specific domains (Draaisma, 2009; Conn & Bhugra, 2012; Tang & Bie, 2016; Anjay, Palanivel & Palanivel, 2011). However, there is a paucity of research that has looked at how autistic people think they are perceived by others, and no studies to date have asked autistic people what they think the autistic stereotypes are.

Objectives:

This study examined how autistic people felt they are perceived by others, including what the autistic stereotypes are from their perspectives and lived experiences.

Methods:

A qualitative design was chosen, consisting of semi-structured interviews, and a set of pre-prepared questions that had been piloted beforehand with autistic people. 12 participants were interviewed and their responses were tape recorded (*M*=28 minutes) and then transcribed verbatim. Transcripts were analysed using Interpretative Phenomenological Analysis (IPA) (Smith, Flowers and Larkin, 2009), which involved coding each script for linguistic content, descriptive content and interpretation of possible meanings, resulting in a list of themes for each individual participant. A set of recurrent master themes was then identified across the whole data set. In order for a theme to be classed as recurrent, it needed to be present across at least half of participants. To ensure credibility of the analysis a subset of scripts were checked for accuracy and quality of interpretation by one of the co-authors.

Results:

Four master themes emerged from the analysis of the data. These were: (1) Autistic people are 'weird', (2) Negative effects/consequences of autistic stereotypes, (3) Heterogeneity of autistic people, (4) The effect of the environment / context. Most participants thought that autistic people may be perceived by others as being 'weird'. Finding also demonstrated that being perceived in a negative way by others may lead to negative consequences for autistic people - such as bullying and exclusion. The diversity of people on the autistic spectrum was also emphasised by participants, especially in relation to the range of traits both stereotypic and counter-stereotypic (atypical) that autistic people can have.

Finally participants highlighted how certain environments be both disabling and enabling for autistic people.

Conclusions:

Participants in this study felt they were being perceived in a predominantly negative way and that this may have negative outcomes for autistic people. This finding is important as negative attitudes towards others can lead to negative behaviour, if left unchallenged. Moreover, this study highlights the diversity of autistic people and challenges stereotypes that autistic people are all the same. Finally this study highlights the importance of creating environments that do not limit or disable autistic people in any way.

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185.146 Behavioral Artistry: Validation of Preferred Characteristics of Effective Behavioral Interventionists in Autism By Parents and Practitioners

K. Callahan[1], *R. L. Foxx*[2], *S. M. Nichols*[3], *S. Mehta*[4], *R. Sharma*[5], *X. Aerts*[3], *A. Swierczynski*[6], *M. E. McComb*[3], *K. Flatt*[1], *G. Segal*[3] *and W. Mackey*[1], *(1)University of North Texas, Denton, TX, (2)Penn State University at Harrisburg, Harrisburg, PA, (3)Kristin Farmer Autism Center, University of North Texas, Denton, TX, (4)Educational Psychology, University of North Texas, Denton, TX, (5)Rehabilitation and Health Services, University of North Texas, Denton, TX, (6)University of North Texas Kristin Farmer Autism Center, Denton, TX*

Background: The article “Twenty-five years of Applied Behavior Analysis: Lessons Learned” summarized insights from three decades of research and treatment in the field of Applied Behavior Analysis, concluding that the effectiveness of ABA therapy may be negatively impacted by limited skillsets among today’s behavioral interventionists. Richard Foxx believes there is an important difference in outcomes between persons delivering ABA services in a traditional way (“behavioral technologists”) and those who demonstrate a broader set of humanistic/interpersonal behaviors (“behavioral artists”). Behavioral technologists often simply deliver a scripted set of procedures without a focus on the quality of the interaction. In contrast, behavioral artists demonstrate eight characteristics which mark these therapists as “natural behavior analysts,” including having a sense of humor, using effective communication skills, and being caring, flexible, and optimistic.

Objectives: We investigated Foxx’s conclusion that behavioral interventionists today lack important interpersonal behaviors associated with BA when compared to service providers in other human services professions, and whether parents of children with autism, and other service providers, prefer characteristics associated with behavioral artistry: (1) Can BA characteristics be correlated with validated standardized assessments?; (2) What are the relationships between self-reported characteristics of BA and students majoring in Behavior Analysis, Special Education, Rehabilitation Studies, Other Human Services majors, and Engineering/Computer Science?” and (3) What is the level of social validity of BA characteristics by parents of children with ASD?

Methods: We reviewed psychological assessments in order to correlate operationally-defined BA traits. Expert raters (N=38) determined that Cattell’s Sixteen Personality Factor Questionnaire (16PF) correlated significantly with BA traits. An online 16PF survey was completed by more than 200 university students in the target majors, many of whom currently provide services for individuals with autism at a university-based treatment center. ANOVA and other statistical analyses were conducted to determine differences between levels of BA reported by undergraduate and graduate students in the various majors. An online survey was completed by a national sample of parents (N=86) of children with ASD. Parents read descriptions of characteristics of autism service providers and chose preferred traits. Responses were analyzed to determine the level of social validity for the correlated BA traits.

Results: Students majoring in behavior analysis reported a lower percentage of BA traits than those in all other human services majors. Parents of children with autism preferred the 16PF factors associated with BA traits over non-BA traits for 14 of 15 traits.

Conclusions: These results provide face and concurrent validity for the concept of BA as a potential factor in the delivery of improved treatment in autism. Social validation of BA was demonstrated by clear parent preferences for the traits associated with BA by behavior analysts and interventionists. However, our results indicate that behavioral interventionists in the field of autism may lack many important clinical/interpersonal skills. Research is underway to determine if interventionists with lower rates of BA implement treatment less competently and if they have less positive outcomes. This research could have significant implications for the preparation and training of effective service providers in autism.

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185.147 Broader Autism Phenotype Characteristics and Young Adults' Sibling Support

A. Jensen[1] *and G. I. Orsmond*[2], *(1)Brigham Young University, Provo, UT, (2)Department of Occupational Therapy, Boston University, Boston, MA*

Background: Despite less frequent contact than at younger ages (e.g., White, 2001), young adults’ relationships with their siblings have important implications for relational and individual adjustment (e.g., Jensen et al., 2013). Given that siblings play important roles, as parents age, in caring for siblings with an autism spectrum disorder (ASD; Burke et al., 2012), it is critical to understand the nature of how young adult siblings support one another. In particular, examining how Broader Autism Phenotype (BAP) characteristics are associated with sibling support may aid in understanding these processes.

Objectives: The aim of this study was to examine associations between BAP characteristics in both young adults and their siblings, and the support young adults provide their siblings. Because of the gendered nature of sibling relationships and support (Kim et al., 2006), we examined whether patterns of support varied by young adults’ and their siblings’ sex.

Methods: Data came from a larger study about sibling influence in young adulthood, which included 873 young adults from across the United States, recruited through Amazon Mechanical Turk. Young adult participants were in their mid 20s (*M age* = 25.44, *SD* = 2.54) and had about two siblings (*M* = 2.23, *SD* = 1.49), were mostly female (56%), and Caucasian (73%). Participants reported their relationship with their closest aged sibling and up to two additional siblings (if applicable). In total, the 873 participants reported on tangible (financial and practical) and emotional (communication, discussing life, emotional assistance) support with 1,543 different siblings. Participants reported on their own BAP characteristics and those of each of their siblings via the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001); 10 of the young adults and 27 of their siblings were reported to have a diagnosed ASD.

Results: Multi-level modeling was used to account for the nature of multiple relationships being nested within individuals. Separate hierarchical models were run for each dependent variable: tangible support, and emotional support. The models tested up to the three-way interactions of the young adults’ BAP characteristics X young adults’ sex X siblings’ sex, and the siblings’ BAP characteristics X young adults’ sex X siblings’ sex. Results revealed (see Table 1) that when young adults rated their sibling higher on the AQ, they reported giving more tangible support to that

sibling, especially towards brothers. Females who rated themselves higher on the AQ also reported giving less tangible support to their brothers and sisters. Results also revealed (see Table 2) that individuals who rated themselves higher on the AQ reported giving less emotional support to their brothers and sisters.

Conclusions: These findings suggest that BAP characteristics in the general population, and not just ASD diagnosis, may play a role in the support siblings provide one another in young adulthood. In some cases, siblings may be aware of the needs of their brothers and sisters who show characteristics associated with ASDs, and may provide more tangible support to them. Those who report having more BAP characteristics themselves may not support their siblings in return

148 **185.148** Building Bridges between the Autism and Research Communities: Opinions from People with a Lived Experience of Autism

D. Poole[1], *E. Gowen*[2], *A. Greenstein*[3], *T. Bleazard*[4], *P. Baimbridge*[5], *J. T. Pelham*[6] *and K. Stevenson*[6], *(1)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom of Great Britain and Northern Ireland, (2)Division of Neuroscience and Experimental Psychology, University of Manchester, Manchester, United Kingdom, (3)Manchester Metropolitan University, Manchester, United Kingdom, (4)University of Manchester, Manchester, United Kingdom, (5)Salfordautism, Salford, United Kingdom, (6)Non-Affiliated, Manchester, United Kingdom*

Background: Recent work has highlighted that there is a disconnect between the autistic and research communities (Pellicano, Dinsmore & Charman, 2014ab). There is a concern that this is harming trust, leading to the reduced involvement of autistic people in research and skewing research priorities. It has also been suggested that research is failing to impact the everyday lives of the majority of autistic people.

Objectives: In the present study, we sought the opinions and experiences of the autism community about research in an attempt to improve mutual understanding and identify how the academic and autism communities could work together better.

Methods: The project involved a collaboration between Autism@Manchester, an interdisciplinary network including academics from several research fields and Salfordautism, an autism support organisation that is led and run by autistic people. We organised 3 x 2 hour workshops with autistic adults and the parents of autistic children (n = 30). The workshops included (1) introducing the group to different types of research (2) focus groups exploring experiences of research, barriers to research participation and possible solutions (3) possibilities for future partnerships. Here we outline the focus group results, analysed using thematic network analysis.

Results: Three overarching themes were identified in analysis of the focus group discussions. The first theme explored motivations for taking part in research. Participants highlighted a desire to learn about themselves and improve society's understanding of autism. Research participation was highlighted as a valuable form of post-diagnostic support. However, participants expressed a desire to shape research goals, moving beyond passive participation. The second theme explored ways of equalising power relations between participants and researchers. Participants criticised a failure to share research outcomes quickly and in accessible forms. Forums for discussing research findings were highlighted as crucial for building bridges. In the third theme, practical advice for involving the autistic community in research was considered. Participants expressed a broad desire for more participation and suggested linking research networks to reduce the work in finding out about opportunities to participate. Ways to improve accessibility and the dissemination of research information were also addressed. Several ongoing challenges to greater involvement of the autism community in research were also identified including lack of institutional support and the different ways in which autistic and non-autistic people express themselves.

Conclusions: There was a strong positive view about research with participants understanding and supporting its value. Our focus group analysis showed that engagement was necessary throughout the research process. From study design to implementation, dissemination and discussions moving forward, the autism community suggested opportunities for facilitating participation and increasing partnership. These findings have been written into guidelines aimed to support autism researchers to build stronger partnerships with the autism community for successful research in future.

149 **185.149** Characterising the Relationship between Maternal Sleep, Child Daytime Behaviour and Physical and Mental Wellbeing in Mothers of School-Aged Children with and without a Diagnosis of Autism

Z. Yusuf[1], *G. Pavlopoulou*[2], *D. Dimitriou*[3] *and W. A. Bin Eid*[4], *(1)Lilas Lab UCL IOE, London, United Kingdom, (2)Lifespan Learning and Sleep Lab, UCL.IOE,Lilas Lab, london, United Kingdom of Great Britain and Northern Ireland, (3)Lifespan Learning and Sleep Laboratory (LILAS) UCL, Institute of Education, London, United Kingdom, (4)Lifespan Learning and Sleep Lab, Institute of Education UCL, London, United Kingdom*

Background: Raising a child with autism brings unique opportunities and challenges. Over the past 20 years a growing body of research has been examining the role of autism severity and child behaviours on maternal wellbeing. Sleep problems are very common in children on the autism spectrum and in other members of their families. Those sleep problems include difficulty falling asleep, waking during the night, erratic/irregular sleep patterns, other arousals/disturbances, and daytime sleepiness. However, we still know very little we know about the relationship of sleep, maternal wellbeing and child behaviour.

Objectives: This study aims to characterise the relationship between maternal sleep, chid daytime behaviour and physical and mental wellbeing in mothers of school-aged children with and without a diagnosis of Autism.

Methods: A cross-sectional, mixed design was employed. 40 mothers completed a number of psychometric self-reports, a questionnaire on autism severity and child daytime behaviours as well as a a 7-day sleep diary.

Results: A self-selected sample of 20 mothers raising a child with a diagnosis of autism and 20 mothers of typically developing children were recruited from various community settings and charities in the UK. Mothers with a child with an autism diagnosis reported poorer sleep (M= 9.00), higher parenting stress, (M= 95.30) lower physical quality of life (M= 47.19) and emotional quality of life (M= 40.30) than mothers of typically developing children. Maternal stress (p = .014) and emotional quality of life (p = .005) were significant predictors of child behaviour problem in mothers of children with autism.

Conclusions: This is one of the very few studies aiming to characterise the relationship between sleep and wellbeing in the life of mothers with a child with autism. Implications of this research shed light in areas that healthcare practitioners should consider the effects of sleep in all family members when looking for interventions targeting quality of life. Further research should employ non-invasive objective sleep measures such as actigraphy along with interviews to gain better insights into their sleep patterns and hygiene and verify links with physical, mental health and overall quality of life.

150 **185.150** Characterising the Relationships between Sleep Patterns, Anxiety Profiles, School Attendance and Daytime Behaviour in Female Adolescents with and without a Diagnosis of Autism

N. Ready[1]*, G. Pavlopoulou*[2] *and D. Dimitriou*[3]*, (1)Lilas Lab UCL IOE, London, United Kingdom, (2)Lifespan Learning and Sleep Lab, UCL.IOE,Lilas Lab, london, United Kingdom of Great Britain and Northern Ireland, (3)Lifespan Learning and Sleep Laboratory (LILAS) UCL, Institute of Education, London, United Kingdom*

Background: There is a wealth of literature for the role sleep plays in the growth, development, health and well-being of adolescents. In recent years, research in gender and autism has developed at pace, developing our understanding of the way autism needs present in females and the challenges they experience as a result of this. This field is still, however, widely under-researched.
Objectives: To examine the role sleep plays within female adolescents and the influence it has on anxiety and daytime behaviours, both at home and at school.

Methods: Using a multi-informant research design, including both subjective and objective sleep measures, a cross-sectional, quantitative, correlational study examining the relationships between sleep patterns, anxiety profiles, school attendance and school behaviours in typically developing female adolescents and female adolescents with autism was carried out. Actigraphy data were collected, alongside self-report (Pittsburgh Sleep Quality Index, Beck Youth Inventories II, Strengths & Difficulties Questionnaire), parent-report (Child Sleep Habits Questionnaire, Strengths & Difficulties Questionnaire) and teacher report (Strengths & Difficulties Questionnaire, Child Behaviours Checklist) questionnaires for anxiety and behaviour. School attendance information was also collected.

Results: 33 female participants (16 without a diagnosis; 17 with a diagnosis), between 11-16 years of age, completed the study. Sleep patterns in isolation were broadly similar between both groups and all participants were getting 2-4 hours less than the 2017 National Sleep Foundation recommendations. However, differences were found between the two groups, between sleep patterns and each of the outcomes examined with a significant number of correlations found between these factors in female adolescents with autism. In females with a diagnosis of autism, positive correlations were found between self-reported anxiety and sleep disturbances. Anxious behaviours were reported by parents to increase as the scores in each sleep domain increased also. A linear regression demonstrated that each of the following sleep domains significantly predicted the total difficulties in behaviours score reported by parents of females without a diagnosis in the SDQ, accounting for a significant proportion of the variance found in parent reported behaviour scores. Sleep anxiety also significantly predicted the total difficulties score reported. For teacher reported behaviours in females with a diagnosis, the most frequent negative correlations occurred also with actigraphy mean bed time, indicating the importance of this factor across both groups of participants.

Conclusions: These findings have implications not only for parents and professionals in considering the impact of poor sleep patterns on outcomes at home and school, but also for developing adolescents' awareness and understanding about the important role sleep plays in their wellbeing. Future research should examine sleep patterns and sleep hygiene using subjective sleep measures and eliciting personal account on sleep to understand in more depth the relationship between sleep

151 **185.151** Considering Methodological Accommodation to the Diversity of ASD: A Realist Synthesis Review of Data Collection Methods

J. D. Orjasaeter[1]*, D. B. Nicholas*[2] *and L. Zwaigenbaum*[3]*, (1)Faculty of Social Work, University of Calgary, Central and Northern Alberta Region, Edmonton, AB, Canada, (2)University of Calgary, Edmonton, AB, Canada, (3)University of Alberta, Edmonton, AB, Canada*

Background:
Qualitative inquiry related to the lived experiences of ASD is shown as largely drawing on traditional approaches; most notably, interviews and focus groups (Tesfaye, 2016). These approaches potentially limit data elicitation from subpopulations within ASD such as individuals with co-existing cognitive and/or communicative challenges. Such subgroups potentially have unique experiences that merit greater understanding. Methodological adaptation appears needed to incorporate a more flexible range of research approaches. To fail to do so risks errors of commission (e.g., presumption of data validity) and omission (e.g., missed sub-group representation of experience).

Objectives:
The aim of this umbrella review was to identify potential and promising approaches to data collection that could ensure more inclusion and accommodation of the range of ASD expression. Drawing on a realist synthesis approach, this review explored the following research question: "What data collection approaches inform the assessment of lived experience across the breadth of cognitive and communicative abilities and expression in ASD?".

Methods:
This realist synthesis review intentionally included relevant yet disparate substantive areas, populations and contexts to amplify potentially salient understanding. Data collection methods elicited lived experience or first person accounts of populations with variable levels of language and cognitive expression. Articles were reviewed, identified and coded.

This review drew on three relevant yet distinct literature bases and populations: (i) persons with ASD, (ii) persons with intellectual disability, and (iii) persons with dementia. Selection of these diverse disability areas and populations accounted for an inherent range of inter- and intra-population abilities/disabilities and experiences which included domains of language expression, communication and cognition.

Results:
The overall search yielded a total of 1,244 studies; 162 studies were confirmed to be eligible for inclusion. Studies meeting inclusion criteria represented a variety of research designs that consisted of exploratory, descriptive and evaluative research. Common methods in studies included interviews, focus groups, observation, surveys, standardized assessments and inventories. Methods that were viewed to be salient to the application of strategies for eliciting first-hand perspectives included photovoice (n= 6 studies), Talking Mats (n= 2 studies), 'deep assessment' (n= 1 study), SenseCam (n= 2 studies), and TimeSlips (n= 2 studies). These approaches identify potential methods for more inclusive engagement in studies than traditionally may have been accommodated.

Conclusions:

Findings from this review inform person-centered research in the aim of eliciting depth and breadth of diverse lived experience and first-person expression in ASD. Emerging evocative approaches offer methodologic possibilities, yet may impose challenges based on data conformity and a lack of clearly defined methods for the ASD population. Notwithstanding such challenges, optimal data yield warrants careful consideration relative to the important aim of inclusive representation in ASD sampling. Addressing these considerations have the potential to advance knowledge about first person experiences and needs of people with ASD and in so doing, move the research community beyond conventional methods in the aim of inclusive ASD research.

152 **185.152** Coparenting and Well-Being in Mothers and Fathers of Children with Autism Spectrum Disorder

***N. Ekas**, Texas Christian University, Fort Worth, TX*

Background: Fathers of children with autism spectrum disorder (ASD) have been relatively neglected in research; however, recent research has investigated the quality of the coparenting relationship and its association with parental well-being (May, Fletcher, Dempsey, & Newman, 2015). Parents of children with ASD typically have lower levels of well-being and romantic relationship quality (Gau et al., 2012). However, a positive coparenting relationship beneficially impacts well-being (May et al., 2015). One factor that may influence the quality of the coparenting relationship are parental perceptions of the father's role in raising his children (Schoppe-Sullivan et al., 2008).

Objectives: The purpose of this study was to examine associations between perceptions of the father's role, coparenting relationship quality, and well-being in mothers and fathers of children with ASD.

Methods: Thirty-three cohabitating couples of a child with ASD (age 4–12) completed online questionnaires to assess perceptions of the role of the father (ROFQ), the quality of the coparenting relationship (CRS), depressive symptoms (CESD), and romantic relationship satisfaction (CSI).

Results: For fathers, coparenting closeness mediated the relationship between paternal perceptions of the role of the father and depressive symptoms (95% CI: -.69, -.01) and relationship satisfaction (95% CI: .05, 3.34). Greater perceptions of the role of the father were associated with greater coparenting closeness, $b = .07$, $SE = .04$, $p < .05$, which was associated with fewer depressive symptoms, $b = -2.81$, $SE = 1.19$, $p < .05$, and higher romantic relationship satisfaction, $b = 15.72$, $SE = 2.75$, $p < .001$. For mothers, coparenting closeness also mediated the relationship between maternal perceptions of the role of the father and depressive symptoms (95% CI: -.92, -.08) and romantic relationship satisfaction (95% CI: .67, 3.26). The pattern of associations was similar to that for fathers.

Conclusions: This study provides preliminary evidence that the coparenting relationship is associated with better individual well-being and better dyadic well-being. Although studies have yet to investigate the role of the father in the context of ASD, it appears that both mothers and fathers believe that the father has an important role, which allows them to not only be closer as parents but also as a couple. Therefore, interventions could help enhance perceptions of a father's role to encourage a positive coparenting relationship in order to benefit well-being.

153 **185.153** Decision-Making Processes That Inform Parents' Disclosure of Their Child's Autism Diagnosis to Others

***S. Thompson-Hodgetts**[1], L. G. Rogers[1], R. Mazumder[1] and S. K. Phelan[2], (1)University of Alberta, Edmonton, AB, Canada, (2)Occupational Therapy, University of Alberta, Edmonton, AB, Canada*

Background: When children are diagnosed with ASD, parents are faced with numerous decisions, including to whom they should disclose this information. There are limited resources to inform their decisions and no literature that looks at processes of disclosure.

Objectives: To investigate the decision-making processes by which parents of a child diagnosed with ASD choose to disclose their child's diagnosis to others; for example, educators, family and friends, healthcare professionals, other parents, and others in the community.

Methods: In this constructivist grounded theory study, we conducted semi-structured interviews with 25 parents (19 mothers, 6 fathers) of 23 children diagnosed with ASD (19 males, 4 females, age range 3 to 13 years). Participants were purposefully sampled across diversity in child age, presentation across the ASD spectrum, time since diagnosis, and decisions to disclose or not disclose. Interviews were transcribed verbatim and managed through NVivo 11 Pro. Established grounded theory constant comparison methods were used to yield processes depicting parents' decision-making related to disclosure of their child's ASD diagnosis to others. Following convention in qualitative research, rigor was demonstrated through established methods of trustworthiness and authenticity, including critical reflexive dialogue with colleagues about the data, prolonged engagement by team members immersed in ASD, negative case analysis, and member-checking through clarification probes during interviews.

Results: Five sequenced processes informed disclosure: (1) Finding the Fit (2) Assessing the Benefits, (3) Following Values and Beliefs, (4) Managing Peoples' Responses, and (5) Adjusting Along the Way. Parents initially needed to determine whether the diagnosis of ASD was a fit for their child, which involved learning about or changing their perceptions about the disorder, as they typically did not know a lot about ASD. The primary reason for disclosure to anyone was whether it would benefit the child for others to know the diagnosis. All parents disclosed to the school with the expectation that the child would receive services and understanding. A secondary consideration was whether disclosure supported the parent. Next this information was filtered through the parents' values and beliefs related to privacy, disability, and family culture. These were rarely black and white decisions, and often parents disclosed to some people and not to others. Parents needed to then manage the varying responses and advice from others. Then, as the parent and child journey continued, decisions to disclose or not disclose sometimes changed based on responses from others.

Conclusions: The process of disclosing their child's diagnosis of ASD to others is complex. Findings from this study can contribute to discourses related to disclosure or non-disclosure, and help increase sensitivity and understanding for healthcare professionals, educators, and the general public related to parents' decisions of whether or not to disclose their child's diagnosis of ASD.

154 **185.154** Expecting Family Members to be on Board: Parents' Disclosure of Their Child's ASD Diagnosis to Relatives

***S. Thompson-Hodgetts**[1], L. G. Rogers[1], R. Mazumder[1] and S. K. Phelan[2], (1)University of Alberta, Edmonton, AB, Canada, (2)Occupational Therapy, University of Alberta, Edmonton, AB, Canada*

Background: Parents who receive a diagnosis of ASD for their child are faced with immediate and ongoing decisions of who to inform about the diagnosis. There is little in the literature to support parents in making these disclosure decisions, and to inform professionals who often support parents in these decisions.

Objectives: To investigate why, when and how parents disclosed their child's autism diagnosis to others, including both the decision-making process as well as the impact of these disclosure decisions. This abstract represents the results of disclosing the ASD diagnosis to relatives.

Methods: A constructivist grounded theory design was used. Grounded theory is well established for the investigation of complex, multi-faceted human experiential phenomena, offering a theoretically rich understanding of processes and perceived outcomes. We interviewed 25 parents of children diagnosed with ASD across Alberta, Canada. Our diverse sample included 19 mothers and 6 fathers (aged 28-56 years) of 23 children (19 males and 4 females, aged 3 to 13 years). Children were diagnosed between one month and eight years prior to the interview. Five participants indicated they immigrated to Canada, away from their relatives. Interviews were transcribed verbatim and managed through NVivo 11 Pro.

Results: Parents reported various criteria and factors that affected why, when and how they disclosed their child's ASD diagnosis to their relatives. While some parents told all family members, many had a more mixed profile of reporting to some relatives and not others. Factors affecting disclosure included the relationship, age, and geographic distance from relatives; how much contact they had with relatives on a day-to-day basis; and whether disclosing diagnosis to a relative offered perceived benefit to the child or parent. Parents rarely disclosure to their elderly parents or those who were geographically distant if they thought the diagnostic information would worry them. Results of disclosure were complex. Participants' reported that relatives' responses ranged from many who received support and acceptance by relatives, to well-meaning but not helpful responses from relatives, denial of the diagnosis, lack of understanding of ASD, and imposing judgment on the parents for poor parenting and family genetics. Further complicating the disclosure process were cultural and societal factors of stigma and blame which were imposed on the parents from relatives and others. More complex interactions were also described including the parents and relatives coming to terms with recognition of a potential ASD diagnosis among family members including spouses. Couples often differed in preferences for disclosure to relatives, but, except in a few cases, this lack of agreement was not reported as a source of conflict; often parents would agree that one parent take the lead in the disclosure process.

Conclusions: The processes involved in disclosing the diagnosis of ASD to relatives are complex. In many cases relatives were available to support parents, but in other cases relatives became a source of additional worry and stress for the parents at a time when they desired support.

155 **185.155** Early Intensive Parent Training to Promote Development of Their Children with Autism Ameliorates Anxiety & Marital Discord and Increases Knowledge of Autism

B. Siegel[1], *S. Behar*[2] *and R. DeWitt*[3], *(1)Autism Center of Northern California, San Francisco, CA, (2)Palo Alto University, Palo Alto, CA, (3)Autism Center of Northern California (ACNC), San Francisco, CA*

Background: This study focuses on the effects of parent training on parental well-being. Parenting a child with autism is an unanticipated life stressor managed alongside the goal of optimizing benefit to the child. Various approaches to parent training have emerged to 1) bolster and generalize the effect of professional child interventions for autism, 2) manage a child's problem behaviors, and 3) teach communication skills. There is, however, less study on how parent training may improve parent well-being. We test the idea that parents with a greater knowledge of autism, and with technical skills to develop daily living skills, communication, social and play skills will have fewer negative psycho-social outcomes than parents who do not undergo early training to acquire these knowledge and skills.

Objectives: The present study was to compare knowledge of autism and measures of psychological well-being in parents who did and did not receive a full-time, week-long 1:1 intensive parent training protocol shortly after diagnosis of autism in their 2-3 year old. This preliminary cross-sectional study was carried out as a first step in longitudinal examination of adjustment to the diagnosis of autism in parents. We intend to examine the bi-directional influence of child improvements in parent outcomes alongside effects of parent training in improving child outcomes. We see characterization of bi-directionality as important in understanding how to help parents adjust to the diagnosis of autism, especially given some children will not improve as markedly as others. It is logical that parents with a child who improves markedly to feel better; but how do we also help parents who may need to adjust expectations? What are factors in supporting such parents to feel comparably successful when they are just as active and well-trained as caregivers?

Methods: The treatment group attended week-long, 30-hour parent training with one-to-one demonstrations and coaching from behavioral, communication, and play and social skills intervention specialists. Study respondents completed *Knowledge of Autism*, and *Adjustment to the Diagnosis of Autism* (ADA) questionnaires, plus the *Beck Depression Inventory (BDI)* and the *Dyadic Adjustment Scale (DAS)*. The current N=12 for the intervention group, with the aim of a matched non-treatment group by INSAR.

Results: Intervention group parents showed 79% accuracy in their knowledge about autism. On the *BDI*, they showed less than average anxiety (45th percentile). On the *DAS*, respondents indicated they most always agreed on external family issues (50th percentile), had only occasional problems on more intimate topics (82nd percentile), having positive interactions at least once per day. On *ADA* intervention group parents showed they accepted the diagnosis and felt others should know more about autism, noting they believed they would feel better as their child did better, and that reading all you can was a helpful coping strategy.

Conclusions: Our preliminary data on trained parents suggest fairly low levels of anxiety, fairly good levels of understanding about autism, as well as adequate scores on psychosocial measures. Our presentation in May will contrast these results to parents who have not (yet) received the same parent training.

156 **185.156** Elucidating Female Autism Study (EmFASiS). Investigating Differences in Presentation, Diagnostic Process and Personal Experiences in Males and Females with Autism.

S. Piening[1], *Y. Groen*[2], *K. Greaves-Lord*[3], *S. Castelein*[4,5], *A. F. Stapert*[1], *A. M. Euser*[1], *D. Jansen*[1], *L. Davids*[1,6] *and I. D. van Balkom*[1,7], *(1)Autism Team Northern Netherlands, Jonx (Lentis), Groningen, Netherlands, (2)Clinical and Developmental Neuropsycholog, University of Groningen, Groningen, Netherlands, (3)Erasmus MC, Rotterdam, Netherlands, (4)Lentis Research (Lentis), Groningen, Netherlands, (5)Experimental Psychotherapy and Psychopathology, Behavioural and social sciences, Rijksuniversiteit Groningen, Groningen, Netherlands, (6)Medical Psychology, Martini Hospital, Groningen, Netherlands, (7)Lentis Psychiatric Institute, Zuidlaren, Netherlands*

Background:

Females are more often affected by Autism Spectrum Disorder (ASD) than previously assumed. Differences in ASD symptoms and complaints, and male-biased diagnostic instruments combined with better skills in masking ASD-symptoms by females may contribute to late recognition of symptoms. Females with late diagnosed autism often look back with sadness when considering how different their lives could have been had they received a timely diagnosis and appropriate care.

Objectives:

The **E**m**FAS**i**S** project consists of several studies and this first study aims to facilitate earlier identification and diagnosis of ASD in females through better understanding of female autism phenotypes and differences with males. Improved understanding of autism in females will inform diagnostic and treatment processes and may prevent emergence of comorbid disorders, and unexplained physical symptoms. Issues which lead to lower quality of life, decreased participation in society, and higher societal costs.

Methods:

The first study of the **E**m**FAS**i**S** project consists of semi-structured interviews with 15 females and 15 males with autism. The semi structured interview will be developed in close cooperation with experienced service users and will include questions regarding experiences with their gender-roles (such as daughter/son, friend, partner, parent, caretaker, employee), current and past complaints and symptoms, as well as personal diagnostic process and treatment. Analyses will be performed using a qualitative data-analysis program.

Results:

The study will start in December 2017 and results of the qualitative study will be presented at the conference.

Conclusions:

In addition to gaining insight into differences in presentation, diagnostic process and personal experiences in males and females with autism, we expect to identify influencing factors regarding diagnostic delay in females.

157 **185.157** Evaluating Depression and Quality of Life in Mothers of Children with Autism Spectrum Disorders

*A. Deshpande[1], P. Sunil[2], M. Bhargavi[1], D. Murnal[2], N. Mundkur[2] and **A. Jayaraman**[3], (1)Sangamitra, Bangalore, India, (2)Centre for Child Development and Disabilities, Bangalore, India, (3)Center for Child Development and Disabilities, Bengaluru, Karnataka, India*

Background:

Studies have shown that parents of children with developmental delays report poorer well-being. In most cases, parents, especially mothers, tend to ignore or deny that they are experiencing depression and suboptimal quality of life, and seldom seek help. Proper strategies implemented for dealing with caregiver stress would mean increased patience, understanding, acceptance, and overall caregiving towards their children with developmental delays, especially autism spectrum disorder (ASD).

Objectives:

In this study, we evaluated the primary care-giver depression and quality of life to assess the level of depression and the quality of life (QoL) of mothers of children with ASD that are enrolled in our center for intervention programs.

Methods:

The intervention programs in our center for young children with ASD are divided into 2 main types: Therapist-based intervention (TI) and parent-based intervention (PI). In the PI program, mothers actively participated along with the therapists and early educators in a 3 h/day program for their children with ASD at the center, followed by incorporating the same skills learnt at the center at home for at least 2 h/day. In total, we assessed 64 mothers of children with ASD at our center (47 in therapy-based, 17 in parent-based intervention programs) once before the start of the intervention program and once after at least 6-months into the intervention program. To analyze the QoL of mothers, we used the Short-form Health Survey (SF-36) questionnaire. The degree of depression was assessed by the Beck Depression Inventory (BDI) questionnaire. We compared the progress of mothers in both of our intervention programs to better understand the need for additional support programs for mothers of children with ASD. Paired t-test and Spearman correlation were used for analysis.

Results:

Before the start of intervention, 47 of 64 mothers (34/47 – TI; 13/17 - PI) showed varying degrees of depression upon evaluation including 7 cases of severe or extreme depression. At the end of 6-months after start of intervention for their children, 28 mothers (21/47 – TI; 7/17 - PI) showed signs of depression, with no cases of severe and extreme depression. After 6-months, a significantly higher number of mothers in the PI group showing improvement than those in the TI group ($P<0.05$). For QoL evaluation, 55/64 mothers showed improvement in their quality of life after 6 months. Here again, mothers in the PI group showed significant improvements in many more domains than those in the TI group ($P<0.05$). Both these results corresponded with improvements seen in their children due to the intervention programs.

Conclusions:

Based on our results, we observed that the mothers from the PI program fared better than the mothers of children in the TI program. This suggests that along with the positive feedback of the improvement seen in their children, additional weekly programs targeting the mothers in the parent-based intervention helped the mothers to cope up better.

158 **185.158** Evaluating Maternal Participation in Mobile Health Research

*J. Toroney[1], **J. K. Law**[1,2,3], R. Ellis[4], S. Dhingra[4] and P. H. Lipkin[1,2,3], (1)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD, (2)Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, (3)Johns Hopkins University School of Medicine, Baltimore, MD, (4)Public Good Ventures Limited, Atlanta, GA*

Background: With the advancement of digital technology, mobile health apps facilitate the routine collection of health data, constituting an invaluable asset of information to organizations (e.g. government and private). Such data is often already collected and easily accessed, raising an interest in utilizing such data for public good; however, little is known about an individual’s willingness to share this data freely for research purposes.

Objectives: (1)Evaluate the feasibility of collecting mobile health data (mHD) for research purposes (2) Utilize mHD to inform future health-related research

Methods: The Caregiver Health and Activity Monitoring Pilot Study (CHAMPS), was a 16-week study asking mothers in the Interactive Autism Network (IAN) - a community-powered research network that focuses on improving the lives of individuals with ASD and their families - to: (1) complete multiple brief online questionnaires about their own perceived physical health and well-being and (2) share their mHD (activity level) with researchers by connecting their Fitbit to a secure online platform.

Eligible IAN mothers were emailed a study invitation to join CHAMPS. Eligibility criteria included: (1) being the mother of a child or adolescent with ASD and (2) participating in a previous questionnaire that asked mothers if they owned a Fitbit. Study invitations were sent to two groups: Group A consisted of mothers that already owned a Fitbit and Group B included mothers that did not own an activity monitor. A Fitbit was purchased for the latter group. Data was collected monthly from internet-based questionnaires consisting of custom questions and standardized surveys, including 10-item PROMIS Global Health. Participants were asked about their perceived health, well-being, and Fitbit use.

Results: A total of 109 mothers joined CHAMPS. Overall, 83% (n=91) of participants completed the study; however, these rates differed by group. Group B had a significantly higher completion rate, demonstrating greater engagement (Group A=63%, Group B=98%).

At the beginning of the study period, 22 participants in Group A connected their Fitbit. Several participants contacted our research team because they no longer possessed a working Fitbit. By contrast, 100% of Group B participants connected their Fitbit to the study platform. The inability to connect the Fitbit was related to not having a functional device rather than the platform's capability.

The final questionnaire presented participants with the opportunity to express their feelings and thoughts in an open-ended format. Group A focused on the positive aspects of contributing to research while Group B focused on their experiences using the Fitbit. The novelty of having a Fitbit, or not, seemed to influence how participants viewed their participation.

Conclusions: New Fitbit users were more engaged in CHAMPS as compared to mothers that already owned an activity monitor. The new Fitbit user group had higher study completion rates, all participants shared their Fitbit data, and feedback focused on the Fitbit itself rather than the study as a whole. Mothers of children and adolescents with ASD are willing to share mobile health data for research.

159 **185.159** Exploring Factors Related to Decision-Making and Barriers to Service for Single Parents

N. Bardikoff *and M. Spoelstra, Autism Ontario, Toronto, ON, Canada*

Background: Research on children with ASD has shown that appropriate interventions, delivered at appropriate developmental periods, can lead to marked increases in functioning across a range of domains (for review, Warren et al., 2011). Given the importance of treatment choice and timing, families' decisions about intervention type and subsequent service use, are of great interest to both the research and professional fields. Research shows that socioeconomic status, autism knowledge and education level affect treatment and service use (Pickert & Ingersoll, 2015). Yet most studies examine the experiences of multi-parent households, few have addressed the possible added considerations and barriers experienced by single parents.

A survey of caregivers of individuals with ASD in Ontario found that 33% of respondents identified as single parents, (Ontario average single-parent households, 20%; Statistics Canada, 2016). Given the high number of single-parent households within the ASD community it is important to determine needs and experiences when accessing services.

Objectives: To fill knowledge gaps of different family structures by examining how single-parent households make decisions about treatment and subsequent barriers to service they experience.

Methods: Autism Ontario conducted an online survey for caregivers in April, 2017. It was distributed across our network, via partner organizations and Ontario's regional autism providers. It was available in English and French, and focused on various aspects of service and support.

Results: There were 3,130 respondents, 1,024 who identified as single parents. The majority of respondents cared for male children (81.2%) and 15.3% indicated that they cared for more than one child with ASD. Children ranged from toddlers to adults.

Respondents rated potential barriers to service on a 5-point likert scale. After controlling for age of the child, child's gender and region, single-parents rated financial restrictions, travel, services not available at convenient times, previous poor experiences with professionals, lack of response from providers and lack of in-home services as significantly larger barriers to service compared to non-single parents ($Fs > 4.14$, $ps < 0.05$). Factors including, child deemed ineligible, long waitlists and services in non-preferred language were not significantly different between single- and non-single parent respondents ($Fs < 2.27$, $ps > 0.05$).

Respondents rated amount of influence various sources have during the decision-making process regarding treatment. After controlling for age of the child, child's gender and region, single-parents rated Ministry of Children, social media and news media as significantly more influential sources than non-single parents ($Fs > 7.55$, $ps < 0.05$). Non-single parents rated current research as a significantly more influential source than single-parents (F (1,1996) = 8.08, $p < 0.01$). Sources including, family and friends, other parents, professionals, school personnel and your own understanding of your child were not significantly different between single- and non-single parents ($Fs < 3.7$, $ps > 0.05$).

Conclusions: Single-parent households experience different barriers to service and rely on different sources of information when considering intervention options for their children. We will discuss the implications of these findings in regards to the tailoring of services and supports for children of families that differ from typical multi-parent households.

160 **185.160** Exploring the Mediating Role of Parenting Stress in the Association between Adolescent Depressive Symptoms in ASD and Disruption in the Home Environment: Does Parenting Efficacy Ameliorate Spillover?

H. K. Schiltz[1]*, A. J. McVey*[1]*, A. D. Haendel*[2]*, K. Willar*[3]*, J. Karst*[4]*, A. Carson*[5] *and A. V. Van Hecke*[6]*, (1)Marquette University, Milwaukee, WI, (2)Speech-Language Pathology, Concordia University Wisconsin, Mequon, WI, (3)Children's Hospital Colorado, Aurora, CO, (4)Medical College of Wisconsin, Milwaukee, WI, (5)Baylor College of Medicine, Houston, TX, (6)Psychology, Marquette University, Milwaukee, WI*

Background: Co-morbidities are common among youth with ASD (Leyfer et al., 2006). It is unclear, however, whether co-occurring symptoms have implications for global levels of family functioning over and above autism severity alone. Previous research has identified links between child characteristics and level of parenting stress (McStay, Dissanayake, Scheeren, Koot, & Begeer, 2014). This raises the possibility that levels of co-

occurring symptoms may amplify parenting stress and, in turn, increase family disruption. Moreover, parents' efficacy and perception of parenting competence is known to play an important role in family functioning (Giallo, Wood, Jellett, & Porter, 2013), and therefore may buffer the impact of their child's difficulties on the home environment.
Objectives: To address the aforementioned possibilities, the present study explored 1) whether depressive symptoms contribute to environmental disruption in the home, controlling for ASD severity, 2) if parenting stress mediates the relation between depressive symptoms and disruption in the home, and 3) a moderated meditation model to determine whether parenting efficacy acts as a moderator of these effects.

Methods: Caregivers of 92 adolescents with ASD completed the questionnaires used in this sub-study as part of a larger RCT of the PEERS® social skills intervention; only pre-intervention data was used in the analyses. ASD was confirmed using the ADOS-G and all participants had an IQ greater than or equal to 70 on the Kaufman Brief Intelligence Test. The Confusion, Hubbub, and Order Scale (CHAOS) was used to measure global levels of disruption in the home environment, the Stress Index for Parents of Adolescents (SIPA) was used to measure parenting stress, and the Parent Sense of Competence Scale (PSOC) was used to assess parents' perception of their parenting efficacy. The Social Responsiveness Scale (SRS) was employed as a proxy of autism severity and the Short Mood and Feelings Questionnaire (SMFQ) as an index of adolescent depressive symptoms.

Results: A multiple linear regression predicting CHAOS from SRS and SMFQ was significant $F(2,89) = 5.57$, $p < 0.01$ and revealed a significant main effect of SMFQ $b = 0.36$, $p = 0.001$, controlling for SRS. A PROCESS mediation model was used to test the mediating role of SIPA and revealed a significant indirect effect $b = 0.79$, [CI: 0.45, 1.26]. Follow up conditional PROCESS analyses were employed to test the moderating role of PSOC on the previous mediation model. No significant interaction effects were identified and, thus, the mediation model does not differ at varying levels of parent efficacy.

Conclusions: Findings from this study suggest that heightened depressive symptoms are linked with increased disruption in the home environment, beyond the effect of autism severity. Moreover, this association appears to be driven by an increase in parenting stress. Lack of interaction effects suggests that parent efficacy may not buffer the impact of child depressive symptoms on environmental disruptions, although it likely operates in other ways to facilitate positive family functioning that are not captured in these analyses. Overall, both autism symptoms and mental health may be important targets for intervention and avenues to enhance family functioning.

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185.161 Fabric to the Facts. Understanding Social Problems and Co-Occurring Conditions in Young Adults with Autism Spectrum Disorder

***L. Mattys**, KU Leuven, Leuven, Belgium*

Background:

As children with autism spectrum disorder (ASD) become adults, adaptive functioning usually improves, but social problems seem to remain or even increase, and comorbid psychiatric disorders are likely to occur. Though current research seeks better understanding of these problems, our knowledge remains theory-driven and is often not directly clinically applicable, leaving the group in need.

Objectives:

This study proposes a shift of perspective, including lived experiences from adults with ASD instead of outside perceptions from researchers, to get an insider understanding of the problem and make recommendations on how to improve current clinical practice by better targeting existing initiatives and interventions.

Methods:

Fourteen young adults with ASD (ages 17-26) were interviewed using a semi-structured interview guide that addressed topics that were previously found to be the most salient developmental themes for typically developing young adults. Their contents of these interviews were transcribed and analysed using Interpretative Phenomenological Analysis. Special precautions were taken to avoid interpretational biases by member-checking the validity of our findings with participants, and including other researchers, so that inter-rater reliability could be checked.

Results:

Participants experienced continued social problems, that had become more covert as they had learned to avoid visible social errors. Tremendous effort was reported to be put into adjusting to social rules and expectations of others and hiding symptoms of ASD. Exhaustion, inhibitory problems, difficulties imagining the future and inflexible thinking were mentioned as the biggest causes of lowered well-being. Interviewees also discussed their own methods of coping, such as creatively expressing emotions or physical exercise, highlighting potentially helpful strategies to explore that are currently not included in general guidelines for clinical practice.

Conclusions:

These findings open new directions for research to follow regarding the development of social skills of children with ASD as they grow into adults, as well as regarding clinical interventions based on self-advocacy of the targeted patient group.

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185.162 Family Accommodation of Restricted and Repetitive Behaviors in Children with ASD

***J. Koller**[1], D. A. Zachor[2], I. Feldman[3], C. Shulman[4], E. Ben-Itzchak[5] and E. R. Lebowitz[6], (1)Seymour Fox School of Education, Hebrew University of Jerusalem, Jerusalem, Israel, (2)The Autism Center/Pediatrics, Tel Aviv University / Assaf Harofeh Medical Center, Zerifin, Israel, (3)The Hebrew University of Jerusalem, Jerusalem, Israel, (4)The School of Social Work, The Hebrew University of Jerusalem, Jerusalem, Israel, (5)Bruckner Center for Research in Autism, Communication Disorder, Ariel University, Ariel, Israel, (6)Yale Child Study Center, Yale School of Medicine, New Haven, CT*

Background: This study is the first to examine family accommodation of core ASD symptoms. Family accommodation has been defined as the ways in which parents modify their behavior to help a child avoid or alleviate states of distress and negative affect caused by emotional disorders (Lebowitz & Bloch, 2012; Lebowitz, Scharfstein & Jones, 2014). Research demonstrates that accommodation is common among families of children with OCD and anxiety disorders. Furthermore, high levels of accommodation have been repeatedly associated with greater symptom severity, lower functioning, and poorer treatment outcomes for children, and with distress in parents (Caporino et al., 2011; Lebowitz & Bloch, 2012; Lebowitz et al., 2013; Lebowitz, Scharfstein & Jones, 2014; Storch et al., 2007).
The only published study of family accommodation in children with ASD focused on accommodation of anxiety symptoms. Family accommodation

was similar to that reported by parents of anxious children without ASD, and correlated with severity of the anxiety symptoms (Storch et al., 2015). There has yet to be an examination of family accommodation of RRBs, or its associations with RRB and autism severity. Previous research has found associations between ASD symptom severity and specific parental behaviors (e.g., Gulsrud, Hellemann, Shire & Kasari, 2016; Woodman, Smith, Greenberg & Mailick, 2015), underscoring the merit of such an examination.

Objectives: To preliminarily examine family accommodation of RRBs and its relation to RRB severity in children newly diagnosed with ASD.

Methods: Participants include 19 children (6 females; mean age = 7.71, SD = 3.72) diagnosed with ASD at a tertiary autism center located at a large medical center in central Israel, and their parents. All participants underwent comprehensive assessments including medical history and neurological examination, cognitive and adaptive behavior evaluations and diagnostic measures. Measures include the Family Accommodation Scale for Restricted and Repetitive Behaviors (FAS-RRB; Koller, Shulman & Lebowitz, 2016), the Repetitive Behavior Scale-Revised (RBS-R; Bodfish, Symons, & Lewis, 1998), the Autism Diagnostic Observation Schedule 2 (ADOS2; Lord, DiLavore & Gotham, 2012), and the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter & Le Couteur, 1994).

Results: Accommodation was prevalent, with 17 out of 19 participants (89.47%) reported engaging in accommodation at least once a month and 13 (68.42%) reported daily accommodating their child's RRBs. The most frequently reported forms of accommodation included participating in RRB-related actions (reported by 14 parents), assisting avoidance of RRB-related stimuli (14), and providing RRB-related items (13). Family accommodation was significantly positively correlated with RRB severity (r =.769, p <.001), indicating that increased accommodation was associated with more severe RRBs.

Conclusions: This preliminary study provides the first evidence that parents of children with ASD commonly accommodate their child's RRBs and that the accommodation is positively associated with the severity of the RRBs. These results indicate that accommodation of RRBs may follow a similar pattern to what has been reported in OCD and anxiety disorders (Lebowitz et al., 2014). These findings add to the understanding of autism symptomatology, point to an important and previously unexamined area of research, and highlight heretofore unexplored avenues for potential interventions.

163 **185.163** Health of Mothers of Children with Autism Spectrum Disorders and Intellectual Disability: A Case-Control Study

A. Al Ansari[1] *and H. Jahrami*[2]*, (1)Psychiatric Hospital, Manama, Bahrain, (2)Ministry of Health, Manama, Bahrain*

Background: The impact of caring for a child with a disability has been observed among mothers of children with autism spectrum disorders (ASDs) or Intellectual Disability (ID) in Western countries, but little is known about these challenges in the Arab region.
Objectives: The aim of the current study is to gather knowledge about physical health, mental health and Quality of Life (QOL) experienced by Bahraini mothers of children with ASD or ID in comparison to the mothers of healthy controls (HC).

Methods: Using a cross-sectional study design, data about mothers' demographic characteristics, general health, QOL and functioning were collected through direct interviews. The participants included 90 mothers with 30 mothers from each group (ASD, ID, HC).

Results: Mothers of children with ASD reported more psychological, and environmental problems and received more help from family members when compared to parents of ID and HC children. All groups obtained a similar score on QOL total score and physical health score. Parents of ASD and ID children scored lower than the parents of HC children on GAF measurement.

Conclusions: Mothers of children with ASD and, to a lesser extent, mothers of children with ID needed more social support and counseling regarding their own mental health after their children received a diagnosis.

164 **185.164** IMPACT of Parent Education on Families in South-EAST Europe

D. R. Preece[1]*, J. Stošić*[2]*, E. Theodorou*[3]*, J. Troshanska*[4]*, K. Mavrou*[3]*, L. Symeou*[3]*, J. Frey Škrinjar*[2] *and V. Trajkovski*[5]*, (1)Faculty of Education and Humanities, University of Northampton, Northampton , United Kingdom of Great Britain and Northern Ireland, (2)Department of Inclusive Education and Rehabilitation, University of Zagreb, Zagreb, Croatia, (3)School of Humanities, Social and Education Sciences, European University Cyprus, Nicosia, Cyprus, (4)Macedonian Scientific Society for Autism, Skopje, Macedonia, The former Yugoslav Republic of, (5)Faculty of Philosophy, University of Ss Cyril and Methodius, Skopje, Macedonia, The former Yugoslav Republic of*

Background: Autism challenges traditional parenting styles, and can make parents feel deskilled and disempowered, especially if little information or support is available to them. Providing accurate information about autism to parents, and teaching them to adapt their parenting using good autism practice has been shown to be effective in improving personal, educational and social outcomes for individuals with autism and their families (Bearss et al 2015, Farmer and Reupert 2013). However, such support is extremely limited or non-existent within some south-east European countries.
Objectives: A three-year European Union-funded project has been established involving family members, professionals and academics. Its objectives are to develop a core parent autism education curriculum and locally appropriate parent education materials and methods; to provide parent education in three diverse south-eastern European countries (Croatia, Cyprus and the Former Yugoslav Republic of Macedonia) where diagnosis and service provision are emergent; to develop local parent education teams within these countries to ensure sustainability; and to evaluate the impact of the parent education events upon families attending.

Methods: After reviewing the literature and surveying parental priorities in the three countries, a 12-hour parent education programme and locally differentiated training materials were developed. In total, five cohorts of approximately 20 parents each will receive parent education within each of the three countries. A combined process and outcome mixed methods evaluation methodology (Royse et al 2009) is being used to evaluate the project. Data are gathered via pre-attendance, post-attendance and follow-up (3-month) parent questionnaires – incorporating the CarerQoL quality of life scale (Hoefman et al 2014) – from all participants, semi-structured interviews with a purposive sample of parents, trainer focus groups and reflective diaries, and document analysis. We here report on quantitative (n = 108) and qualitative data (n = 20) from parent cohorts 1 and 2.

Results: Quantitative data identify that >90% of respondents have improved their understanding of autism, >80% report improved child communication and >75% report improvements in overall family life, their ability to predict their child's behaviour and their ability to respond to concerns and comments from the broader family. Carer QoL data indicate increased parental happiness following attendance (p=.001). Key themes from qualitative data are the positive impact of attending the parent education programme, increased awareness regarding sensory and communication issues and improvements in everyday life. Parents also reported that attendance provided opportunities to meet other parents and reduced social isolation.

Conclusions: Data from parent cohorts 1 and 2 identify that parents who have attended the parent education programme have found it beneficial, and that it has had a positive impact on their family life. Key areas of impact have been improvements in communication and improved management of sensory and behavioural issues. This supports the continued and wider provision of parent education within these countries. Further data from cohorts 3 and 4 will have been collected and analysed by the time of INSAR 2018.

165 **185.165** Investigating the Real-Word Application of Social Stories™ within Education and Home Settings

E. Smith[1], *H. Johnson*[1], *A. Constantin*[2] *and M. Brosnan*[3], *(1)University of Bath, Bath, United Kingdom, (2)University of Edinburgh, Edinburgh, United Kingdom of Great Britain and Northern Ireland, (3)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

Social Stories™ are highly structured and personalised social narratives, written and delivered according to a set of criteria outlined by Carol Gray. They are widely used within the autistic community and perceived by teachers and parents to be both an effective and acceptable treatment. Despite their popularity, meta analyses of the research literature reveals mixed findings regarding effectiveness. To date there has been little in the research literature to show how Social Stories™ are being developed and delivered by practitioners and parents in real-word settings and therefore it may not be possible to consider the implications for effectiveness in practice from the research literature.

Objectives:

To investigate how Social Stories™ are being used by parents and practitioners within education and home settings, and consider how this compares to their use within research studies.

Methods:

An online survey was conducted with 103 practitioners and 36 parents over a 6-month period. The survey comprised a series of self-report questions to assess common practices for Social Story™ construction and delivery. Questions related to the 11 intervention variables used in Kokina and Kern's (2010) meta-analysis to enable comparisons to be made between research and practice.

Results:

All respondent reported experience of using Social Stories™ but relatively few parents (40%) and practitioners (61.7%) had received specific training and less than half (48.5%) indicated that Gray's criteria were consistently adhered to.

Table 1 presents a comparison between the proportion of research studies relating to the different intervention variables included in Kokina and Kern's (2010) meta analysis, and the percentage of practitioners and parents who report using Social Stories™ in this way. For several features the majority of participants reported using Social Stories™ in the manor that was found to be most effective (brief intervention; using words and pictures; targeting a single behaviour; use of a functional assessment; use of comprehension checks). Other areas highlighted disparities (when the story was read; who read the story; story length). In addition, when considering the behaviours targeted for intervention both practitioners and parents reported the most common use of Social Stories™ for supporting children with transitions and novel situations, yet very few research studies have focussed on this area (supported by an updated literature search in March 2017).

Conclusions:

The current Social Stories™ research literature is largely based upon addressing inappropriate behaviours in autism and highlights a huge variation in the level of effectiveness across studies. In practice, however, Social Stories™ are largely not being written to Gray's criteria and are being used to assist in transitions and novel situations for children with autism. The effectiveness of Social Stories™ derived from the research literature may therefore have limited relevance for the effectiveness of Social Stories™ in practice. Further research is required to consider the impact of how Social Stories™ are developed and delivered in practice to minimise potential research-practice discrepancies, and to ascertain the impact of violating Gray's criteria upon Social Stories™ effectiveness for children with autism.

Funding for the project was provided by The Leverhulme Trust.

166 **185.166** Maximizing Adolescent Post-Secondary Success: Development and Refinement of a Novel Intervention for Parents of Youth with ASD

A. V. Kirby[1], *K. J. Feldman*[2], *M. Himle*[2], *M. Diener*[2], *C. Wright*[2] *and J. Hoffman*[2], *(1)University of Utah College of Health, Salt Lake City, UT, (2)University of Utah, Salt Lake City, UT*

Background: Adolescence is a critical time during which families of adolescents with autism spectrum disorder (ASD) plan and prepare for the future. Recent evidence suggests that parents' expectations during adolescence act as significant mediators of key outcomes for adults with ASD (Kirby, 2016). Studies have also found that higher expectations for the future and higher parental self-efficacy are associated with more family engagement in positive post-secondary preparation activities (e.g., social activities, volunteer work/employment, parent-youth discussions about the future, working toward goals; Holmes et al., under review).

Objectives: To develop and refine a novel intervention to provide support for parents of youth with ASD, focused on increasing positive post-secondary preparation activities by addressing parents' expectations and self-efficacy related to preparing youth for adulthood.

Methods: As part of the intervention development process, we followed 15 parent-youth dyads (youth with ASD and without intellectual disability) over nine months to understand day-to-day concerns and approaches to preparing for adulthood. Informed by that preliminary work, published empirical findings, and psychological theories (i.e., self-efficacy theory, expectancy-value theory), we developed a five-week group intervention: Maximizing Adolescent Post-Secondary Success (MAPSS). An interdisciplinary research team collaborated throughout the MAPSS intervention development process. We then recruited families to participate in a first iteration of the program (n=4 mothers of youth with ASD and their sons, ages 14-16). Sessions were 90 minutes per week for five weeks and included a concurrent life skills group for the youth with occasional interaction with parents (e.g., during weekly goal setting). Parent participants were required to be a primary caregiver of an adolescent (ages 14-18 years) with

ASD in high school and anticipating receipt of a high school diploma. Upon completion, we collected participant feedback about the program. The primary outcome measure was the Transition Preparation Activities Measure (T-PAM; Kirby, n.d.), secondary measures included the Competency factor of the Family Empowerment Scale (Koren et al., 1992) and Adulthood Expectations Questionnaire (AEQ; Kirby, n.d.), all of which were administered at baseline and at program completion.

Results: Seventy-five percent of participants remained in the program (n=1 dropped out due to a family emergency, but completed an exit interview to provide feedback). Table 1 contains summary participant feedback about the program. Pre- and post-study T-PAM results supported the primary hypothesis. After the five-week program, overall preparation rating increased 13%, overall worry for the future rating decreased 12%, and endorsement of preparation activities increased 7%. No notable changes were identified on the secondary measures.

Conclusions: Results of the first iteration of the MAPSS group suggest it was well-received by participants and provided appropriate content. We did see modest improvements in primary outcome measures but not in secondary measures; the team is reviewing appropriateness of secondary measures as well as adjustments to the content to more effectively target those outcomes. Participant suggestions for improvement included expanding the content focused on adolescent motivation and incorporating more parent-youth combined activities, which will be explored prior to further pilot testing. Future research will include measuring long-term outcomes (i.e., post-secondary outcomes).

167 **185.167** The Lived Experience of Fathers and Mothers of Children with ASD: Facilitators and Barriers to Access of Support.

M. Seymour[1,2]*, S. Allen*[1]*, R. Giallo*[2] *and C. E. Wood*[1]*, (1)Swinburne University of Technology, Melbourne, Australia, (2)Healthy Mothers Healthy Families Research Group, Murdoch Childrens Research Institute, Parkville, Australia*

Background:

Enhancing the wellbeing of parents/carers of children with a disability is recognised as an important area for disability policy and clinical practice [1]. Parenting a child with an Autism Spectrum Disorder (ASD) is associated with social isolation, increased stress, anxiety, and depression [2], along with poorer quality of life and physical health [3]. Many parents of children with ASD report substantial unmet needs (e.g., difficulty accessing services, financial pressure) [4, 5] where more directed parent mental health support is needed. Enhancing the mental health of parents in general, has flow on effects to the wider family, including promoting the potential for positive outcomes for their child [6, 7].

Objectives:

To explore the phenomenological mental health experiences of fathers and mothers of school-aged children with an ASD. Additionally, to investigate facilitators and barriers parents of children with ASD face to accessing support for their own mental health.

Methods:

Participants were four fathers and seven mothers of children (aged 8-10 years) with an ASD, living in urban Victoria, Australia. An Interpretative Phenomenological Approach (IPA) was used as it allows for the detailed examination of participants' lived experiences. Semi-structured interviews were conducted in participants' homes, work-places, or a local psychology clinic. Interviews lasted approximately 90 minutes, and were completed by two researchers who undertook flexible dialogues, while following an interview schedule. All interviews were audio recorded and transcribed verbatim. Themes capturing the participants' lived mental health experiences were consolidated into superordinate themes. A bio-ecological approach was used to guide the identification of potential facilitators and barriers to parents accessing the support they required.

Results:

Mothers and fathers reported both positive and negative impacts of parenting a child with ASD on their mental health, including worry, somatisation, exhaustion, acceptance and hope. Individual, interpersonal, and community factors were identified as barriers and facilitators to parents accessing the support they required. Within the individual domain, the importance of self-care and flexibility/restriction were identified as impacting parents' access to support for their own mental health. External perceptions and informal social support were identified as important factors within the interpersonal domain. Finally, at the community level, system understanding, access to services, financial pressure, and professional support impacted parents' access to support for their own mental health.

Conclusions:

The results of this qualitative study shed important light on the lived mental health experiences of fathers and mothers raising children with an ASD, along with their unique support needs. While fathers and mothers identified that there are many challenges to parenting a child with ASD that adversely impact their own mental health, there are also many moments of growth, acceptance and optimism. Parents identified important individual, interpersonal and community factors which impact their access to support for their mental health, many of which are modifiable. Continued research and support is needed in order to improve service capacity to provide quality care to the unique needs of mothers and fathers raising children with ASD.

168 **185.168** Open Feasibility Study: Navigator ACT for Parents to Children of Autism Spectrum Disorders (ASD) and/or Other Disabilities

T. Holmberg Bergman[1]*, B. Berg*[2] *and T. Hirvikoski*[3]*, (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden, (2)Stockholm County Council Habilitation and Health, Stockholm, Sweden, (3)Habilitation & Health, Stockholm County Council, Stockholm, Sweden*

Background:

Parents of children with disabilities, especially Autism Spectrum Disorders, report psychological distress, e.g., depression, anxiety and parenting stress (e.g., Mak & Kwok, 2010, Hayes & Watson, 2013). While psychological problems of these parents have gained attention, a little is done to investigate the usefulness and affectiveness of the treatments available. However, Acceptance- and Commitment Therapy (ACT) have shown promising results in a few open pilot studies (e.g. Blackledge & Hayes, 2006; Kowalskovski, 2012). At Habilitation & Health (disability service clinics in Stockholm, Sweden), ACT has been used since 2007 as part of parent support services. During the recent years, a manual-based ACT group intervention *"Navigator ACT"* was developed to enhance psychological well-being of these parents.

Objectives:

An open study was conducted to evaluate the feasibility, parent satisfaction and preliminary efficacy of the 5-session *"Navigator ACT"* for parents to children with ASD and/or other disabilities. The following research questions were considered: 1. Is the Navigator ACT a feasible treatment method in an out-patient clinical disability services context? 2. Are parents satisfied with the intervention? 3. Is the Navigator ACT (preliminary) an effective method in increasing parental psychological/behavioral flexibility and mindfulness skills as well in reducing symptoms of depression, anxiety and parenting stress. Furthermore, a possible effect on behavioral problems of the child with disability was investigated.

Methods:

The open feasibility study was conducted at 7 outpatient disability service clinics in Sweden. A total of 94 parents were allocated to treatment. The feasibility criteria was defined as 75 % of the parents participating in at least 4/5 sessions. Parent satisfaction was measured by session- and treatment evaluations as well as evaluation of treatment credibility. For preliminary efficacy measures, pre, post and 3-month follow-up was conducted by using several self-rating questionnaires concerning e.g., symptoms of depression and anxiety, parenting stress and behavioral flexibility.

Results: 80 % of the parents attended at least 4/5 sessions. Treatment satisfaction was good and stable over the five sessions. The preliminary efficacy measures showed statistically significant increases in psychological/behavioral flexibility and mindfulness as well as reductions in symptoms of depression and anxiety.

Conclusions:

The Navigator ACT was a feasible intervention in a clinical disability service context. Navigator ACT shows promising preliminary efficacy regarding psychological flexibility and well-being of parents to children with ASD and/or other disabilities. We are currently preparing for a pragmatic multi-center randomized controlled trial concerning Navigator ACT.

169 **185.169** Parent Perspectives and Perceptions of Autism Spectrum Disorder Diagnosis: A Scoping Review and Framework Development

A. Makino[1], *L. Hartman*[2], *G. King*[2], *P. Y. Wong*[3] *and M. Penner*[1], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (3)Health Sciences Library, Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada*

Background: The growing number of children diagnosed with autism spectrum disorder (ASD) has greatly increased the demand for diagnostic assessments, leading to lengthy wait times. This is relevant as diagnosis is often needed to access behaviorally-based intervention which has been shown to significantly improve outcomes. Across the globe, there is no standard path or process for ASD diagnosis leading to a growing interest in examining the practices and quality of diagnostic assessments. Families of children with ASD are key stakeholders in the diagnostic process and their perspectives deserve to be explored and addressed.

Objectives: 1) To identify the quantity, methodological characteristics, key themes, and gaps in the current literature examining parents' and caregivers' perspectives of ASD diagnosis; 2) To create a framework for understanding parent and caregiver experiences of ASD diagnosis based on existing literature.

Methods: A scoping review was completed following Arksey and O'Malley's (2005) framework. Five databases were systematically searched (CINAHL, Embase, Medline, PsycInfo, Scopus) for the period Jan 1994–Sep 2017. Titles and abstracts were screened for relevance. 121 articles underwent full text review.

Results: Seventy-one articles met inclusion criteria. Articles consisted of quantitative questionnaire-based studies, qualitative interviews/focus groups, mixed-method designs, and reviews. The number of annual publications increased over time. Results indicate that diagnosis is a uniquely stressful and emotionally intense time for parents and caregivers. The path to diagnosis was often seen as convoluted and fraught with delays. Factors found to impact the diagnostic experience for families included clinicians' approaches to delivery of and the information and resources provided at the time of diagnosis. Based on these findings a framework was created indicating four central components of the family's diagnostic experience: 1) the journey to assessment, 2) the assessment process, 3) delivery of the diagnosis and feedback session, and 4) provision of information, resources and support. With the exception of the negative impact of wait times, perceptions of the diagnostic process itself, such as background of the assessor, methods of assessment, and setting of diagnosis, have not been thoroughly examined in the literature to date.

Conclusions: The literature demonstrates a growing interest in parent and caregiver perspectives of ASD diagnosis. The path to diagnostic assessment was long and complex for many families and should be targeted as an area for improvement. Clinicians should strive for an honest but hopeful tone with the strengths-based approach to diagnosis that families desire. The feedback session after diagnostic assessment should emphasize information and resource support as this has been identified as the most important element of the diagnostic process for families.

170 **185.170** Parental Psychological Distress and Health-Related Quality of Life: The Impact of Autism Spectrum Disorder and Parental Counseling

A. Karaivazoglou[1], *E. Papadaki*[1], *K. Assimakopoulos*[2], *G. Iconomou*[2], *G. Touliatos*[1] *and S. Kotsopoulos*[1], *(1)Day Centre for Children with Developmental Disorders, Messolonghi, Greece, (2)Department of Psychiatry, University of Patras, Rio, Patras, Greece*

Background: Parenting children with Autism Spectrum Disorder (ASD) constitutes a challenging task which puts extreme demands on families' financial, social, cognitive and emotional resources. In this respect, parents of ASD children frequently suffer from somatic and psychological complaints and report low levels of health-related quality of life (HRQOL).

Objectives: The primary aim of the current study was to measure anxiety and depressive symptoms and health-related quality of life (HRQOL) in parents of children diagnosed with ASD and determine their demographic correlates. A secondary aim was to evaluate the impact of systematic counseling on parental psychosocial functioning.

Methods: The Hospital Anxiety and Depression Scale (HADS) and the Short Form-36 Health Survey (SF-36) were used to assess anxiety, depression and HRQOL, respectively. All participants were administered these questionnaires at baseline. Moreover, a sub-group of parents were re-evaluated after 6-12 months of systematic counseling.

Results: 81 parents participated to the study, 54 with a child diagnosed with ASD according to DSM-V criteria and standardized evaluations(CARS, SCQ, ADOS-2) and 27 with mentally and physically healthy children. Parents of ASD children reported increased levels of anxiety (p=0.040) and depression (p=0.001) and lower scores in social functioning (p=0.004) compared to parents of healthy children. Among parents of ASD children, parents with younger children reported lower anxiety scores (r=0.359, p=0.010) and higher vitality (r=-0.389, p=0.006), social functioning (r=-0.389, p=0.006) and mental health (r=-0.484, p=0.000) scores. In addition, employed parents scored significantly lower (p=0.017) in the general health sub-domain of HRQOL. Twenty-three (23) parents of ASD children were prospectively followed-up and re-administered the above questionnaires after 6-12 months. Seventeen (17) of these parents had received regular parental counseling sessions, while 6 parents had not. Parents which had received counseling reported significant improvement in the mental health sub-domain of the SF36 (p=0.027) compared to parents which were not engaged in parental counseling.

Conclusions: Parenting ASD children is associated with significant psychological distress and disturbed social functioning. Systematic parental counseling may lessen parents' psychosocial burden by improving mental health-related HRQOL.

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185.171 Parental Stress, Marital Satisfaction and Stigma in Lithuanian Parents Raising Child with ASD

R. Buivydaite[1], *C. Newton*[2] *and A. Prasauskiene*[3], *(1)University of Oxford, Oxford, United Kingdom of Great Britain and Northern Ireland, (2)Kenya Medical Research Institute, Kilifi, KENYA, (3)Psychiatry, Lithuanian Health University, Kaunas, Lithuania*

Background: The research has revealed that there are few studies about autism conducted in Eastern Europe (Mikulenaitė & Ūllevičiūtė, 2004; Lesinskienė *et al*, 2008). The research project is motivated by lack of studies on autism in Lithuania, particularly the stress experienced by the parents. Experiences of stigma leads to increased parental stress. High levels of parental stress are correlated with mental health problems like depression and anxiety (Jones *et al*, 2008).

Objectives: Therefore, we conducted a study to explore parental mental health, marital satisfaction and experiences of stigma for parents raising children with autism, cerebral palsy and controls in Lithuania.

Methods: *Participants* - parents of children with autism spectrum disorder (ASD) 137, cerebral palsy (CP) 100, typically developing (TD) 140. *Tools* - Socio-demographic questionnaire, Parental Stress Index by Abidin 1992 (PSI –SF), Couple satisfaction index by Funk & Rogge 2008 (CSI) and Family Interview Schedule stigma scale by World Health organization 1994 (FISSS). *Procedure* - parents are informed through hospital staff in Lithuania, parents association of autism and cerebral palsy. Typically developing children parents were approached via schools.

Results: Results revealed that parental stress is highly experienced in ASD and CP group. There were no parental difference between mothers and fathers of children with ASD. Also the levels of experienced stigma was equally high between ASD and CP parents', stating that in Lithuania there is no difference in experience of stigma between 'visible' and 'invisible' disabilities, contradicting the existing findings from previous studies. Moreover, this study revealed, the higher divorce rate for autism group compared with other two groups. We also found, that autism characteristics, such as difficult behaviour, lack of communication and parenting styles were the underlying factors for the parental stress among the parents of children with ASD.

Conclusions: This study revealed the underlying issues that parent's, who are raising child with autism, face in their day to day lives while raising a child in Lithuania. This research informs about the stress levels, experience of stigma and marital satisfaction that must be address with urgent support for families.

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185.172 Parenting Adolescent Boys with Autism Spectrum Disorder (ASD) Versus Adolescent Boys with Disruptive Behaviour Disorder and Typically Developing Boys

E. O'Nions[1,2,3], *R. Roberts*[2], *E. Viding*[2] *and I. Noens*[4,5], *(1)Social, Genetic & Developmental Psychiatry, King's College London, London, United Kingdom, (2)Department of Clinical, Educational and Health Psychology, University College London, London, United Kingdom, (3)Parenting and Special Education Research Unit, KU Leuven, Leuven, Belgium, (4)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium, (5)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium*

Background:

Extant research suggests that parents of boys with disruptive behaviour adopt less adaptive parenting practices compared to parents of typically developing boys, which can constitute risk/maintaining factors in the development of problem behaviour. Disruptive behaviours are also common in children with ASD. However, no research has directly compared parenting between these groups, or explored differential relationships between parenting and disruptive behaviour severity.

Objectives:

We aimed to explore differential parenting between parents of boys with ASD, parents of boys with disruptive behaviour (DB) and parents of typically developing (TD) boys. Given that differential mechanisms are believed to promote disruptive behaviours, we hypothesised that parents of boys with ASD would resemble parents of TD boys in positive (involvement, positive parenting, supervision and monitoring), and negative (consistent discipline, physical punishment) parenting behaviours.

Methods:

Parents of boys aged 11 - 16 with DB (N = 26) and matched TD boys (N = 29) completed measures as part of a larger study. Inclusion in the DB group required (1) significant conduct disorder symptoms based on parent/teacher report, and (2) attendance of a specialist educational setting. Data from parents of boys with ASD (N = 29) were drawn from a separate study. Both ASD and DB groups spanned a range of conduct disorder symptoms (ASD mean: 4.21, SD: 4.68; DB mean: 7.63, SD: 4.13). Data on parenting were collected using the Alabama Parenting Questionnaire (Frick, 1991).

Results:

No group differences were found for parental involvement and positive parenting ($F(2,81) = .183$, p >.3; $F(2,81) = .744$, p>.3, age included as a covariate). Robust group differences were reported for supervision and monitoring ($F(2,81) = 22.81$, p<.001). Post hoc-analysis indicated that parents of adolescent boys with ASD engaged in most supervision and monitoring (significantly more than parents of TD boys), and parents of boys with DB engaged in least (significantly less than TD boys). Group differences for inconsistent discipline and physical punishment reached nominal significance, but would not survive correction ($F(2,81) = 3.715$, p=.029; $F(2,81) = 4.055$, p =.021). Post-hoc analysis indicated that parents of boys with ASD reported less inconsistent discipline and physical punishment compared to parents of DB boys. Continuous analysis within groups indicated that the severity of conduct disorder symptoms was not related to parenting in ASD and TD boys. However, in boys with DB, there was a robust relationship between (lack of) monitoring and supervision and conduct disorder symptoms (partial correlation controlling for age: $r = .702$, p<.001).

Conclusions:

We demonstrate differences in parenting behaviours between parents of TD boys, boys with ASD and boys with DB; and differential relationships between parenting and conduct disorder symptoms. Parents of boys with ASD engaged in more monitoring and supervision compared to TD parents, yet conduct disorder symptoms were significantly elevated. This suggests that a lack of monitoring and supervision is not a risk factor for conduct disorder symptoms in ASD. Longitudinal research using multiple informants is needed to explore the directionality of effects and overcome possible rater bias.

173 **185.173** Parenting Plus: Raising Children and Adolescents with Autism Spectrum Disorder

L. van Esch[1,2]*, H. Boonen*[1,2]*, G. Lambrechts*[1,2,3]*, J. Maljaars*[1,2,3]*, E. Ceulemans*[4]*, K. Van Leeuwen*[1] *and I. Noens*[2,5]*, (1)Parenting and Special Education Research Unit, KU Leuven, Leuven, Belgium, (2)Leuven Autism Research (LAuRes), KU Leuven, Leuven, Belgium, (3)Child Psychiatry, UPC-KU Leuven, Leuven, Belgium, (4)Quantitative Psychology and Individual Differences, KU Leuven, Leuven, Belgium, (5)Parenting and Special Education Research Unit, University of Leuven, Leuven, Belgium*

Background: Parents of children with ASD face specific challenges in raising their child. Research clearly indicated that parents of children with ASD across all ages experience more parenting stress than those of typically developing children or children with other disabilities. Nevertheless, research investigating the behavioural aspects of parenting children with ASD is rather scarce.

Objectives: We aim to present the overall results of multiple studies on parenting behaviours among mothers of children with ASD. The main objectives were twofold: (1) to compare parenting behaviours among mothers of children with and without ASD, and (2) to examine whether and how mother's parenting behaviours are related to child (gender, age, IQ, ASD characteristics and behaviour problems) and mother (parental stress and psychological well-being) characteristics.

Methods: A multi-method approach was used, combining information from questionnaires, interviews, tests and observations, collected from mother-child dyads across different age groups (Preschool: 22 with and 50 without ASD; Primary school: 30 with and 39 without ASD; Secondary school: 44 with and 38 without ASD).

Results: Parenting behaviours in the ASD group were largely comparable to those in the control group; few differences were found. Across all age groups, mothers of children with ASD scored lower on observed provision of structure. In addition, mothers of preschool and school-aged children scored lower on observed sensitivity and mothers of preschool children with ASD higher on observed negativity towards their child. On the contrary, mothers of children with ASD in secondary school showed more sensitivity and creativity than mothers in the control group. Regarding self-reported parenting behaviours, mothers of preschool children with ASD stimulated the development of their child less, whereas mothers of children with ASD in the older age groups adapted the environment for their child more. However, when controlling for parenting stress, most of the group differences did not remain significant. Based on questionnaires filled out by 73 mothers of children aged 6-16 years, parental control appeared related to lower IQ scores, more ASD characteristics and less externalising behaviour problems of the child in the control group. In the ASD group, parental control was only related to the age of the child. When controlling for parenting stress, the correlation between parental warmth and externalising behaviour became significant, suggesting a suppression effect of parenting stress on this relation.

Conclusions: The findings suggest that (1) parenting behaviours are largely comparable across control and ASD group, (2) behavioural differences between both groups are mostly explained by differences in parenting stress, and (3) mothers of children with ASD become more sensitive/creative across age groups in comparison to the control group. Little child and mother characteristics are found to be related to parenting behaviour in the ASD group as opposed to the control group. Taken together, this suggests that mothers of children with ASD get increasingly adapted to the needs of their child with ASD. Parenting stress seems to have an important effect, suggesting that counsellors should not only focus on the behavioural aspects, but also take parenting stress into account.

174 **185.174** Positive and Negative Cognitive Appraisal of the Impact of Children with Autism Spectrum Disorder on the Family: A South African Study

L. Schlebusch[1,2] *and S. Dada*[3]*, (1)Division of Child and Adolescent Psychiatry, University of Cape Town, Rondebosch, South Africa, (2)Centre of Excellence in Human Development, Johannesburg, South Africa, (3)Centre for Augmentative and Alternative Communication, University of Pretoria, Pretoria, South Africa*

Background:

There is a large body of evidence that confirms that children with autism spectrum disorder (ASD) pose a range of distinct challenges to families, that parents and siblings experience high levels of stress, and that life is hard for these families. However, there is a risk that the dominant portrayal of a negative impact elicits an elaborate representation of the challenges associated with ASD, without considering any positives. Although researchers are yet to understand the full range of families' experiences when raising a child with ASD, stress and coping theory and research have shown that families can perceive (or cognitively appraise) the impact of their child with a disability as both negative *and* positive.

Objectives:

We investigated the measurement of positive and negative cognitive appraisal in the context of childhood disability in a middle-income country, and describe how South African families positively and negatively appraise the impact on the family of raising a child with ASD.

Methods:

We used the responses of 180 parents who completed the *Family Impact of Childhood Disability Scale*, which was part of the survey data gathered in a larger study that examined the perspectives of families of young children with ASD in South Africa. Participating families were recruited from 35 disability-related service providers in the Gauteng province. We assessed the reliability of the *Family Impact of Childhood Disability Scale* by calculating Cronbach's alpha and the validity by using confirmatory factor analysis techniques. We conducted statistical analyses to determine the descriptive statistics.

Results:

Our findings indicate that the measurement of cognitive appraisal of the impact of ASD on the family was measured in a reliable and valid manner, thus contributing evidence to the universal properties of positive *and* negative appraisal when raising a child with a disability. Families rated the positive appraisals to have a more substantial impact on the family than the negative appraisals.

Conclusions:

The findings of our study provide a cross-cultural perspective of the positive and negative cognitive appraisal of families who are raising a young child with ASD. Similar to other families in other countries, the participating families perceived the impact of a child with ASD as both positive *and* negative and revealed that parents are able to re-create positive meanings about their child with ASD. The positive findings portray the complexity of families and challenge the limitations and stigmatisation that society ascribes to raising a child with ASD. The research and clinical implications of these findings will be discussed.

175 **185.175** Predictors of Positive Contributions When Raising an Individual with ASD: An Actor-Partner Interdependence Model.

C. Garcia Lopez[1,2]*, P. Pozo*[2,3]*, P. Recio*[2,3] *and E. Sarria*[2,3]*, (1)UTAE, Hospital San Joan de Deu, Barcelona, Spain, (2)IMIENS (Instituto Mixto de Investigación-Escuela Nacional de Sanidad), Madrid, Spain, (3)Faculty of Psychology, UNED, Madrid, Spain*

Background: Autism Spectrum Disorder (ASD) is considered one of the developmental disorders with greatest impact on the family system. Theoretical and empirical research has typically focused on its negative impact on parental mental health, paying little attention to parents' positive perceptions regarding ASD and the positive influence that it could produce on family adaptation. A further issue concerns the fact that the majority of studies on the ASD family field consider only one of the parent's perceptions (generally mothers), not taking into account that family members affect one another. Particularly, couples affect each other cognitively, emotionally and behaviorally, which implies the need to consider a systematic perspective when studying ASD family adaptation. Taking into account the limitations identified in previous research, we explore the notion that parental positive perceptions might be influenced by the child with ASD but also by the psychological adaptation of the partner.

Objectives: The goal of this study is to test the benefits and potential use of the actor-partner interdependence model (APIM) in examining how different psychological adaptation measures of fathers and mothers of children with ASD influence each other's perception of positive contributions regarding their child with ASD.

Methods: 135 Spanish father-mother dyads raising individuals with ASD completed validated questionnaires measuring different psychological adaptation measures, *i.e*., stress, anxiety, depression, sense of coherence and positive contributions *i.e., happiness and fulfillment, personal growth and maturity* and *strength and family closeness.* We first fitted a series of single predictor models to test for possibly confounding variables, *i.e.,* parent and child age, family income, education level, ASD severity and behavior problems, and included the ones significantly associated with outcome measures in the final APIM models. Three sets of four models, *i.e*., one for each positive contribution outcome, were specified using a multilevel modeling (MLM) approach.

Results: Multilevel analysis revealed some actor effects of sense of coherence, stress and anxiety, and some partner effects of anxiety and depression to be important determinants of the perception of positive contributions, above and beyond child and sociodemographic factors. ASD severity, child age and family income were also identified as significant predictors of both progenitors' perceptions of positive contributions.

Conclusions: The psychological adaptation measures here explored have proved to be relevant determinants of both progenitors' perceptions of positive contributions regarding ASD, and should therefore be screened by clinicians, when working with ASD families. Professionals should also consider adjusting expectations according to the child's ASD severity given its negative relationship with the perception of positive contributions. Finally, governments should consider new policies aiming to support ASD families' treatment expenses.

176 **185.176** Public Places and Social Participation : Obstacles Faced By Parents with ASD Children

F. Beauregard[1]*, M. Couture*[2] *and C. Gauthier-Boudreault*[1]*, (1)Université de Sherbrooke, Sherbrooke, QC, Canada, (2)Rehabilitation, Universite de Sherbrooke, Sherbrooke, QC, Canada*

Background: There has been little research into the experiences of children and families (Hanvey, 2003) when frequenting public spaces. According to the Participation and Activity Limitation Survey, social participation tends to diminish with the severity of the child's disability or when parents lack support (Statistics Canada, 2006). Another factor that could also influence social participation is the nature of the child's disorder. In fact, the existence of an invisible disability such as autism spectrum disorder (ASD) could impede families' use of public spaces. According to the most recent studies, the prevalence of persons with ASD was 11.3/1000 (1 in 88) in 2008. Problem behaviours are also frequent (APA, 2013; Poppes et al., 2010). For families of children with an ASD, their problems with communication and social interactions can make it difficult to be in public spaces. Sallafranque et al. (2012) have identified numerous obstacles to social participation for children with an ASD. However, obstacles to participation have not been examined from the standpoint of presence in public spaces. Moreover, few studies have looked at the repercussions of these disorders in terms of social participation in the community. Thus, the aim of this study was to develop a profile of these families' experiences with public spaces and to document the obstacles to their participation.

Objectives: In this communication, we present the obstacles faced by parents when they frequent public places with their ASD child.

Methods: This was a descriptive survey. Parents were recruited through parents' associations (Quebec Autism Federation) and invited to complete an online questionnaire that took approximately 30 minutes. The questionnaire was intended for parents of children (0-21 years) with an ASD. The online questionnaire was developed based on a literature survey and the International Classification of Functioning, Disability and Health (ICF). It consisted of both closed and open-ended questions that documented the public spaces into which the families went and the obstacles to their social participation. One open question was about the obstacles that parents encounter when frequenting public places with their ASD child.

Results: About 100 parents completed the online questionnaire. The results of the questionnaire suggest that these parents visit very few public spaces. Those they visit are primarily utilitarian in nature, such as grocery stores and malls. This study showed that going into public spaces is stressful for these parents because of several obstacles. These were grouped into three categories: 1) sensory stimuli, such as sounds, lights, and crowds 2) attitudes and perceptions of other people, whether suppliers or users of services; 3) concerns for their children's safety. The analysis also revealed that the obstacles could influence each other.

Conclusions: A better understanding of these families' situation could become a point of reference in developing services. This could make it easier to ensure that a proposed adaptation actually meets the needs of this population and that efforts to sensitize the people involved or others who use these spaces are targeting the right issues.

177 **185.177** Reimagining Autism: Drama, Theatre, Autism and the Illuminating Blind Spots of Interdisciplinary Collaboration

ABSTRACT WITHDRAWN

Background:
Spectrum Conditions' was an interdisciplinary collaboration between drama and psychology at the University of Kent (2011-14), funded by the Arts and Humanities Research Council (AHRC). As communication, social interaction and social imagination are core characteristics of theatre as well as being diagnostic features of autism spectrum disorders, theatre methods are attracting increasing interest in the field as interventions with the potential to help children with autism connect to the social world (Corbett, 2016, Lerner et. al. 2016).

The project assessed the feasibility and justification for further research of this novel school-based theatre intervention. Participatory performance techniques (emerging from the field of applied theatre) extend the skills-based approaches of role-play and social scripts to engage children through improvisation and intensive interaction. The approach involved small groups (3-4) of autistic participants (22 children aged 7-12) with varying levels of ASD interacting with practitioners in themed multisensory scenic environments.

A theme of this paper is the lessons to be learned from the inter spaces of collaboration between disciplines: questions of what constitutes evidence, the exposure of methodological "blind spots" and the ways in which the practice has subsequently cast new light on imagination and gender

Objectives:

1.To establish the feasibility of the intervention and whether it produces measurable effects;

2.To develop a template for the creative laboratory, including programmes of training for practice-based autism research.

3. To evaluate the efficacy of drama as a research tool for autism

Methods:

The original research involved a series of immersive installations, contained within the 'pod', a portable structure (functioning like an interactive multi-sensory room). The environments were designed to facilitate communication, social interaction, imagination and imaginative play. Participants (22 children with varying levels of ASD, aged 7-12) encountered a range of stimuli, triggers and responsive technologies.

Before and after the intervention, study participants completed measures of social interaction, communication, emotion recognition, and parents and teachers questionnaires before and up to twelve months after the intervention. Feasibility was evaluated through process (recruitment, retention, blinding, inter-rater reliability, willingness of children to engage), resources (space, logistics), management (dealing with unexpected changes, ease of assessment), and scientific data (statistical analyses).

Results:

Children, parents and teachers reported high satisfaction with the intervention; missing data was relatively low; key assessments were implemented as planned; evidence of potential effect was demonstrated on several key outcome measures. Some reported difficulties were encountered with recruitment, test administration, parental response, and setting up the pod.

Conclusions:

Imagining Autism may be a feasible approach particularly for special education schools. Strengths include the novelty of the approach, implementation in the real world; education settings, focus on sensory processing and imagination. However, it was the unexpected insights emerging from the project that are the focus of this paper and that are consistent with new developments in autism research: specifically, recognition of social creativity in autism and what the practice revealed about female presentations of autism.

178 **185.178** Shifting Sands: Examining Social Support Needs of Children with ASD and Their Families across the Pathway of Development

D. B. Nicholas[1] *and L. Lach*[2,3]*, (1)University of Calgary, Edmonton, AB, Canada, (2)School of Social Work, McGill University, Montreal, QC, Canada, (3)Departments of Pediatrics and Neurology/Neurosurgery, Faculty of Medicine, McGill University, Montreal, QC, Canada*

Background: Social support is a social determinant of health that plays an important role in the well-being of parents as they care for their child(ren) with ASD. Social support includes formal resources (e.g., government funds) and informal help and engagement (e.g., family, friends). While it is intuitively recognized that social support needs shift with advancing age and changing circumstances across the life course, the nature and extent of needs for support over time and circumstance are unclear. Currently, little is known about the support needs of parents as they move through their child's developmental transitions (e.g., diagnosis, school entry, transfer to high school, exit from high school, etc.).
Objectives: This qualitative study examined the following question: What types of support do parents of children with ASD need at varying points of child and family development (at diagnosis, entering primary school, entering high school, and exiting high school)?

Methods: Utilizing an interpretive description approach (within a larger study), group interviews were conducted with n=50 parents of children with a neurodevelopmental disability. In this presentation, we will focus only on parents of children with ASD. Data addresses participant experiences and identifies parental needs for social support and services over time.

Results: Findings offer support experiences and needs over time. Overall, accessed social support was commonly insufficient relative to support needs. Parents reported they required, by default, to independently seek needed supports and services. They described ongoing needs for navigational support and peer connection with other parents. At diagnosis, parents reportedly required information about ASD, service guidance and targeted navigational support; they sought external support that offered messages of hope for the future as they adjusted to the diagnosis of ASD. Once the child had reached a more stable point relative to resource access, parents needed ongoing support in their continuing adjustment and, in some cases, relationship stability amidst the challenges and 'new norm' of ASD. Upon school entry, support in managing changing relationships within the school system emerged. Stigma was increasingly noted over time as the child's expression of ASD more visibly rendered differences from neurotypical peers. Upon high school entry, families expressed challenges due to fewer resources; they worried more about safety in unsupervised settings such as in school buses, and amidst potential (and actual) peer bullying toward their adolescent. Concerns about transition to adulthood more strongly emerged later in (and beyond) high school.

Despite nuanced differences and shifts across development, existing services were reported as common in terms of being insufficient. There was a reported lack of available knowledge about existing services and service needs at particular developmental stages.

Conclusions: These findings inform overall support planning as well as identify areas to refine along the developmental pathway, as per individual and family needs. Support needs emerge as continuing yet shifting, with increased focus warranted on anticipated needs, goal setting, and activity/targeted outcome planning. Recommendations for support delivery will be offered in the presentation, as will implications for program and policy development.

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185.179 Sibling Relationships in Families of Children with ASD

Y. Rum[1]*, D. A. Zachor*[2]*, Y. Armony*[1] *and E. Dromi*[3]*, (1)Tel Aviv University, Tel Aviv, Israel, (2)The Autism Center/Pediatrics, Tel Aviv University / Assaf Harofeh Medical Center, Zerifin, Israel, (3)Constantiner School of Education, Tel Aviv University, Tel Aviv, Israel*

Background:

Sibling relationships include warm qualities such as affection, companionship, and intimacy, and consist also of conflict, rivalry and power. These relationships are often the longest and most important bonds a person has throughout life (Boer, Dunn, & Dunn, 2013; Gass, Jenkins, & Dunn, 2007). The influential role that Typically Developed (TD) siblings of children with Autistic Spectrum Disorder (ASD) play on their brother or sister's social and cognitive development was recognized in previous research (Ben-Itzchak & Zachor, 2016). However, little is known about siblings' relationships in families of children with ASD.

Younger siblings of children with ASD have been studied mainly in the context of looking at early signs of ASD in high-risk populations. Few studies have focused on older TD-siblings and on the siblings' relationships (Kaminsky & Dewey, 2001; Rivers & Stoneman, 2003). The limited number of studies on this topic requires additional data, which should be collected in different cultures with diverse methodologies.

Objectives:

- To explore the perspective of the older TD-sibling on his/her relationship with his/her younger sibling with ASD.
- To compare questionnaire results with open-ended answers given during interviews.

Methods:

Twenty-five sibling dyads (10 same-gender, 15 mixed-gender) participated. Older siblings were TD (M=9.2 years, SD=2.01; 11 boys, 14 girls); younger siblings were diagnosed with ASD (M=6.4 years, SD=1.53; 24 boys, 1 girl).

TD-siblings completed:

- Sibling Relationship Questionnaire (SRQ; Furman & Buhrmester, 1985): measures Warmth/Closeness, Relative Status/Power, Conflict, and Rivalry. Items were rated on a 5-point Likert scale (5 indicates high levels of a factor, 1 indicates low levels).
- An open ended oral interview regarding sibling relationships. Each interview was transcribed and analyzed in a qualitative approach.

Results:

SRQ factor group means were within average range: Warmth/Closeness M=3.08 (SD=0.678); Relative Status/Power M=2.229 (SD=1.587); Conflict M=2.566 (SD=1.127); Rivalry M=2.9 (SD=0.466). This is in accordance with previous reports (Kaminsky & Dewey, 2001).

Content analysis of the interview data revealed eight categories: particularity of ASD sibling; disparities; conflict; negative reference; positive reference; similarity and closeness; TD-sibling's role; strengths of the ASD sibling.

Without being directly asked, 20% of TD-children chose to describe their siblings' strengths and advantages, and almost 50% described similarity and closeness they share with their siblings. 40% referred to disparities between them and their siblings, and 20% referred to difficulties and the particularity of their siblings. Only one child used the word 'autism' (*"I don't know if my mother told you, but he has autism"*). While the SRQ demonstrated a moderate level of conflict, interviews showed that conflicts can be characterized as a strong attribute in the relationships.

Conclusions:

- It is important to extend sibling research beyond biological questions to include sibling relationships.
- In line with previous research, our results reveal a generally positive perception of TD-children on their relationships with siblings with ASD.
- Qualitative analysis detected themes absent from the structured questionnaire.
- The study demonstrates the benefits of a mixed methods approach to better understand sibling relationships.
- Future studies will explore the connection between siblings' perception of relationships and actual behaviors during interactions.

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185.180 SPARK Research Match: A Platform to Accelerate Research By Matching SPARK Participants with New Autism Studies

C. W. Lehman[1]*, J. K. Law*[2]*, J. Toroney*[2]*, B. Vernoia*[1]*, P. Feliciano*[1] *and W. K. Chung*[1]*, (1)Simons Foundation, New York, NY, (2)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD*

Background: The Simons Foundation Powering Autism Research for Knowledge (SPARK) is a collaborative, online study that enrolls individuals with a professional diagnosis of autism and their family members into an autism research cohort. All participants consent to be contacted about future autism research studies. With over 90,000 engaged participants and over 30,000 with ASD, SPARK offers an unprecedented opportunity to facilitate autism research broadly by assisting researchers with study recruitment – one of the major challenges in conducting clinical studies (Denhoff 2015). SPARK features a research match (RM) process that supports external study data collection to facilitate research recruitment, requires bi-directional data sharing to enhance both SPARK data and researchers' studies and to minimize participant burden, and captures participant and researcher feedback to inform future RM studies.

Objectives: (1) Describe the research match process in SPARK (2) Report outcomes for completed studies

Methods: The RM process is divided into three stages: application, launch, and study close. All investigators seeking to recruit SPARK participants complete an application. Proposed studies are reviewed by the RM committee, comprised of research and recruitment experts, and scored based on research and engagement merit. During the pre-launch phase, the RM team works with the investigator to draft recruitment materials that fit the standard SPARK communications and to modify the study consent to allow for bi-directional data-sharing. For internet-based studies, SPARK has developed the infrastructure for online surveys and databases. During the launch phase, potentially eligible SPARK participants are notified by email about the new study. Participants can 'opt-in' to receiving additional information. For online studies, the RM platform supports electronic consent, data collection, and incentive distribution. For in person studies, participants complete an online data authorization and provide updated contact information, which are shared with the external study team for follow-up and study team contact. After study launch, response rates are closely monitored and adjusted to balance recruitment goals and participant experience. The final stage includes preparation and transfer of study data set (if applicable) and a summary RM report for the external research team with recruitment metrics. Participant and researcher feedback are captured at the close of the project. The SPARK team also works with researchers to prepare aggregate study results for communication to participants.

Results: As of October 2017, SPARK has received 10 applications. To date, 4 RM studies have launched (2 online, 1 in person, and 1 other) and over 10,000 SPARK participants were invited to participate in at least one RM study. Data from these initial studies demonstrated response rates as high as 60% and high participant satisfaction with the process and study topics. Implications for study recruitment and satisfaction based on project type (e.g. survey vs in person) will be presented. Additionally, feedback data from researchers and participants will be shared.

Conclusions: Overall, the research match process in SPARK benefits both researchers and participants by facilitating high quality research to help address important questions about autism, with the goal of improving the understanding, diagnosis, and treatment of autism and related disorders.

181 **185.181** Students with Autism Spectrum Disorder and Their Parents in the Transition into Higher Education: Dynamics in Parent-Child Relationships

V. Van Hees[1]*, H. Roeyers*[2] *and J. De Mol*[3]*, (1)Ghent University, Departement of Experimental, Clinical and Health Psychology, Ghent, Belgium, (2)Department of Experimental-Clinical and Health Psychology, Ghent University, Ghent, Belgium, (3)Department of Psychology and Educational Sciences, Université catholique de Louvain, Louvain-La-Neuve, Belgium*

Background: The number of individuals with autism spectrum disorder (ASD) attending postsecondary education is growing. Compared to other disability groups, students with ASD in postsecondary education have reduced graduation rates, and face difficulties with managing the competing social and academic demands in postsecondary education, achieving appropriate time management and self-advocacy skills, and difficulties with regulating emotions and sensory issues. In addition to these challenges, many young adults with ASD lose the entitlement to formal supports services after they leave secondary education school. As a consequence, they rely on their parents who have to continue their role as the main source of support and care. This situation where parents hold persistent responsibility to provide support to their child may have a significant impact on family life. How the transition impacts on families caring for young adults with ASD has hardly been studied.

Objectives: The purpose of the present study was to gain a thorough understanding of how the higher education transition context impacts on dynamics in the parent-child relationship for students with ASD. In accordance with the aim of the study, we systematically investigated from a dialectic perspective both parents' and students' perceptions on college attendance, the perceived obstacles and the support needs, while focusing on the dynamic processes in the parent-child relationships.

Methods: Social Relational Theory formed the conceptual framework for this study as it represents an open-ended dialectical framework regarding dynamics in the parent-child relationship and provides guidance for exploring underlying micro processes of social transactions. Semi-structured interviews with senior students and first-year college students with ASD, their mothers and fathers (were analyzed based on grounded theory and dyadic analysis principles.

Results: Both parties were confronted with an abundance of challenges and experienced strong feelings of ambivalence, stress and anxiety. Differences in perspectives occurred regarding the construction of adulthood, the acquisition of autonomy, disclosure and subscribing to support services. These differences caused tensions in the parent-child relationship, hindering the transformation of the relationship into an adult-like mutual relationship.

Conclusions: This study was the first to examine the first-person accounts of students with ASD, their fathers and their mothers on a systemic within-family level. The dyadic interview analysis made it possible to carefully compare, reflect on and integrate the perspectives of the participating family members and in this way lifted our systemic understanding of the complexity of the transition process for families with a youngster with ASD. If the school setting, clinicians, and the wider network around the family, approach this complexity with mutual respect and understanding to both parents and the students with ASD, a strong partnership can be created which contributes to a more successful transition experience for these families. We emphasize the need for further clinical and educational reflection and research to forward our understanding on family functioning in families with a youngster with ASD.

182 **185.182** The Concept of "Autism" in Parenthood and in the Clinic. an Empirical Investigation.

D. Jacobs*, Centre for Biomedical Ethics and Law, KU Leuven, Leuven, Belgium*

Background:

The concept of autism is characterized by change and heterogeneity throughout history (Verhoeff, 2013) and throughout cultures (Kim, 2012). Moreover, it is unclear whether the research findings on ASD are translated into meaningful information for the clinic and for parents (and their children).

Objectives:

We aim at investigating the experiences of parents of getting an ASD diagnosis for their child, and the experiences of clinicians in using an ASD diagnosis. The final goal is to come to an ethical synthesis, grounded in the results of our empirical investigation, and in our systematic literature review on the topic.

Methods:

In our empirical study, we investigate how the autism concept is understood and experienced by parents and physicians. Parents who ask an ASD (autism spectrum disorder) diagnostic assessment for their child are interviewed at three different moments (Saldaña, 2003). Physicians working with children with (a presumption of) ASD are interviewed once.

Results:

I will present the results of the Interpretative Phenomenological Analysis (IPA) of the clinician and parent interviews (Smith, Flowers, & Larkin, 2009).

A preliminary interpretation of these empirical results argues that the most common research view on ASD appears to be different from the interviewed physicians' view.

Such a discussion secondly purports that the interviewed physicians and parents experience several advantages connected to a diagnosis of ASD. These advantages appear to be closely linked to the way our society is organized in distributing mental services, and to the way people in our society view and estimate children and parents.

Conclusions:

Evidence-based medicine is not the only guiding principle for clinicians when dealing with ASD.

Besides, the experienced advantages of a diagnosis are culturally embedded, and when also possible disadvantages are considered, the question arises as to whether giving a categorical diagnosis of a medical disease is the most favorable way to deal with autism-like behaviors and worries, both for clinicians and for parents and children.

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183 **185.183** The Desirability of Autistic Males' Online Dating Profiles.

*D. Rees-Evans[1], J. Gavin[1] and **M. Brosnan**[2], (1)University of Bath, Bath, United Kingdom, (2)Centre for Applied Autism Research, University of Bath, Bath, United Kingdom of Great Britain and Northern Ireland*

Background:

A lack of success through traditional, face-to-face dating has led some adults with Autism Spectrum Disorder (ASD) to pursue relationships through online dating. The online dating profile is a significant gateway to the initiation of dating. Research within the general population has suggested that trust is a key variable influencing the desire to interact further with an individual (our definition of desirability) and consistency within the online dating profile has been identified as a key influence of trustworthiness.

Objectives:

To compare the relative impact of both typically-desirable and autistic attributes and interests upon perceived desirability and trustworthiness in online dating profiles.

Methods:

Participants were 111 females who self-identified as 'seeking a man' through online dating. The mean age was 25 years (sd=7, range = 18-57). Participants were recruited through online advertisements and asked to rate the desirability and trustworthiness of a male in an online dating profile (both averaged, range 1-5). Participants also rated their current level of autism knowledge from 1 'never heard of it' through to 4 'expert'.

Four online dating profiles were constructed based on the format of the world's most popular online dating site. All profiles shared generic average physical information such as body type, height and a photo previously rated to be average. The profiles varied in a free text section. The typical attributes (upbeat, confident, good sense of humour) and interests (bike riding, photography, kids and listening to music) were taken from those listed as desirable by the online dating site. The autistic attributes (honest, shy and kind of nerdy) and interests (exercising, watching TV, technology and gaming) were taken from an analysis of autistic online dating profiles. Participants read and rated one of the following combinations:

1. a) Autism Attributes, Autism Interests (AA-AI)
2. b) Typical Attributes, Typical Interests (TA-TI)
3. c) Autism Attributes, Typical Interests (AA-TI)
4. d) Typical Attributes, Autism Interests (TA-AI)

A MANCOVA was conducted on desirability and trustworthiness by condition, controlling for level of autism knowledge.

Results:

Desirability and trustworthiness significantly correlated with each other ($r=.36$, $P<.001$). There was a significant main effect for condition for desirability ($F(3,106)=3.50$, $p<.05$) but not trustworthiness ($F(3,106)=2.01$, ns). The Figure highlights that the consistent profiles were more desirable than the inconsistent profiles, interestingly the consistent autistic profile was the most desirable.

Conclusions:

An autistic profile describing autistic attributes and interests was rated as being comparably desirable to a profile describing typically desirable attributes and interests. Whether autistic or typical, presenting attributes and interests that were consistent with each other was more desirable than inconsistent profiles. Previous research has suggested that this effect is driven by perceptions of trustworthiness, but the present study does not fully support this, although trustworthiness and desirability were correlated with each other. The results would suggest that autistic online daters should have profiles consistent in their attributes and interests, and not embed profiles with typically desirable features. It should be noted that this is relative, the consistent profiles have a mean around the midpoint of the 1-5 scale.

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185.184 The Differential Impact on Parents of Two Different EIBI Programs in Canada

B. D'Entremont[1], *H. E. Flanagan*[2], *I. M. Smith*[3], *N. Garon*[4], *W. J. Ungar*[5], *K. Tsiplova*[5], *C. Waddell*[6], *S. E. Bryson*[7], *J. den Otter*[8], *N. Leger*[9] *and P. McDonnell*[10], *(1)University of New Brunswick, Fredericton, NB, Canada, (2)IWK Health Centre, Halifax, NS, Canada, (3)Dalhousie University / IWK Health Centre, Halifax, NS, CANADA, (4)Mount Allison University, Sackville, NB, Canada, (5)University of Toronto / The Hospital for Sick Children, Toronto, ON, Canada, (6)Simon Fraser University, Vancouver, BC, Canada, (7)Dalhousie University, Halifax, NS, Canada, (8)Education and Early Childhood Development, Fredericton, NB, Canada, (9)Department of Education and Early Childhood Development, Government of New Brunswick, Fredericton, NB, Canada, (10)McDonnell, Cartwright, and Associates, Fredericton, NB, Canada*

Background: Research supports the effectiveness of early intensive behavioural intervention (EIBI), including community-based programs, for preschoolers with autism spectrum disorder (ASD; Reichow & Wolery, 2009). Less is known about parents' experiences with these programs. Research suggests that parent satisfaction, increased parental self-efficacy and decreased family stress can lead to families remaining in treatment and to improved child outcomes (Karst & van Hecke, 2012). However, longitudinal data are lacking and we are aware of no research comparing the impact of different early intervention programs on parents. Our Preschool Autism Treatment Impact study addressed this by comparing cost-effectiveness and treatment impact of two provincial EIBI programs, including effects on parents.
Objectives: To compare parent satisfaction, parental self-efficacy, and level of family stress for parents of preschool children with ASD, served by two publicly-funded province-wide EIBI programs, over the duration of intervention.

Methods: Data were collected at intervention onset (T1) from 269 parents from Province A and 367 parents from Province B. The programs differ in several ways. In global terms, program A adheres to a naturalistic, less-intensive model with a focus on parent training, whereas program B is similar to more conventional community-based EIBI. Parents completed a questionnaire measuring parenting self-efficacy in the areas of communication and social skills, daily living skills, and challenging behaviour, as well as a single-item measure of stress/crisis level at T1, after one year of intervention (T2) and at school entry (T3). Parents also completed a satisfaction survey at T2 and T3.

Results: Controlling for T1 self-efficacy (higher in Province A), parental self-efficacy increased similarly in all 3 domains from T1 to T2 for both provinces (see Table 1). In Province A, this improvement was maintained from T2 to T3 for Communication/Social Skills and Daily Living Skills. Self-efficacy for Challenging Behaviour declined from T2 to T3, but not to T1 levels. Responses at T3 for Province B were insufficient to include in longitudinal analyses. Family stress/crisis level decreased from T1 to T2 ($F_{(1,131)} = 16.28$, $p < 0.001$) with no differences between provinces. Results suggest parents were experiencing some difficulties/stress but were coping. Parents were generally satisfied with both EIBI programs. Responses across provinces were compared at T2 (see Table 2). Although response patterns were similar, parents in Province A reported more satisfaction with the location of services, their child's team's coordination with other services and support of parent involvement, their learning of helpful strategies, and the high quality of treatment. Satisfaction remained stable from T2 to T3 in Province B; Province A did not provide EIBI services between T2 and T3.

Conclusions: EIBI programs have a positive impact on families. This is true even when programs differ in key aspects including intensity, range of intervention techniques employed, duration, and service delivery model. Although only Province A specifically used a parent training model, parents from both provinces increased similarly in self-efficacy and decreased similarly in relation to stress/crisis. Some differences in parent satisfaction, favouring Province A, suggest that focusing on, and involving, parents may increase family satisfaction.

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185.185 The Effects of Short-Term, Intensive Pivotal Response Treatment Education on Parent Self-Efficacy and Stress for Families Newly Diagnosed with Autism

K. Oliver[1], *R. L. Koegel*[2], *K. Byrne*[3] *and H. Wenzel*[1], *(1)Koegel Autism Center, Santa Barbara, CA, (2)Stanford Medical School, Stanford, CA, (3)University of California, Santa Barbara, Koegel Autism Center, Santa Barbara, CA*

Background: Parent involvement in the treatment programming of their child with autism spectrum disorder (ASD) is widely recognized as an important component for successful outcomes. Parent education programs that provide training in Pivotal Response Treatment (PRT) to families of young children with ASD have been shown to improve both child and parent outcomes. PRT is an evidence-based treatment approach that uses motivational strategies to target social communication. Benefits of educating parents in PRT include increases in child verbalizations, parent and child positive affect, and decreases in parent stress.
Objectives: There seems to be a paucity of research regarding the impact of intensive individualized parent education programs in PRT on additional dimensions of parent well being. The research also appears limited on the effects PRT programs have on parents of children who are newly diagnosed with ASD. Parent education may be particularly important for these families, as this is a period of time when parents often face great uncertainty and distress. Thus, the objective of this study was to examine how a brief, individualized parent education program impacted parent self-efficacy, hope, and stress for parents whose child had a recent diagnosis of ASD, both immediately after the treatment program and long-term.

Methods: Using a concurrent multiple baseline experimental design across participants, this study examined outcomes of an intensive 5-day, 20-hour parent education program in PRT for families whose child has recently received a diagnosis of ASD. Parents learned to implement the motivational components of PRT through observation of a clinician, practicing with their child, and receiving feedback on their implementation. The education program was characterized by a parent-clinician partnership model and used a strength-based approach to teach parents to implement PRT with their child. Standardized assessments, behavioral observation data, and brief interviews with parents were used to analyze parent measures, including stress, self-efficacy, and hope. Parent fidelity of PRT implementation was also collected, in addition to child functional utterances.

Results: Results from the pilot study indicated that all parents showed a decrease in observed stress levels and an increase in observed confidence levels after participating in the parent education program. Further, parents reported increased confidence in teaching their child and getting their child to communicate (i.e., self-efficacy) following the treatment program.

Conclusions: Brief, intensive PRT parent education appears to have positive effects on multiple constructs related to parent well being, such as self-efficacy, hope, and stress, for parents whose child recently received a diagnosis of ASD. This approach is likely an effective way to provide parents with short-term education on how to implement an evidence-based treatment with their child while they await more intensive or comprehensive services.

186 **185.186** The Influence of Coparenting Support on Fathers of Children with Autism

*J. L. Bloom and **M. N. Gragg**, University of Windsor, Windsor, ON, Canada*

Background: Fathers of children with Autism Spectrum Disorders (ASD) experience a great deal of parenting stress, and report having to prioritize their coparenting relationship above their marital relationship, to appropriately care for their children. For fathers of typically developing children (TD), supportive coparenting relationships are related to fathers' well-being, self-efficacy, and involvement, however, these relationships have not been directly studied with fathers of children with ASD. Self-determination theory suggests that individuals who are supported and confident in their abilities for a behaviour will be more intrinsically motivated to engage in this, will enjoy this more, and will have greater well-being. For fathers of children with ASD, supportive coparenting relationships may influence their involvement, in both play and child-care, and their well-being.

Objectives: The present study investigated the quality of coparenting support received by fathers of children with ASD and the influence of this on fathers, including: involvement in play, involvement in child-care, motivation for involvement, and parenting stress. Fathers' qualitative responses to 3 survey questions and 6 questions during an optional telephone interview were also examined.

Methods: An online survey was completed by 66 fathers of children with ASD aged 4 to 11 years. The survey included a child ASD screening measure, and questions regarding fathers' coparenting relationship quality, involvement in play and child-care, satisfaction and motivation for involvement, and parenting stress. Participants (M_{age} = 40.2) were primarily biological fathers, married, Caucasian, from Canada, with a post-secondary education, and living in the same home as their children (sons = 54) with ASD (M_{age} = 6.9). The majority of fathers lived with their coparent (M_{age} = 37.8) who were primarily spouses. An optional phone interview was conducted with 7 participants, including 6 questions related to their involvement, their coparenting support, and their well-being.

Data collection is ongoing and it is expected that, in total, 120 fathers will complete the online survey and 20 fathers will complete the optional phone interview.

Results: Overall, fathers reported supportive coparenting relationships (M_{total} = 5.25, subscales ranged from M = 4.6 to M = 6.2, on a 7-point Likert scale). Multiple regression analyses revealed that greater coparenting relationship quality predicted lower parenting stress, and greater satisfaction with involvement in both play and child-care. In turn, greater satisfaction with involvement in play predicted more frequent involvement in play. Greater satisfaction with involvement in child-care similarly predicted more involvement in child-care. Responses to open-ended questions on the survey and phone interview will be analyzed using thematic analysis.

Conclusions: Results suggested that the support fathers receive from their coparent can have an important influence on fathers' parenting stress and their involvement with their children with ASD. These findings are consistent with the literature for fathers of TD. Given that raising children with ASD may place a strain on the marital relationship, these results highlight the value of supportive coparenting relationships for fathers of children with ASD. Implications for maintaining supportive coparenting relationships and incorporating coparenting dynamics into parent-training programs will be discussed.

187 **185.187** The Interest of Adolescents with Autism in Future Careers Involving Technology

ABSTRACT WITHDRAWN

Background: In the US, students with autism have some of the poorest post-school outcomes of any disability category, according to the National Longitudinal Transition Study-2. Finding opportunities to match their skills and interests to sustainable employment is a priority. It has been reported that many individuals with autism are attracted to technology, in particular screen-based technology, especially for entertainment. For most young people, their interests often lead to future careers. Since careers involving technology skills are in high demand, technology-related careers hold promise for improving the adult outcomes for students with autism. However, little is known about this subject.

Objectives: The primary purpose of this study was to understand what interest adolescents with autism have in a future career using technology. Also, to understand specifically which areas involving technology they are interested to pursue in higher education.

Methods: This study used a paper survey with 275 high school students with autism from 30 high schools spread across 3 states in the US. The majority of participants are male (87%), white (72%), without ID (93%), and on track to graduate high school with a regular diploma (100%).

Results: Student survey participants were asked about their interest in using technology in their future. The majority (75%) said they would like to have a job using technology. Most are considering going to college (96%) and 65% would like to study a technology-related subject in college. Video game design was the most popular technology related subject followed by computer science, engineering, and web design.

Conclusions: Cultivating student interest in technology early during middle and high school might help to ensure fulfilling their future interest in studying technology-related subjects at university and working in occupations using technology.

188 **185.188** Online Learning : A Good Fit for Students with Autism?

ABSTRACT WITHDRAWN

Background: Adolescents with autism are heavy users of technology for entertainment. What is not well known is how they use it to support learning. Navigating the high social demands of high school can be overwhelming for many students with autism causing stress and anxiety. Online learning may be a way for these students to take courses, in particular in subject areas of interest that may not be available in their local high school, thus helping to better prepare them for life after high school. However, there is very little literature on the compatibility of online learning for students with autism. Taking courses from the comfort of a quiet classroom dedicated to online learning, or even from home, may be another way to help adolescents with autism better transition to higher education and/or careers of interest.

Objectives: The purpose of this study was to explore the experiences of online learning for secondary students with autism. Specifically, in what ways do they find online learning beneficial and what subjects are they taking.

Methods: This study used a paper survey with 275 high school students with autism from 30 high schools spread across 3 states in the US. The majority of participants are male (87%), white (72%), without ID (93%), and on track to graduate high school with a regular diploma (100%).

Results: This study found that while only 27% of participants had an online learning experience, 52% indicated they were favorably disposed to taking one in the future. Of those students who had an online experience, the majority found it beneficial mostly due to their ability to control the amount of time they needed to learn. 55% said they liked learning online because they could take as little or as much time as they needed to work on the course and 48% said they liked it because they could work on it anytime they wanted to. Regarding the reduction in social interaction through online learning, only 19% said they liked it because they did not have to interact with the teacher and 18% because they did not have to interact with other students. Most participants took courses in subjects related to science and math.

Conclusions: Students with autism who have experienced online learning find it beneficial for the control it gives them over when and the amount of time they devote to the learning. Reasons related to a reduction in social interaction were less important. Online learning has potential to help young adults with autism to ease into higher education or to fill gaps in their knowledge using online courses as they transition to adulthood.

189 **185.189** Transition from High School: Parent Stress and Family Quality of Life When Their Child Has Autism Spectrum Disorder

J. Best *and B. D'Entremont, University of New Brunswick, Fredericton, NB, Canada*

Background:

Research examining the transition from high school has found that parents of children with developmental disabilities report more stress and fewer rewards than parents of typically developing children (Glidden & Jobe, 2007) and that parent stress reported by parents of children with developmental disabilities is predicted by parent coping (Glidden & Natcher, 2009) while family quality of life (FQOL) is predicted by child problem behaviours, support needs, and religious faith during this time (Boehm, Carter, & Taylor, 2015). Unfortunately, these studies either did not include parents of children with ASD (Glidden & Jobe, 2007; Glidden & Natcher, 2009) or did not include any transition-specific measures (Boehm et al., 2015). Unlike the United States, where previous research was conducted, no federal policy exists governing this transition in Canada nor has any research been conducted in Canada on this transition.

Objectives:

To examine the contribution of parent coping, child behavioural symptoms, presence of a written plan for the transition out of high school, and parent satisfaction with the transition process, to parent stress and FQOL during the transition process. The research questions explored were: Do parental coping strategies predict parent stress and FQOL during this transition? Do both positive and problematic child behaviours predict parent stress and FQOL related to the transition out of high school? What is the contribution of having a transition plan and transition satisfaction over and above parent coping and child behaviours during this transition?

Methods:

Fifty-seven parents or guardians of a child with ASD completed an online survey containing demographic information and the following measures: Brief COPE (Carver, 1997), Nisonger Child Behaviour Rating Form (Aman, et al., 1996), Transition Daily Rewards and Worries Questionnaire (Glidden & Jobe, 2007), the Beach Centre Family Quality of Life Scale (Hoffman et al., 2006), parent satisfaction with the transition, and presence of a written transition plan. A series of hierarchical multiple regression with child behaviours and coping entered as on the first step, and transition plan and satisfaction on the second were used to predict the dependent variables of FQOL and parent stress.

Results:

Parent coping and child behaviour symptoms independently predicted FQOL and parent stress. Importantly, having a written transition plan predicted better satisfaction with disability related supports and fewer worries about community resources, while satisfaction with the transition process predicted greater family emotional well-being. These transition details predicted scores over and above parent coping and child behaviours. Finally, 82.5% of parents reported that their child did not have a written transition plan for the transition out of high school and only 16% reported being satisfied with their child's transition out of high school.

Conclusions:

This study highlights how the family's experience of the transition process plays an important role FQOL and parent stress during this time. Further, it highlights an area for critical future research. With few parents reporting satisfaction or the presence of a transition plan, future research should aim to understand factors that affect the resources accessed and satisfaction of parents in Canada during this time.

190 **185.190** What's It like to Have a Sibling with Autism: Experiences of Typically Developing Sibling from New Delhi, India.

D. Taneja[1,2] *and S. P. K. Jena*[3]*, (1)Action For Autism, New Delhi, India, (2)Applied Psychology, Delhi University, New Delhi, India, (3)Delhi University, New Delhi, India*

Background: Having a person with autism in the family, can be challenging for all members, including the typically developing siblings of the person with autism. In most communities, parents of children with similar conditions have the opportunities to interact while availing services for their child or by participating in parent support groups. However, it is very common for typically developing siblings to not get an opportunity to share their experiences with other siblings. They go through life feeling 'alone', often resenting their sibling with disability, and not fully understanding the implications of having a brother or a sister with autism. This is especially of great concern in low and middle income countries like India, where no state support is as yet available, and the unspoken cultural expectation is that the typical sibling will care for the autistic sibling once the parents are no more. To understand the experiences of typically developing siblings of individuals with autism, we conducted a peer support programme based on US based sibling support model *Sibshops.*

Objectives: The present paper seeks to highlight the feelings and emotions felt by the typically developing siblings of children with autism. It evaluates the impact of a peer support programme on the typical siblings' feelings and emotions towards the disabled sibling.

Methods: Nine typically developing siblings participated in a peer-support programme at Action for Autism, the National Centre for Autism in India. Twelve sessions of 3-4 hours each were conducted over a period of four months. The sibling support model *Sibshops* was adapted for the Indian culture and was a mix of fun and discussion activities focussing on peer support. The programme was a safe place for siblings to share their feelings with other sibling participants. The typically developing siblings as well as their parents were interviewed at the beginning and at the end of the programme. In addition, activities of the peer-support programmes were designed to capture different emotions and feelings towards the typically developing siblings. These discussion activities were audio recorded and transcribed. Analysis was conducted to understand various emotions and feelings of typically developing siblings of individuals with autism.

Results: Findings indicate positive impact of the programme on various attributes of the typically developing sibling. Typically developing sibling as young as ten years of age reported feeling embarrassed, guilty, angry, worry towards their sibling. They also expressed various positive emotions such as pride and happy.

Conclusions: This is one of the few studies in a low resource country, which focusses on typically developing siblings of children with autism. Results support the need for such group interventions and controlled evaluation of sibling support groups to improve mental health and functioning of typically developing sibling. It has implications for running sibling support groups in low resource countries like India to address the needs of and the growing expectations from typically developing siblings of individuals with autism.

191 **185.191** A New Tool to Assess Family Context Features That Promote the Early Development of Young Children at-Risk for ASD

A. Aranbarri[1], *A. C. Stahmer*[1], *J. Acha*[2], *E. Arranz*[2], *M. E. Miller*[1], *M. R. Talbott*[1] *and S. Rogers*[3], *(1)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (2)Department of Basic Psychological Processes and Their Development, Psychology Faculty, University of the Basque Country UPV/EHU, Donostia-San Sebastian, Spain, (3)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA*

Background: Recent studies confirm the importance of a high-quality family context for promoting children's early development, even after adjusting for socioeconomic variables (e.g., Rijlaarsdam et al., 2013). Although these studies have examined the role of home environment and family context in typical development, there is likely an effect for children with Autism Spectrum Disorder (ASD) as well. This is especially true as children with ASD often participate in early intervention programs (EIPs) at home setting, with families serving as an integral part of the intervention team. The *Etxadi-Gangoiti Scale* is a recently published, validated measure designed to assess the family context of typically developing children (Arranz et al., 2014; Velasco et al., 2014). However, some questions are inappropriate for children with ASD (see examples in Table 1).

Objectives: To adapt the *Etxadi-Gangoiti Scale* for use with families of young children with ASD and assess comprehension, clarity, and familiarity at the community level, as well as feasibility in an EIP.

Methods: We adapted the scale considering early ASD developmental features and in-home EIP delivery. Four experts in early development and ASD analyzed the scale content. We conducted two community focus groups: (1) 6 EIP providers (psychology, education, and nursery disciplines) serving urban and rural areas, and low-medium resource children with ASD. (2) 5 parents of children with ASD (4 mothers, 1 father; 3 African American, 2 Hispanic) living in urban areas. Forty percent reported living in somewhat unsafe neighborhoods. Both groups scored each item for the level of comprehension, clarity, and familiarity using a 6-point Likert scale (1=*Very hard to understand*, 6=*Very easy to understand*). Items receiving a score of 4 (*somewhat easy to understand*) or lower were discussed and edited as a group to obtain consensus. Lastly, edited items were scored a second time using the same metric. Providers scored the feasibility of the scale in an EIP.

Results: The adapted scale includes 62-items in two subscales: a) caregiver self-report (47 items); b) observational assessment for EIP providers (15 items). The scale measures family features associated with promoting early development, summarized by 8 indicators (see items' distribution across indicators and subscales in Figure 1): 1) Home and physical environment; 2) Presence of toys to promote development; 3) Family routines, structure and habits; 4) Parent behaviors promoting socio-emotional, communication, play, and cognitive development; 5) Exposure to peers; 6) Family and social support 7) Level of family stress; 8) Caregiver's knowledge and exposure to disability. Parents' rated 14 items (30%) with a score of 4 or lower. After editing, they scored 5 or higher for all items. The Provider group edited 8 items (53%) based on initial scores, and after discussion, all items reached the highest comprehension score of 6. Regarding the tool's feasibility in EIPs, 83% of providers scored "*strongly agree*."

Conclusions: Existing home and family assessment scales are not appropriate for young children with ASD feasible for in-home EIPs. This scale may help us understand how to individualize ASD treatment and parent coaching strategies for unique family features and environments.

192 **185.192** Autistic Mothers' Experience of Parenthood

S. Hampton[1], *R. Kenny*[1], *R. Holt*[1], *B. Auyeung*[2], *C. Allison*[3] *and S. Baron-Cohen*[3], *(1)University of Cambridge, Cambridge, United Kingdom, (2)University of Edinburgh, Edinburgh, United Kingdom, (3)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Little research has explored how autistic women navigate the challenges involved throughout parenthood. Findings from one study, as well as anecdotal accounts, suggest that autistic mothers do not receive sufficient support and feel judged and misunderstood by medical and education professionals (Pohl et al., 2016). It is therefore important that research addresses not only the challenges autistic mothers face but also their strengths. For example, it is possible that autistic mothers may be well placed to support autistic characteristics of their children and may be particularly strong at providing routine and security for their children.

Objectives: The study aimed to identify the potential strengths of being an autistic mother, as well as areas where support is required.

Methods: The study took a qualitative approach, aiming to provide an in depth, nuanced account to complement the prior quantitative study on the topic. Three autistic mothers attended a focus group concerning their experience of parenthood. The focus group was semi-structured and guided by questions concerning 5 main areas: parenting challenges, parenting strengths, approaches to parenthood, parent-child relationships and support needs. The ages of the mothers ranged from 40 to 43 years old and the ages of their children ranged from 4-22 years old. All of the mothers had at least one child with autism and at least one child without autism.

Results: A process of inductive, thematic analysis revealed 5 key themes. Firstly, parents identified strengths associated with being an autistic mother, including skills in practical aspects of parenting, advocating for one's child and the ability to understand their autistic children due to their own diagnosis. Secondly, parents highlighted parenting challenges, including difficulties engaging in creative play and difficulty modelling social skills for their children. Thirdly, mothers felt a strong sense of others' judgement. They reported feeling judged by professionals, by whom mothers felt blamed for their children's challenges, in addition to a strong pressure to conform to normative parenting expectations. These expectations included expressing emotion in neurotypical ways and emulating normative ideals of the 'perfect' family life. Fourthly, mothers described their own non-normative approach to parenting. They expressed awareness of not conforming to the ideals of motherhood and described a different approach to mothering in which their concern and affection for their children, while just as strong as that of neurotypical mothers, are differently expressed. Finally, mothers showed dissatisfaction with the support available, which often involved being required to attend stressful social situations and endure scrutiny from professionals. Mothers expressed a desire for non-judgemental mentoring and peer support.

Conclusions: These findings point towards the need for greater understanding of parenthood for those with autism amongst professionals. Our findings suggest that traditional forms of support may not be helpful for autistic mothers and that systems of peer support may be particularly beneficial. This qualitative study could be followed by a quantitative survey to test if the themes generalise to a larger sample. The findings have important policy implications for how best to support autistic mothers.

193 **185.193** Caregiver Stress and Comorbid Autism Spectrum Disorder and Epilepsy

A. Aitken[1]*, C. A. McMorris*[2]*, D. Dewey*[3]*, J. Buchhalter*[4] *and K. Smyth*[5]*, (1)School and Applied Child Psychology, University of Calgary, Calgary, AB, Canada, (2)Werklund School of Education, University of Calgary, Calgary, AB, Canada, (3)University of Calgary, Calgary, AB, Canada, (4)Department of Pediatrics, Cumming School of Medicine, Alberta Children's Hospital Research Institute, University of Calgary, University of Calgary, Calgary, AB, Canada, (5)Department of Pediatrics, Cumming School of Medicine, Alberta Children's Hospital Research Institute, University of Calgary, Calgary, AB, Canada*

Background: Nearly one third of children with Autism Spectrum Disorder (ASD) have comorbid epilepsy (EP), with these individuals displaying more severe symptoms in areas of social impairment, challenging behaviours, motor difficulties, and other medical complications. Significant levels of stress have been well documented among caregivers of children with ASD, as well as among families of children with EP. However, to date there is little research investigating the stress that caregivers of children with comorbid ASD and EP experience. Caregivers of children with ASD have reported familial, financial, and mental health issues. Given that children with comorbid ASD and EP present with more severe symptoms across a wide range of functions, it is important to develop a better understanding of the experiences of caregivers of children with ASD and EP. Determining caregiver's experiences will address a significant gap in research literature and will assist health practitioners in meeting the needs of these families.

Objectives: The project has two primary aims: 1) to examine the quality of life, stress and parenting experiences of caregivers of children with ASD and EP; and 2) to investigate the relationship between caregivers' quality of life and the clinical profiles of their children/youth with ASD and EP. It is hypothesized that caregivers of children and youth with ASD and EP who have severe developmental delays, behavioural problems, and additional medical complications will report higher levels of stress and poorer quality of life.

Methods: Participants are recruited from the Autism and Epilepsy Clinic, a specialized clinic at the Alberta Children's Hospital (ACH; Alberta, Canada) that provides seizure management to children and youth with ASD and EP. Since its establishment in 2013, this clinic has served approximately 200 children. Participants must have a diagnosis of ASD and EP. To determine the clinical profiles of the children, chart reviews will be completed through the electronic clinical note used by health practitioners in the Autism and Epilepsy Clinic. This innovative note includes detailed information on the age of seizure onset, seizure type and frequency, medications/treatments, medical diagnoses, cognitive functioning, and other presenting problems. Children will also participate in a comprehensive neuropsychological assessment, with measures of cognitive functioning (WPPSI-IV; WISC-V), executive functioning (NEPSY-II), and behaviour (BASC-3; CARS-2). The Kidscreeen-52, and PSI-4 will be used to assess the children's and caregivers' current quality of life and stress. Data will be analyzed using basic descriptive statistics, and will be examined in relation to caregiver measures.

Results: We anticipate over 50 completed assessments by Spring 2018.

Conclusions: The present study will examine the association between the clinical profiles of children and youth with ASD and EP, and their caregivers' quality of life and stress. It is important that families have a clinical support network that understands their unique situation and can provide the necessary services for these children. Findings from the present study will help to inform the development of caregiver resources and aid health practitioners in improving the outcomes for these children and their caregivers.

194 **185.194** Challenging Behavior in Preschoolers with ASD

C. K. Toolan[1]*, A. Holbrook*[2]*, S. Y. Shire*[3]*, R. Landa*[4]*, T. Smith*[5] *and C. Kasari*[1]*, (1)University of California, Los Angeles, Los Angeles, CA, (2)University of California Los Angeles, Los Angeles, CA, (3)University of Oregon, Eugene, OR, (4)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (5)University of Rochester Medical Center, Rochester, NY*

Background:

Children with ASD often present challenging behaviors (CBs) across home and school contexts. CBs impact caregiver stress and mental health (Davis & Carter, 2008; Hayes & Watson, 2012). CBs in school contexts affect teachers' instructional efforts (Carr & Robinson, 1991) and predict burnout (Hastings & Brown, 2002).

While there is much literature on CBs with school-aged children and youth (Lecavalier et al, 2006), there is less on preschoolers, particularly those with low rates of communication. These children may be at high risk of exhibiting CBs due to difficulty communicating their wants and needs. Additionally, much of the existing research is cross-sectional, with few examining CBs longitudinally.

Objectives:

1. Characterize parent- and teacher-reported CBs in preschoolers with ASD
2. Examine change in CBs over a 6-month period

Methods:

This study used baseline data from a social communication intervention RCT. Preschoolers (n=145) who used <30 spontaneous words at entry received 6 months of communication interventions. Parents received weekly training in intervention for 2 months. Treatment groups were combined since both targeted communication skills within intervention.

At entry and exit, parents completed the Home Situations Questionnaire-PDD (HSQ, 25 items), which assesses behavioral noncompliance in everyday settings. Parents were asked to endorse whether their child exhibited noncompliance in a range of situations (e.g., when transitioning between activities). Parents were also asked to rate the severity of their child's behavior for endorsed items (1=mild to 9=severe). In addition to total scores, subscores were calculated for the number and severity of socially inflexible vs. demand-specific CBs (Pelletier et al, 2006). Socially inflexible CBs included situations where children exhibited low adaptability to non-routine situations, while demand-specific CBs occurred when direct demands were placed on the child.

Teachers completed the School Situations Questionnaire (SSQ, 9 items), which is the HSQ analogue for school contexts (e.g., during free-play time in class). Total number of CBs and severity scores were calculated for entry and exit.

Results:

Table 1 includes descriptives for the number and severity of CBs reported by parents and teachers. HSQ and SSQ scores were not correlated.

Paired sample t-tests with corrections were conducted to examine change in number and severity of CBs over time. There were no significant changes in the number of CBs reported by parents or teachers. However, there were significant decreases in HSQ total severity (p=.004), HSQ socially inflexible severity (p=.001), and SSQ total severity (p=.005).

At entry, 50% of children presented clinically severe CBs on HSQ (2 SDs above normative mean from original HSQ; Altepeter & Breen, 1989), which reduced to 39% of children at exit. The change in proportion of children with clinically severe CBs was significant (p<.037).

Conclusions:

Parents and teachers both reported decreases in CB severity over time. Additionally, the decrease in children's CB at home was clinically significant, with fewer children scoring at elevated levels by exit.

This study confirms that CB is prevalent in preschoolers with ASD and limited language, but shows that CB decreases while children are in intervention to improve their communication.

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185.195 Families Structure and Children with Autism: Population Estimates and Comparisons Using the United States' National Health Interview Survey

K. Hamre, *School of Social Work, Indiana University, Bloomington, IN*

Background:

It is important to understand the unique experiences of families who have a child with autism spectrum disorder (ASD). While much research in the area of autism has focused on children, comparatively less is known about the family experience. Understanding that a child's outcomes directly relate to the well-being and ability to adapt of their family, and drawing on family stress adaptation theory, this study investigates the makeup of families in which children with ASD reside, making comparisons to families with a child without a reported diagnosis of ASD.

Objectives:

The purpose of the study was to 1) develop population estimates of various family structures for children with ASD, 2) compare family structure population estimates with that of the general population; and, 3) model the effects of ASD on different family structures, while controlling for key variables.

Methods:

This study utilized the United States Centers for Disease Control and Prevention's 2014 and 2015 National Health Interview Survey (NHIS). This survey is a nationally representative, annual, cross sectional, household survey of families in the United States. The sample includes 22,697 families with children ages 3 to 17, of which 489 reported having a child with a diagnosis of ASD. Population estimates and standard errors were constructed and statistically compared to the general population and logistic regression was used to model the effects of ASD on family structure.

Results:

Findings include population estimates across family structures with children with a reported ASD diagnosis. Findings indicate 41.5% of children with ASD live in two parent families while 19.1% of children with ASD live in single parent families. More granular family structures are also investigated, including single mothers, single fathers, and cohabitating partners. Key findings include statistically significant differences between the population estimates of the ASD and non-ASD family structures. Among the findings, the results show an estimated 16% of children with ASD live in a home with a single mother, compared to 13.6% of children with no reported ASD diagnosis. In addition, logistic regression model results reveal that children with ASD have lower odds of living in a two-parent household. Children with ASD were found to have higher odds of living with a single mother compared to children without ASD. These logistic models controlled for a number of factors, including race, parent education, and socioeconomic status.

Conclusions:

The data indicates that families with children with ASD are having different experiences than families with children without an ASD diagnosis. This study presents population estimates across family structures for children with ASD in the United States, and makes comparisons to the general population. These results have implications in policy and practice for families with children with autism spectrum disorder.

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185.196 Narratives about Self from High Functioning Autistic Adults in India

N. Singhal[1], *D. Taneja*[1], *M. Barua*[1], *T. Behl*[1], *R. Pradhan*[1], *T. Daley*[2] *and T. S. Weisner*[3], *(1)Action For Autism, New Delhi, India, (2)Westat, Durham, NC, (3)UCLA, Los Angeles, CA*

Background:

Autism in India remains a highly stigmatized condition, and many adults with high functioning autism continue to be undiagnosed and/or hidden. Even once the diagnosis is received, parents and therapists often do not disclose or share the diagnosis with the individuals with autism. So, what do our young people know about their autism? How do they perceive and understand themselves and their differences? Not many studies have explored this from the perspective of people with autism. The RAFIN Adult Study is the first to systematically examine adults with ASC in India.

Objectives:

This paper reports initial data on explanations by high functioning adults about their similarities and differences and their understanding of the reasons behind them.

Methods:

Thirteen high functioning adults with ASC were interviewed in their homes. The interactions with the adults were carried out through semi-structured interviews in the preferred language and lasted for about 2-3.5 hours. Amongst several other topics, we discussed the individual's understanding of their own self, their perceptions of similarities and differences from others around them, the nature of these differences (if any), as well as the kind of support they may like. This data is a part of a larger study of 54 adults and their families in Delhi & NCR region where we spoke to adults and their families about their journey since receiving the diagnosis as well as plans for the future.

Results:

Almost all participants had specific thoughts about how they were similar to and different from non-autistic people. The responses were categorised in various themes, such as concrete attributes, personality attributes, interests and preferences, specific skills, diagnoses, disclosure about diagnoses, strengths and limitations of being different.

Conclusions:

In one of the first studies of adults with autism in India, the authors present self-reports of verbally fluent adults with ASC about their understanding of their similarities and differences.

The study highlights that people on the spectrum are aware of their differences – some as early as primary school. However, an understanding and explanation of this difference comes much later, if at all. Most participants in our sample needed further clarity in understanding their difference.

The study emphasizes the need for active involvement of people with ASC in all life aspects, including research and interviews, aimed at understanding their unique life experiences; need for development of self-report measures and interview strategies; and most importantly the process of disclosure of diagnosis to individuals with autism.

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185.197 Parental Perceptions of Their Healthcare Experiences & Future Need for Children / Young People with Autism in the U.K.

A. Bratt[1] *and S. Chantziara*[2]*, (1)Medway School of Pharmacy, Kent, United Kingdom of Great Britain and Northern Ireland, (2)Medway School of Pharmacy, Universities of Kent and Greenwich, Chatham, United Kingdom*

Background: Children with Autistic Spectrum Disorders (ASD's), present with inherently heterogeneous behavioural challenges & often concomitant physiological and psychiatric conditions. In general they require a higher need for medical support from a wide range of health care professionals throughout the course of their development than their neurotypical peers.

Objectives: No published data has currently been collected in the U.K. to show either, 1): How frequently children / young people with autism access all types of health care provision?, or 2): How satisfied their parents / carers are with the level of health-related support which their dependents with autism have received? The current study aimed to capture this information, in addition to testing what factors may shape the overall "healthcare experience".

Methods: Data were obtained by combined means of a paper & online, 25-item questionnaire distributed to parents of children (aged 0-18 years) with autism via 3 gatekeepers; Kent Autistic Trust, (KAT), Medway Autism Group and Information Centre, (MAGIC), & the National Autism Database U.K. The services surveyed were General Practitioners (GP's), Paediatricians, Child & Adolescent Mental Health Services, (CAMHS); Accident & Emergency & inpatient hospital admissions. Participants were asked if they had previously heard of Hospital passports; (HPs), (dossiers of integrated patient information), and if they considered whether HP's could hold potential utility for their child?

Results: Data were obtained from 214 completed questionnaires. Findings revealed that hospital services were used least, however parents were most satisfied with these acute care services, as well as with primary care provision from GP's. In contrast 60% of families were less than satisfied with mental health services provided by CAMHS. Parental satisfaction with hospital paediatrician services was higher among those who attended higher numbers of appointments than those accessing fewer consultations. Common qualitative themes raised concerns surrounding the level of ASD-specific knowledge among healthcare professionals, length of waiting times for referrals, & level of inter-specialism communication. Most participants, (80%) were unaware of the existence of hospital passports, however a large majority, (95%) considered them of potential benefit to their child / young person with autism.

Conclusions: Parental suggestions for healthcare improvements could potentially inform future practice to drive the need for ASD-related individualised care. Overall the profile of differences in parental satisfaction across healthcare services highlight that specific areas could be improved to be more adequately tailored to meet the holistic healthcare needs of children with autism.

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185.198 The Effectiveness of Paid Facebook Advertising on Recruitment and Engagement in the Simons Foundation Powering Autism Research for Knowledge (SPARK) Research Initiative

V. J. Myers*, B. E. Robertson, A. Daniels, P. Feliciano and W. K. Chung, Simons Foundation, New York, NY*

Background:

Historically, participation in autism research has been low relative to other medical conditions. Past research indicates that only about 5-10% of individuals with autism have been in a clinical research study. Recruitment for autism research studies has been primarily through academic research centers which are limited to specific geographic areas. Social media platforms like Facebook, however, allow researchers to target their recruitment efforts more effectively and efficiently. There are an estimated 13 million Facebook users between the ages of 18 and 65+ with a defined interest in "autism awareness." Targeted Facebook advertising to these users for autism research may significantly enhance study recruitment and participation.

Objectives:

The primary aim of this study was to quantify the participants who joined SPARK through paid Facebook advertising from June through August

2017. A secondary aim was to measure the increase in followers via paid Facebook advertising and to evaluate the percentage increase in SPARK participation of individuals, families and fathers before and after the advertising period.

Methods:

A series of videos, graphic interchange formats (GIFs) and static images were created for use in paid Facebook advertisements. Engaging and inviting recruitment language was developed to accompany the digital assets. A tracking code was embedded within the HTML of the study website to measure the number of people who joined SPARK. The code was also used in targeting individuals who had initiated, but not completed registration. Characteristics of the targeted audiences included parents who had not completed registration, mothers with autism interests and married mothers with autism interests.

Results:

From June through August 2017, 2,899 individuals enrolled in SPARK through Facebook advertising. Advertisements to individuals who had initiated, but not completed registration were less effective and only 13 percent of new registrants came from this audience segment. The most successful target audience was married mothers with autism interests, which recruited 52 percent of the total. We saw a 73 percent increase in overall registration and a 20 percent increase in father registration during the study period. We saw a 61 percent increase in Facebook page likes during this time as well as increased engagement on the study's Facebook page.

Conclusions:

Facebook is an effective way to recruit participants for SPARK. Fathers are a difficult demographic to reach; but when targeting mothers on Facebook we see increased participation from fathers too. In summary, mothers are a more effective demographic to target through Facebook advertising to recruit participants for autism research.

199 **185.199** Autistic Identity (or Lack Thereof) in High School and Undergraduate Students

A. Riccio[1], *S. K. Kapp*[2], *J. Delos Santos*[3], *N. Tricarico*[4], *D. DeNigris*[5], *W. Pinkava*[4], *P. J. Brooks*[6] *and K. Gillespie-Lynch*[7], *(1)Department of Psychology, The Graduate Center, City University of New York (CUNY), New York, NY, (2)University of Exeter, Exeter, United Kingdom, (3)Hunter College, City University of New York, New York, NY, (4)College of Staten Island, City University of New York, Staten Island, NY, (5)Psychology & Counseling, Fairleigh Dickinson University, Madison, NJ, (6)Psychology, College of Staten Island, Staten Island, NY, (7)Department of Psychology, College of Staten Island; CUNY Graduate Center, Brooklyn, NY*

Background: Traditionally, autism has been researched by professionals who lack the lived experience of being autistic. As a result, disseminated information is often considered incomplete or inaccurate by autistic individuals. Researchers, lay persons, and autistic individuals alike may benefit from listening to views of autistic people, bridging gaps in understanding (Nicolaidis, 2012). Many autistic scholars and researchers view autism as a form of diversity rather than pathology (Pellicano & Stears, 2011). Identification with the neurodiversity movement, which encourages acceptance of neurological conditions, is prevalent among autistic individuals recruited online (Kapp et al., 2013). Online samples of autistic people demonstrate higher knowledge of and report lower stigma toward autism than non-autistic people (Gillespie-Lynch et al., 2017). We wished to examine if autistic young people recruited in person have similarly positive viewpoints about autism.

Objectives: We, four autistic and four non-autistic researchers, conducted a participatory study examining disability identity among autistic high school and college students recruited in person.

Methods: Autistic students attending high school (n=17) or college (n=22) in a metropolis completed structured interviews and assessments. High school students were recruited from a technology-based summer camp. Undergraduates were recruited from a mentorship program at a public university. All participants were asked to define autism and describe how autism can make someone stronger. High school students were also asked to "describe yourself to someone who doesn't know you". Similarly, undergraduates were asked to describe themselves using only six words/concepts; they also completed the *Reading the Mind in the Eyes* task (assessing ToM; Baron-Cohen et al., 2001). Autistic researchers involved in a broader participatory initiative encouraged us to focus on disability identity (stating that it is the most interesting research focus) and helped develop coding schemes and code.

Results: Irrespective of developmental level, few participants used strength-based terms when defining autism; many more cited challenges, especially social difficulties (Table 1). When prompted to do so, many high school and college students identified strengths they associated with autism (often citing perseverance). Undergraduates who could not define autism when asked had lower ToM scores (p=0.04). Participants who used strength-based language to define autism also used agentic words when describing themselves more generally (p=0.006). Only one participant self-identified using an autism-related term (Table 2).

Conclusions: As hypothesized, autistic high school and undergraduate students recruited in person were less likely to endorse acceptance of neurological differences than online samples (e.g., Gillespie-Lynch et al., 2017). While 36% of participants in prior online research described autism as a neutral difference, less than 10% of the autistic youth recruited in person in this study described autism as a neutral difference. In fact, over 50% of the autistic high school students could not describe autism at all. Students who highlighted strengths associated with autism described themselves agentically, suggesting that neurodiversity-aligned viewpoints are empowering. Findings align with conjectures by an autistic researcher that autism understanding increases with development (Jones et al., 2013) and suggest that autism research should be conducted in person and online simultaneously to maximize generalizability of findings.

200 **185.200** Mental Health Outcomes of a Parent Educations and Support Group for Parents of Children with Autism Spectrum Disorder

S. J. Cohen[1], *J. Hai*[2] *and M. Boyer*[1], *(1)University of California Santa Barbara, Santa Barbara, CA, (2)Education, UC Santa Barbara, Santa Barbara, CA*

Background: Parents of children with Autism Spectrum Disorder (ASD) report greater parenting stress, marital distress, and mental health symptomology than parents of typically developing children, as well as parents of children with other types of disabilities (Hayes & Watson, 2013; Karst & Van Hecke, 2012; Dabrowska & Pisula, 2010). Research suggests that social support, parenting self-efficacy, and coping styles moderate the association between autism and parenting stress (Dunn et al., 2001; Kuhn & Carter 2006). Parent support groups in general have been shown to raise awareness, decrease stress, and increase empowerment among participants (Soloman, M., Pistrang, N., Barker, C., 2001). Although many

support groups of varying structures exist for parents of children with ASD, little research exists on the mental health outcomes of these groups.
Objectives: The objective of the present study is to determine the impact of an 8-week Parent Education and Support group on the mental health and quality of life of parents of children with ASD.

Methods: Twenty parents will participate in this study. Families (i.e. parent dyads) will be randomly assigned to either the treatment or waitlist control condition. Thus, both groups will ultimately participate in the intervention. Before the treatment group begins the intervention, all parents will complete standardized self-report assessment measures of parenting stress, anxiety, depression, marital adjustment, and satisfaction with life. All parents will complete these measures again eight weeks later, after the treatment group has completed the intervention, and once again, eight weeks later, after the waitlist group has completed the intervention. The intervention will consist of an eight week curriculum that incorporates educational components within a discussion-based support group. The curriculum will include psycho-education about ASD, exploring strengths and challenges, discussion of resources for families with ASD (e.g. autism friendly hair dressers, dentists, community activities, etc.), navigating public education (e.g. advocacy in schools, Individualized Education Plans, Special Education, etc.), self-care, and coping skills. Parents will meet weekly with two graduate student clinicians, supervised by a licensed psychologist. Free childcare will be provided for all participating parents to allow participation of parents who might otherwise not be able to attend.

Results: This research study will be completed in March of 2018. Based on past research and current literature, we hypothesize that reported feelings of anxiety, depression, and stress will decrease, and that self-reported martial adjustment and satisfaction with life will increase for the parents who complete the eight week intervention, compared with the waitlist control group.

Conclusions: The results of this study will provide information regarding the effectiveness of this intervention for parents of children with ASD. The goal for these facilitated parent education and support groups is that parents will build social connections, increase their understanding of their child and how to support him/her, increase their awareness of resources available to them, and build effective coping strategies. As a result, we hope parents will experience less stress, anxiety, and depression, and experience greater marital satisfaction and quality of life.

201 **185.201** The Influence of Ethnicity, Family Problems, and Optimism on Services Received Among Latino and Non-Latino White Children with ASD

K. Lopez[1], *J. Reed*[2] *and S. Magaña*[3], *(1)Arizona State University, Phoenix, AZ, (2)Southwest Autism Research and Resource Center, Phoenix, AZ, (3)Steve Hicks School of Social Work, University of Texas at Austin, Austin, TX*

Background: There is increasing evidence of disparities in age of autism diagnosis and treatment access among Latino children with autism. In addition to language barriers, low socioeconomic status (SES) and limited access to health insurance, it is important to investigate additional factors that contribute to these disparities in the Latino population. Given the increased risk of family problems among families of children with ASD it is important to consider the influence of family problems on services received. Moreover, one's general orientation to adversity, including an optimistic perspective may mediate the influence of family problems on the amount of services received. Given that previous research has found Latino mothers to report less family problems and to have more optimistic perspectives than white families when faced with adversities we sought to explore the relationship among family problems, optimism, and services received among Latino and non-Latino White parents raising children with autism.
Objectives: We investigated a mediation model for services received among Latina and non-Latina White mothers. First, we aimed to identify whether optimism mediated the relationship between family problems and services received. Second, we aimed to explore the role of ethnicity as a moderator within the proposed mediation model.

Methods: Forty-five Latino caregivers and 56 non-Latino White caregivers were administered a questionnaire on their experiences with their child's diagnosis and service use. Children were between 3 and 21 years of age (μ=9.6; SD=4.5) at the time of the study. A global measure of *Optimism* was based on the Life Orientation Test. *Family Problems* was measured by the parent and family problems subscale in the Questionnaire on Resources and Stress. *Child behavior problems* was measured using the Scales of Independent Behavior-Revised. *Services received* was based on responses to 7 items pertaining to whether children had ever received a given service.

Bivariate correlations were conducted for all variables in the study. A mediation model was produced using Baron and Kenny's (1989) four step model to mediation. The independent variable was family problems. The dependent variable was the number of services received. The proposed mediator was mother's optimism. Following, we included ethnicity as a moderator in the mediation model using the PROCESS macro in SPSS 24. We expected ethnicity to moderate the relationship between family problems and optimism.

Results: The results for the mediation analyses indicated that optimism did mediate the relationship between family problems and services received. The regressions indicated that more family problems predicted more services received. Fewer family problems predicted greater optimism. Family problems was no longer a significant predictor of services received after controlling for the mediator, optimism. The results for the moderated mediation model indicated that ethnicity was not significant.

Conclusions: Analyses indicate that the number of family problems perceived by mothers contributes to the number of services children with ASD receive, as did mother's global optimism. Understanding the influence of these factors on services received has implications for the development of interventions addressing services for children with ASD and their families.

Poster Session
186 - Medical and Psychiatric Comorbidity
11:30 AM - 1:30 PM - Hall Grote Zaal

202 **186.202** Anxiety and Depression from Adolescence to Old Age in Autism Spectrum Disorder

M. Uljarevic[1,2,3], *D. Hedley*[4], *K. R. Foley*[5], *I. Magiati*[6], *R. Y. Cai*[4], *C. Dissanayake*[4], *A. L. Richdale*[4] *and J. Trollor*[5], *(1)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, CA, (3)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (4)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (5)The University of New South Wales, UNSW Sydney, Australia, (6)Psychology, National University of Singapore, Singapore, Singapore*

Background: Most research on anxiety and depression in autism spectrum disorder (ASD) has focused on children and adolescents. In the general population, anxiety and depression show distinct trajectories across the lifespan with increasing negative impact on functioning over time. As ASD is a lifelong condition, it is important to understand the rates, presentation, and impact of anxiety and depression across different developmental periods, especially from adolescence into young and middle adulthood and beyond.

Objectives: The first aim of the current study was to examine age trends in anxious and depressive symptoms from older adolescence to middle and older adulthood, in a large, cross-sectional sample of adolescents and adults with ASD. The second aim was to examine the association between anxious and depressive symptomatology and other individual characteristics, including gender and ASD symptom severity, as well as socio-economic factors relating to education level and current employment status.

Methods: 255 adolescents and adults with ASD (151 males, 59.2%; M_{age}= 33.52 years, *SD*= 14.98, range: 14.29-80.16 years) completed the Abridged Version of the Autism-Spectrum Quotient (AQ-28), DSM-5 Dimensional Anxiety Scale (DSM-5 DAS) and the Patient Health Questionnaire-9 (PHQ-9) to assess self-reported ASD, anxiety and depression symptoms respectively. Participants were recruited through three Australian studies: the Longitudinal Study of Australian School Leavers with Autism, the Australian Longitudinal Study of Adults with Autism, and the Dandelion Program.

Results: More than one-third of participants reported clinically elevated anxiety (38.4%) or depression (38%). There were no differences between adolescents (15-19 years), young adults (20-39 years), middle-age (40-64 years), and old age (65+ years) adults in anxiety raw scores (F= 1.50, p= .21, ηp^2 = .018) but there were statistically significant differences in depression (F= 2.77, p= .042, ηp^2= .032), with post-hoc comparison showing that individuals in the middle-aged group had significantly higher depression scores than individuals in the adolescent age group (p= .04, *Cohen's d*= .45, BCa 95CI [-5.89, -.08]). There were no group differences in the proportion of individuals who scored above or below the clinical cut-off scores for depression, χ^2= 5.40, p= .14, *Phi*= .145, or anxiety, χ^2= 3.01, p= .39, *Phi*= .109 Linear regression models were used to explore predictors of anxiety and depression. For anxiety, the overall model explained 10.7% of variance, F = 15.05, p < .001, with female gender (β= .16, t= 2.56, p= .011) and higher AQ total score (β= .23, t= 3.68, p < .001) being unique significant independent predictors of higher anxiety symptom severity. For depressive symptomatology, the regression model explained a total of 15.5% of the variance, F = 11.51, p < .001, with female gender (β= .21, t= 3.33, p= .001) and higher AQ total score (β= .27, t= 4.04, p < .001) also independently predicting depression.

Conclusions: Findings from our study provide evidence that both anxiety and depression are highly prevalent across the lifespan in individuals with ASD and emphasise the need to provide a timely and accurate assessment of these co-occurring symptoms in young, middle and older adulthood.

203 **186.203** Association between Sleep Problems and Aggressive Behavior, Attention Problems, and Internalizing Behaviors Using Baseline and Follow-up Data in the Autism Speaks-Autism Treatment Network Registry

A. M. Shui[1,2], *T. Katz*[3], *B. A. Malow*[4] *and M. O. Mazurek*[5], *(1)University of California San Francisco, San Francisco, CA, (2)Biostatistics Center, Massachusetts General Hospital, Boston, MA, (3)Department of Pediatrics, University of Colorado School of Medicine, Aurora, CO, (4)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (5)University of Virginia, Charlottesville, VA*

Background: Sleep difficulties in children with Autism Spectrum Disorder (ASD) have been well established, and studies indicate that 50 to 80% of children with ASD have sleep problems. Aggression has been reported in previous literature as associated with sleep problems among children with ASD in cross-sectional studies. Sleep problems are also associated with increased internalizing and externalizing behavior and hyperactivity. Establishing an association between daytime behaviors and sleep problems over time may help with treatment and prevention of both sleep problems and daytime behaviors.

Objectives: To determine if change in sleep problems is associated with change in daytime behaviors from baseline to first 1-year follow-up among young children with ASD.

Methods: In a sample of children under 6 years-old in the Autism Speaks-Autism Treatment Network (ATN) registry with both baseline and first follow-up Child Behavior Checklist (CBCL) scores available, change scores were calculated from age- and sex-adjusted z-scores by subtracting z-score at baseline (visit 1) from z-score at first follow-up (visit 2). Change scores were calculated for the CBCL syndrome scales: Sleep Problems, Aggressive Behavior, Attention Problems, Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn. The associations between the sleep problems change score and each of the daytime behavior change scores were assessed using adjusted generalized linear models (GLM), controlling for baseline characteristics including demographics and DSM-IV diagnosis. The multiple imputation method was used to address missing data in each model, and a Holm-Bonferroni step-down procedure was applied to the six daytime behaviors to address multiple comparisons. Each adjusted p-value was compared to a significance threshold of 0.05, and nominal p-values prior to the adjustment were also reported.

Results: Of the 3,722 children under age 6 in the ATN registry, 457 had both baseline and first follow-up CBCL scores available. Mean age at baseline CBCL assessment was 3.5 years (SD 0.82), and most children were male (80.7%), non-Hispanic (93.1%), white (83.8%), had caregivers who completed at least some college (82.7%), and had a DSM-IV diagnosis of autistic disorder (68.2%). Adjusting for baseline characteristics and multiple comparisons, aggressive behavior and attention problems change scores were significantly associated with sleep problems change scores. On average, for each unit increase in aggressive behavior change score, sleep problems change score increased by 0.352 ($p<0.001$); and for each unit increase in attention problems change score, sleep problems change score increased by 0.234 ($p<0.001$). By contrast, internalizing behaviors were not correlated with increased difficulties with sleep.

Conclusions: Among young children with ASD, worsening aggressive behavior and attention problems were correlated with worsening sleep problems from baseline to first follow-up. These data highlight the importance of evaluating young children's sleep when aggressive behavior and attention problems are present. Addressing aggressive behavior and attention problems may help with treatment and prevention of sleep problems, and addressing sleep problems may also help with treatment and prevention of aggressive behavior and attention problems. Future research is needed to better understand the association between sleep and aggression/attention to determine if improvements in aggression/attention lead to improvement in sleep or vice versa.

204 **186.204** Associations between Sleep Structure and EEG with Daytime Functioning in ASD

R. Godbout, *Psychiatry, Université de Montréal, Montréal, QC, Canada*

Background: Sleep significantly interacts with daytime functioning. This will be illustrated by a series of studies in school-age children and young adults with ASD by describing the associations between, on one hand, sleep structure and EEG and, on the other hand, clinical measures, cognitive performance, and sensori-motor performance.
Objectives: The objectives of these studies were to elucidate the relationships between sleep structure and daytime functioning using gold stand sleep assessment methods.

Methods: Groups of 11-14 ASD children (mean age 10.3, *SD* = 2.2, range: 6–13) and 15-18 ASD adults (mean age 21.7, *SD* = 3.5, range: 16-27) were diagnosed with AID-R and ADOS. To identify relationships specific to autism, we recruited participants with ASD free from comorbidities including Intellectual Disability, epilepsy, and other psychiatric diagnoses. Results were compared to 13-15 neurotypical (NT) children (mean age = 10.2, *SD* = 2.0, range 7–12) and 14-17 NT adults (mean age 21.7, *SD* = 3.5, range: 16-27). All participants were recorded in a sleep laboratory using polysomnography (PSG) for two consecutive nights; only sleep/EEG data from night 2 were used. Behavioral scales were filled during the previous 2 weeks. Neuropsychological tests (adults only) were administered in the mornings following nights 1 and 2.

IQ measures were generally comparable between ASD and NT groups. Both age groups of participants with ASD showed more internalizing problem behaviors than the NT groups. Neuropsychological performance was lower in adult participants with ASD, particularly in tasks at least partly based on motor output.

Results: Sleep structure in participants with ASD differed from that of NT participants in both age groups, with long sleep latencies, more light nonREM (N1) sleep, and low levels of deep nonREM (N3) sleep; measures of REM sleep were comparable. Light nonREM sleep correlated negatively with IQ scores (Wechsler's and Raven's) in both groups of children. No significant correlations were found in adults but light nonREM sleep correlated negatively with reaction times on selective attention and procedural learning tasks. Deep nonREM (N3) sleep was negatively correlated with internalizing problem behaviors in children while REM sleep showed this association in adults. Deep nonREM (N3) sleep was negatively correlated with reciprocal social interactions core (ADOS) and positively correlated with repetitive behaviors (ADI-R).

EEG sleep spindles were less frequent in children (frontal electrodes) and adults (central electrodes) with ASD when compared to NT participants. Fewer sleep spindles were associated with (1) more trials required for learning a sensori-motor procedural task (rotary pursuit) and (2) higher IQ scores. Slow (delta) EEG activity was (1) lower in adult participants with ASD, (2) uncorrelated with IQ, and (3) negatively correlated with sensori-motor performance.

Conclusions: Signs of poor sleep are associated with impaired daytime performance in ASD as well as NT groups of participants, regardless of age. Patterns of relationships, however, differ according to age and clinical status. These results illustrate the atypical development of cortical afferent and efferent systems in ASD. They also raise the possibility that these systems act differently to regulate behavior in different age and clinical groups.

205 **186.205** Autism and Eating Disorders in Women: A Function of Age

C. M. Brown[1], M. Fuller-Tyszkiewicz[2], I. Krug[3] and ***M. A. Stokes****[4], (1)School of Psychology, Deakin University, Melbourne, Australia, (2)Deakin University, Melbourne, Australia, (3)University of Melbourne, Melbourne, Australia, (4)Deakin University, Burwood, Australia*

Background: Some evidence suggests that eating disorders (EDs) and Autism Spectrum Disorders (ASD) may be related in women, though how these comorbidities differ across diagnosis and age is not well established. It was hypothesised that a) the relationship between ASD and anorexia nervosa would be stronger than other types of EDs, and b) the strength of the relationship between ASD and all EDs would decrease as age increased.
Objectives: To understand the nature of the relationship between ASD and eating disorders in adult women.

Methods: We recruited 897 women between the age of 18 and 68 (*M*=32.06, *SD*=9.41) online through specialist support services and social media. The sample contained *N*=551 typically developing women, *N*=151 with ASD, and *N*=195 with EDs. Self-declared diagnoses were confirmed by use of the Autism-Spectrum Quotient (AQ), and the Eating Attitudes Test (EAT-26).

Results: Data were stratified into two discreet age brackets. For those aged 18-34 years, Chi-square analysis found 45.5% of women with ASD also displayed high ED traits ($\chi^2_{(1)}$=20.27, *p*<.001, *N*=77), while 31.5% of women with an ED also displayed high ASD traits ($\chi^2_{(1)}$=9.99 *p*<.005, *N*=111). Multiple regression revealed that EAT-26 subscales Dieting, and Oral Control significantly predicted AQ scores, while Bulimia & Food Preoccupation did not. For the group aged 35+ years, Chi-square analysis found that women with and without ASD had similar levels of ED traits ($\chi^2_{(1)}$=3.75, *p*=.05, *N*=45, 31.1%), while women with and without an ED differed substantially in the proportion with high ASD traits ($\chi^2_{(1)}$=0.00, *p*=.964, *N*=37, 24.3%). Multiple regression revealed Dieting was the only significant predictor of AQ scores.

Conclusions: Over the age of 35, the relationship between ASD and EDs was non-significant, which is likely to be reflective of the younger age at which EDs are more prevalent (Ackard, Richter, Frisch, Mangham & Cronemeyer, 2013). The study was limited in that it only had the capacity to examine current ED traits, and not historical diagnoses of EDs, though this is an area in which further investigation is warranted. There also appears to be variation in the type of ED related to ASD among women, with anorexic symptomology having the greatest predictive power for ASD traits, which is consistent with existing literature (Huke, Turk, Saeidi, Kent, & Morgan, 2013). This study highlights the necessity for greater understanding of female specific ASD presentation.

206 **186.206** Autism Spectrum Disorder in an Unselected Cohort of Children with Neurofibromatosis Type 1 (NF1)

S. Eijk, ***S. E. Mous****, G. C. Dieleman, B. Dierckx, A. B. Rietman, P. F. de Nijs, R. van Minkelen, C. E. Catsman-Berrevoets, R. Oostenbrink and J. S. Legerstee, Erasmus MC-Sophia Children's Hospital, Rotterdam, Netherlands*

Background: Recently, studies have started to focus on the prevalence and profile of Autism Spectrum Disorders (ASD) in children with neurofibromatosis type 1 (NF1), and prevalence rates of ASD symptoms ranging between 13-30% have been reported. However, these estimates are often based on screening instruments and pre-selected samples of children with NF1 with an initial suspicion of autism spectrum problems, and are most likely not representative for the general pediatric NF1 population.
Objectives: We aimed to examine the prevalence of ASD in an unselected sample of children with NF1 without a presumption of ASD. Additionally, we assessed the predictive value of a screening- and clinical observational instrument in relation to clinical DSM-IV ASD diagnosis in a pediatric NF1 population, and we examined possible correlates.

Methods: In 128 children, aged 2-10, the Autism Diagnostic Observation Schedule (ADOS; a clinical observational instrument for ASD assessment) was administered, and 103 parents also completed the Social Responsiveness Scale (SRS; a screening instrument for autism symptoms). All children were clinically assessed by a child psychiatrist.

Results: A prevalence rate for clinical ASD of 10.9% was found. The positive predictive value in relation to the DSM-IV ASD diagnosis was highest when the screening- and observational instrument were combined. An ASD diagnosis was associated with gender and age; more boys were diagnosed with ASD and the group of children with an ASD diagnosis was older.

Conclusions: This ASD prevalence rate is clearly higher than in the general population, but lower than has been previously reported in NF1 studies using pre-selected samples of children with a presumption of ASD. Furthermore, our results highlight the importance of using both the ADOS and SRS for the identification of ASD in children with NF1.

207 **186.207** Characteristics of Autism Spectrum Disorder in Russell-Silver Syndrome

***C. Lane**, E. Milne and M. Freeth, The University of Sheffield, Sheffield, United Kingdom*

Background:

Russell-Silver syndrome (RSS) is a rare condition associated with slowed growth both prenatally and postnatally. It is estimated that approximately 60% of individuals with a clinical diagnosis of RSS have an identifiable molecular cause. The most common molecular abnormalities are loss of methylation on chromosome 11p15 (observed in 30 – 60% of patients with a clinical diagnosis) and maternal uniparental disomy for chromosome 7 (MUPD7) (observed in 5 – 10% of patients with a clinical diagnosis). Previous research has indicated that autism spectrum disorder (ASD) may be common in individuals with RSS and particularly in those with RSS MUPD7. However, to date, the prevalence of ASD in RSS has not been systematically investigated using standardised assessments.

Objectives:

The aim of this study was to identify the prevalence of ASD in RSS 11P15 and RSS MUPD7, using a quantitative measure of ASD symptomatology - the Social Responsiveness Scale, second edition (SRS-2).

Methods:

The SRS-2 is a 65-item questionnaire, designed to assess severity of ASD symptomatology and is consistent with the DSM-5 criteria for ASD. The parent/caregiver of each participant completed the SRS-2 for 37 individuals with a diagnosis of RSS 11P15 (mean age = 7.71 years, SD = 4.47) and 23 individuals with a diagnosis of RSS MUPD7 (mean age = 9.17 years, SD = 6.46).

Results:

As assessed by the SRS-2, 38% of participants with RSS 11P15 and 43% of participants with RSS MUPD7 scored above clinical cut-off for ASD (total T-score ≥ 60). The findings indicated that individuals with RSS 11P15 and individuals with RSS MUPD7 displayed similar severity of difficulty with social communication impairment. However, individuals with RSS MUPD7 had greater difficulty with restricted interests and repetitive behaviours, compared to individuals with RSS 11P15.

Conclusions:

Overall, the findings indicate that individuals with RSS 11P15 and individuals with RSS MUPD7 display increased prevalence of behavioural symptomatology associated with ASD. In addition, individuals with RSS MUPD7 display particular difficulty with restricted interests and repetitive behaviours.

208 **186.208** Co-Occurring Psychopathology in Children with Autism Spectrum Disorder of Normal-Range Intelligence

***E. L. Palluotto**[1], W. Mandy[2] and D. H. Skuse[3], (1)Oxford Health NHS, Buckinghamshire, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background: Increasing evidence indicates that children with Autism Spectrum Disorder (ASD) experience high rates of co-occurring psychopathology, particularly Attention-Deficit-Hyperactivity-Disorder (ADHD), Anxiety and Depression (Salazar et al., 2015; Simonoff et al., 2008). Affected children with co-occurring psychopathology have poorer outcomes, including an increased risk of hospitalisation. In some respects, the reported characteristics of ASD comorbidity resemble equivalent conditions when those are found in typically developing children. For instance, there is a greater prevalence of internalising psychopathology in females and externalising psychopathology in males. Former studies of comorbidity that have evaluated risk for psychopathology have focused largely on children with intellectual disability, but >85% of ASD is nowadays diagnosed in those with normal-range IQ.

Objectives: This study aimed to identify patterns of psychiatric comorbidity among newly diagnosed ASD children with normal or high IQ, by means of a standardized parental interview, the Development and Wellbeing Assessment (DAWBA) (Goodman et al., 2011). Psychiatric disorders included Panic Disorder, Agoraphobia, PTSD, Eating Disorder, OCD, Depression, Tic Disorder, Separation Anxiety, Social Phobia, GAD, Specific Phobia and ADHD**.** Previous methodological limitations have been minimised by using standardized assessment tools that identified indices of severity, in terms of both ASD and comorbid conditions. Because UK national psychiatric comorbidity data have also been collected by the DAWBA (2016-7), comparisons with general population prevalence and patterns of comorbidity in a non-ASD sample were also possible.

Methods: 78 consecutive referrals (*N*=78; 44 males, 34 females, 5-17 years, *M*age=10.45 years, *SD*=3.5) were recruited from a specialist ASD assessment service. All had normal-high range intelligence (*M*FSIQ=92, *SD*=17) and a clinical diagnosis of ASD (DSM-5 criteria) made based on structured parental interview (3di) and Autism Diagnostic Observation Schedule (ADOS) scores. Parent DAWBA data were available in all cases, plus school reports.

Results: Sixty-five percent met criteria for at least one comorbid disorder, including ADHD (39%) and Specific Phobias (22%). Logistic regression revealed ADHD traits were more common in ASD males than females (OR 3.554 [95% CI 1.245-10.143]). There was no gender difference in the prevalence of comorbid Anxiety or Depression (p>0.05). Depressive traits were more prevalent in older children (OR 1.378 [95% CI 1.046-1.815]). Social Phobia was associated with ASD severity (OR 1.471 [95% CI 1.013-1.983]).

Conclusions: Comorbid psychiatric traits are much more common among children with high-functioning ASD than in typically developing populations. Unless structured screening for comorbidity is undertaken as a routine clinical procedure when assessing children with suspected ASD of normal range intelligence, concurrent disorders may be overlooked, and hence untreated.

209 **186.209** Common and ASD-Distinct Anxiety Presentations and Their Association with Individual Characteristics in a Large Pooled Database of Young People with ASD

B. Y. Lau[1], R. Leong[1], M. Uljarevic[2,3], A. Ozsivadjian[4], J. W. Lerh[1], M. J. Hollocks[5,6], J. Rodgers[7], H. McConachie[8], M. South[9], A. V. Van Hecke[10], A. Y. Hardan[11], R. Libove[11,12], S. R. Leekam[13], E. Simonoff[14] and ***I. Magiati***[1]*, (1)Psychology, National University of Singapore, Singapore, Singapore, (2)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (3)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (4)St. Thomas Hospital, Evelina London Children's Hospital, london, UNITED KINGDOM, (5)King's College London, Cambridge, UNITED KINGDOM, (6)Department of Clinical Psychology, University of East Anglia, Norwich, United Kingdom, (7)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom, (8)Institute of Health and Society, Newcastle University, Newcastle upon Tyne, United Kingdom, (9)Psychology & Neuroscience, Brigham Young University, Provo, UT, (10)Psychology, Marquette University, Milwaukee, WI, (11)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (12)Medicine (Parker Lab), Stanford University, Stanford, CA, (13)School of Psychology, Cardiff University, Cardiff, NSW, United Kingdom, (14)King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom*

Background: Clinically elevated anxiety symptomatology and disorders occur in high rates in young people with ASD. Anxiety symptoms in young people with ASD can be consistent with those found in DSM-5 (also termed as “common” anxieties), while a substantial number may also present with anxiety symptoms that are qualitatively different and more distinct to ASD (“ASD-distinct”).
Objectives: Few studies have systematically examined the phenomenology of anxiety in ASD and only one study to date has explored the associations between different individual characteristics with common and ASD-distinct anxiety presentations. Most current anxiety measurement tools are designed for individuals without ASD and thus, have been inadequate in capturing possible qualitative differences of anxiety in ASD. This research study aims to extend on limited existing literature that examines emerging themes of anxiety symptomatology in ASD, as well as investigating possible associations between individual characteristics and presentations of common and ASD-distinct anxieties.

Methods: Participants were 870 6-18 years old young people with ASD from UK (n=465), Singapore (n=241), and USA (n=164) from an international multi-site pooled database. Caregivers completed the Spence Children's Anxiety Scale – Parent Version (SCAS-P). Open-ended responses to item 39 (“Is there anything else your child is afraid of?”) were coded, and thematically and quantitatively analyzed to investigate (i) differential presentations of anxiety in ASD and (ii) associations between age, gender, cognitive functioning and autism symptom severity and ASD-distinct anxieties.

Results: Nearly half (47.6%) of the 545 responses obtained from 287 participants in the open-ended optional item 39 were found to be ASD-distinct anxieties. Of those, 54% were sensory, 28.2% were specific unusual phobias; 16% were fears about change/ unpredictability/ routine disruption; and 2.1% were relating to ASD specific social demands. Individuals of younger ages, lower overall cognitive functioning, and higher autism symptom severity tended to present with more ASD-distinct anxieties as compared to common anxieties, while age and autism severity were found to be significant independent predictors of reported ASD-distinct anxieties in subsequent regression analyses.

Conclusions: The results appear to support a profile of both common and ASD-distinct anxiety phenomenology amongst young people with ASD. Future clinical assessments or measures of anxiety should aim to routinely include questions, probes and clarifications to enquire about, and disentangle, both common and ASD-distinct anxieties.

210 **186.210** Comorbid Down Syndrome and ASD: Differential Social Affect in ASD Symptoms

T. Hamner[1,2]*, D. L. Robins[3], D. Fidler[4], S. Hepburn[4], N. R. Lee[2] and C. Robinson Rosenberg[5], (1)AJ Drexel Autism Institute, Philadelphia, PA, (2)Department of Psychology, Drexel University, Philadelphia, PA, (3)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (4)Colorado State University, Fort Collins, CO, (5)University of Colorado / JFK Partners, Aurora, CO*

Background: Little is known about the ASD symptom profile of children with comorbid Down syndrome and ASD (DS+ASD). Whereas previous literature suggests limited social impairments in individuals with DS-only (Fidler, 2005), recent research demonstrates an estimated 20% of the DS population has ASD (DiGuiseppi et al., 2010). The limited research available suggests children with DS+ASD have fewer social impairments than in ASD but similar communication impairments; however, social functioning has largely been assessed using parent-report (Warner et al., 2017) or in very small samples (*n*=3; Hepburn et al., 2008). Elucidating differences in ASD symptoms for those with ASD and a comorbid genetic syndrome can further our understanding of the nature and etiology of ASD in these children. Identifying ASD symptom profiles of children with comorbid DS+ASD early in development is critical to informing early identification and intervention.
Objectives: The goal of this study is to assess ASD symptom profiles within and between clinical samples of children with ASD, DS, and DS+ASD.

Methods: Participants included 93 children (59 males; Mean age= 60.43 months) with ASD (n=43), DS (n=38), and DS+ASD (n=12). Data were compiled from a larger study completed at the University of Colorado School of Medicine/Colorado State University (DiGuiseppi et al., 2010) and from the National Database for Autism Research. ASD symptoms were assessed using the ADOS Module 1 and scores were converted to severity scores using the algorithm described by Gotham and colleagues (2007). A 3x2 mixed-model ANOVA with one between subjects factor (diagnostic group: DS, ASD, DS+ASD) and one within subjects factor (ADOS scale: social-affect (SA) and restricted, repetitive behaviors (RRBs)) was completed to examine if SA and RRBs are differentially impacted in the DS+ASD group compared to the other two groups.

Results: A significant group-by-scale interaction was revealed (F [2, 86] = 5.33, $p < 0.001$ using a Greenhouse-Geisser adjustment); each group presented with unique profiles. Specifically, the DS+ASD group had a profile unlike either the DS or ASD in isolation groups. Compared to those with ASD, SA in DS+ASD was significantly less impaired; in contrast, RRBs were similar across ASD and DS+ASD. Compared to those with DS, SA and RRBs were significantly more impaired in the DS+ASD group.

Conclusions: Results suggest ASD symptom profiles for children with DS+ASD are not similar to those with either ASD or DS in isolation. Specifically, whereas the DS+ASD group presents with RRBs similar to those with ASD, SA is less impacted and may act as a protective factor within this group. Given prior research suggesting social abilities are a relative strength for those with DS, investigation of the contribution of reciprocal social interaction and communication to overall social affect within this group is important. Discrepancies within social affect, characteristic to

ASD, have important implications for both early identification and intervention. As early intervention has been shown to alter developmental trajectories and improve lifetime outcomes for children with ASD (Orinstein et al., 2014), it will be important to investigate whether these interventions will have similar benefits for those with DS+ASD.

211 **186.211** Cumulative Sleep Loss and Challenging Behaviors during Treatment for Children with Autism

E. A. Abel[1]*, A. J. Schwichtenberg*[1]*, S. L. Christ*[2] *and M. Brodhead*[3]*, (1)Purdue University, West Lafayette, IN, (2)Human Development & Family Studies, Purdue University, West Lafayette, IN, (3)Michigan State University, East Lansing, MI*

Background: Sleep problems are common in children with autism spectrum disorder (ASD) and can exacerbate challenging daytime behaviors and ASD symptoms. In early childhood, individuals with ASD often receive intensive behavioral interventions using a center-based model, although no published studies have addressed how sleep may influence challenging behaviors in this developmental context.
Objectives: Following models of sleep debt, the present study aimed to address the potential cumulative effects of sleep loss on challenging behaviors occurring in the context of treatment. Specifically, we explored the following research question: On sequential preceding nights in which a child has poor sleep, does he/she exhibit more challenging behaviors the following day? We hypothesized that children with more cumulative sleep loss and/or fragmentation (averaged across all sequential preceding nights of sleep) would exhibit more challenging behaviors on the subsequent day.

Methods: This study included 42 children with ASD (2-10 years). All children had a medical ASD diagnosis and attended a behavioral intervention center five days a week. Sleep was assessed for five, consecutive 24-hour periods (Sunday–Thursday) using an actigraph and a coupled parent-report sleep diary. Daytime behaviors were recorded during the child's treatment hours by his/her behavioral clinician (Monday–Friday)—in conjunction with the sleep assessment schedule. Daytime behaviors included repetitive behaviors, aggression, negative affect, and self-injury. Partial–interval recording was implemented in five–minute intervals for the entirety of the treatment day, and clinicians indicated whether each behavior was observed within each interval.

Generalized linear mixed effects models were used to assess relations between sequential nights of sleep and each target behavior. Sequential measurements of sleep were calculated by maintaining a running average of sleep estimates over the course of the week. For example, Wednesday's behavior would be predicted by the average of sleep for Sunday, Monday, and Tuesday. Terms for level of functioning, caregiver education, sex, and age were included in each model. Total sleep time (TST) and wake after sleep onset (WASO) were included in separate models as predictors of each challenging behavior.

Results: Overall, children who slept less at night engaged in more repetitive behaviors and more negative affect during the day (Table 1). For every three hours of sleep missed (on average) over the previous consecutive nights, children engaged in ~one additional repetitive behavior and ~.50 negative affect expressions per hour. Additionally, for every three hours of WASO, children exhibited ~one additional negative affect expression per hour.

Conclusions: Our findings suggest that, in isolation, one night of poor sleep may not be consequential for a child's challenging behaviors during treatment. Rather, consistent with the theories of sleep debt, unrecovered sleep loss across multiple preceding nights was associated with greater risk for challenging daytime behaviors. Findings from the present study highlight sleep as one potential mechanism to reduce challenging behaviors—particularly when children exhibit extended patterns of maladaptive sleep behaviors.

212 **186.212** Decreased Satisfaction in Peer Relationships Is Strongly Associated with Depression in Children with High ASD Traits: A Population-Based Cross-Sectional Study in Japan

M. Takahashi[1]*, M. Adachi*[1]*, S. Yasuda*[2] *and K. Nakamura*[3]*, (1)Research Center for Child Mental Development, Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (2)Research Center for Child Mental Development Graduate School of Medicine, Hirosaki University, Hirosaki, Japan, (3)Graduate School of Medicine, Hirosaki University, Hirosaki, Japan*

Background: High rates of depression have been reported among children with autism spectrum disorder (ASD); however the relationship between depression and ASD traits observed in a community-based children sample has not yet been studied. In addition, the association between health-related quality of life (HRQOL) and depression in children with high ASD traits in a general population has not been evaluated, although that between HRQOL and depression has been reported in children with ASD in a clinical setting.
Objectives: This study aimed to examine how ASD traits are associated with depression in children using a population-based community sample. Moreover, we investigated how HRQOL is associated with depression in children with high ASD traits.

Methods: We conducted a survey among all children above grade 4 who attended national and public primary or junior high schools and their primary caregivers in September 2016. Of 8518 questionnaires, we received 7147 valid responses (83.9%). We evaluated ASD traits in children using a parental reported questionnaire, Autism Spectrum Screening Questionnaire (ASSQ). The Depression Self-Rating Scale for Children (DSRS-C) and Pediatric Quality of Life Inventory™ (PedsQL™), both self-reported questionnaires, were used for evaluating depression and HRQOL, respectively.

Results: The results of multiple regression analysis for all children revealed that ASSQ score and all subscale scores of PedsQL™ and other demographic factors were significantly associated with DSRS-C score, indicating that high ASD traits were associated with more severe depression even in a community sample of children. Moreover, we conducted multiple regression analyses by categorizing children into two groups based on ASSQ scores (score ≥ 19 or not) in order to examine how ASD traits influence on the relationship HRQOL and depression. Consequently, only emotional and social functioning were significantly associated with depression in the high ASD trait group, although all four PedsQL™ subscale scores were significantly associated with depression in the low ASD trait group. However, the relationship between social functioning score and depression was stronger in the high ASD trait group ($\beta = -0.324$, $p < 0.001$) than in the low ASD trait group ($\beta = -0.177$, $p < 0.001$). The association between emotional functioning and depression was comparable between the high and low ASD trait groups ($\beta = -0.347$, $p < 0.001$ vs. $\beta = -0.391$, $p < 0.001$). These results indicated that decreased satisfaction in peer relationships was more strongly associated with depression in children with high ASD traits than in those with low ASD traits. Furthermore, Analysis of variance for the PedsQL™ subscale scores revealed that all subscale scores were higher in the high ASD trait group than in the low ASD trait group, and the largest effect size was observed in the difference of the social functioning score between groups ($d = 0.82$).

Conclusions: Decreased satisfaction in peer relationships is more strongly associated with more severe depression in children with high ASD traits

than in those with low ASD traits. This result suggests that intervention in the quality of peer relationships among children with high ASD traits is essential to prevent depression.

213 **186.213** Depression in Children with Autism Spectrum Disorders: Measurement and Associations.

S. Brice[1]*, E. Honey*[2]*, J. R. Parr*[3]*, S. Wigham*[1] *and J. Rodgers*[3]*, (1)Institute of Neuroscience, Newcastle University, Newcastle upon Tyne, United Kingdom, (2)Northumberland, Tyne & Wear NHS Foundation Trust, Newcastle Upon Tyne, United Kingdom, (3)Institute of Neuroscience, Newcastle University, Newcastle Upon Tyne, United Kingdom*

Background: Children with autism spectrum disorders (ASD) are acknowledged to have an elevated risk of developing depression compared with their typically developing peers. Despite this, depression is poorly understood and often underdiagnosed in this group. The lack of reliable and valid measures of depression in this population are likely a factor in this. There is emerging evidence of a relationship between depression and a variety of psychological constructs, including traits of ASD although the mechanisms underlying these relationships is as yet unclear.
Objectives: This multi-phased study aimed to further the conceptual understanding of depression in children with ASD. Firstly we aimed to explore the latent factor structure of a well-used measure of childhood depression in a sample of children with ASD. Following this, we aimed to assess the psychometric properties of the measure as well as its acceptability to parents of children with ASD. Finally, the study aimed to explore the direct and indirect relationships between sensory hyposensitivity, restricted and repetitive behaviours and depression in children with ASD.

Methods: Participants were parents of 127 children with ASD without comorbid intellectual disability and 11 parents attended the focus groups for consultation regarding the depression measure. Participants were recruited from two autism research databases in the United Kingdom. Polychoric exploratory factor analysis was used to explore the factor structure of the Children's Depression Inventory (2nd Edition) in a sample of parents of children with ASD. Participants from both datasets were included as they were found not to differ significantly from one another across a range of key characteristics. The psychometric properties of the emergent factor structure were assessed and the model fit was tested by confirmatory factor analysis using structural equational modelling. Hayes (2009) mediation models were then used to explore the direct and indirect relationships between depression and traits of ASD.

Results: The results supported a unifactorial depression scale, with the removal of three of the original seventeen items. This scale evidenced promising reliability and validation however further adaptation is advised based on consultation with parents and poor model fit highlighted during confirmatory factor analysis. Mediation analyses highlighted significant and previously unreported direct and indirect relationships between sensory hyposensitivity, restricted and repetitive behaviours and depression.

Conclusions: These findings constitute the first steps in the creation of a psychometrically robust measure of depression in children with ASD. This can have clinical utility in terms of improved screening for depression in a population whereby it is currently often missed. The potential roles of sensory processing and restricted and repetitive behaviours in the prediction and maintenance of depression offer new avenues for future research and clinical intervention.

214 **186.214** Disparities in Care: An Investigation of Children with Autism Spectrum Disorder and Appendicitis

E. Friedlaender[1]*, H. Griffis*[2,3]*, J. Faerber*[4]*, W. Quarshie*[5,6] *and B. Ely*[7]*, (1)Pediatrics, The Children's Hospital of Philadelphia, Philadelphia, PA, (2)Healthcare Analytics Unit at the Center for Pediatric Clinical Effectiveness, The Children's Hospital of Philadelphia, Philadelphia, PA, (3)PolicyLan, The Children's Hospital of Philadelphia, Philadelphia, PA, (4)The Center for Pedaitric Clinical Effectiveness, The Children's Hospital of Philadelphia, Philadelphia, PA, (5)Healthcare Analytics Unit at PolicyLab, The Children's Hospital of Philadelphia, Philadelphia, PA, (6)The Center for Pediatric Clinical Effectiveness, The Children's Hospital of Philadelphia, Philadelphia, PA, (7)University of Pennsylvania School of Nursing, Philadelphia, PA*

Background: Children with Autism Spectrum Disorders (ASD) display a range of language abilities and behaviors to reflect symptoms from illness or injury that challenge interpretation in the health care environment that, in turn, impact evaluations and appropriate treatment, possibly leaving these individuals a vulnerable population within health care systems. The overwhelming nature of the emergency department (ED) environment as point of entry for diagnosis and treatment of abdominal pain may also contribute to the challenging assessment of the child with ASD. In addition, many providers of emergency medical services are largely unprepared to accommodate and adapt communication and practices to identify and meet the needs of individuals with social communicative differences. Importantly, delay in diagnosis for acute appendicitis may lead to increased morbidity, adding to length of stay, cost, and resource utilization.
Objectives: 1) To evaluate differences in the administration of analgesia between neurotypical (NT) individuals and children with ASD diagnosed with appendicitis in the ED and 2) to compare rates of complicated appendicitis (perforated or with peri-appendiceal abscess) among NT individuals and those with ASD at the time of diagnosis in the ED using the Pediatric Health Information System (PHIS), a comparative national database.

Methods: Retrospective case-control study of children 6-18 years of age with an ED visit for appendicitis between 2005 and 2015. Coarsened exact matching was used to match ASD children to NT controls within each hospital based on age, sex, race, ethnicity, ICD-9 diagnosis, and year of hospitalization. Logistic regression was used to investigate the association between ASD status and medication receipt. Outcomes included receipt of opioid or non-opioid analgesic within the first 48 hours of an ED visit. Comparison of the rates of complicated versus simple appendicitis in ASD and NT children was conducted before matching. Results of weighted logistic regression and truncated negative binomial regression models are reported.

Results: 126,412 children with appendicitis were identified in PHIS. The matched sample consisted of 889 children with ASD (>88% male, 60% 7-18 years of age, 77% white) and 35,672 NT controls. Receipt of opioids or non-opioid analgesics was not found to be statistically different between the two groups. Compared to NT controls, children with ASD with appendicitis had no significant difference regarding: receipt of no medication [0.67% vs. 0.97%; OR= 0.694 (0.309, 1.559), p= 0.38] and receipt of any pain medication [54.22% vs. 54.96%; OR=0.971 (0.848-1.109), p=0.66]. A significant difference (<0.0001) was found between children with ASD and NT controls for complicated appendicitis (N, ASD=355, 37.1% vs. N, NT=37,520, 29.9%).

Conclusions: Children with ASD have increased rates of complex appendicitis compared to those without ASD suggesting limited access to care, caregiver difficulty in assessing pain and others relevant symptoms in their child with ASD or provider difficulty in evaluating this population. However, receipt of analgesia in the ED for appendicitis did not differ significantly between populations of children with ASD and NT peers.

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186.215 Efficacy of a New Family-Based Cognitive-Behavioral Intervention for Insomnia in Children with ASD

***M. O. Mazurek**[1], W. S. Chan[2], M. Munoz[3], J. E. Muckerman[4], T. N. Takahashi[4], S. Takamatsu[3], P. Sahota[3] and C. S. McCrae[3], (1)University of Virginia, Charlottesville, VA, (2)Psychiatry, Dartmouth College, Lebanon, NH, (3)University of Missouri, Columbia, MO, (4)Thompson Center for Autism & Neurodevelopmental Disorders, University of Missouri, Columbia, MO*

Background: Insomnia affects up to 80% of children with autism spectrum disorder (ASD) and has significant detrimental effects on daytime functioning and well-being for both children and parents. Despite the clinical importance of this issue, empirically supported treatments for insomnia in children with ASD are lacking. Cognitive-behavioral therapy for childhood insomnia (CBT-CI) represents a promising approach, but it has not been previously tested in children with ASD.

Objectives: The objective of this study was to test the preliminary efficacy of a family-based cognitive behavioral therapy for insomnia that was specifically adapted for children with ASD (CBT-CI-A). Primary outcomes included child and parent sleep (subjective and objective), child daytime behavior, and parent fatigue.

Methods: Participants included 31 children with ASD and insomnia (ages 6-12, 74% male) and their parents (ages 28-48, 13% male) who participated in an 8-session clinical trial of the newly developed CBT-CI-A. Nineteen families participated in face-to-face therapy sessions, while twelve families participated in remote sessions delivered via videoconferencing technology. Child and parent sleep were assessed by actigraphy (Actiwatch-L®, Respironics) and daily completion of electronic sleep diaries for two weeks at baseline, post-treatment, and 1-month follow-up. Parent diaries assessed daily fatigue (0–100 scale). Averages were calculated across each two-week assessment period for sleep onset latency, total wake time, total sleep time, sleep efficiency, and fatigue (parent only). Child daytime behavior was assessed at each time point via the Aberrant Behavior Checklist.

Results: Data from the face-to-face delivery condition are presented here, but complete data for the entire sample and comparisons between delivery-format will be included in the final presentation. For the face-to-face delivery, paired samples t-tests revealed moderate-large improvements in child objective sleep [onset latency (~18 minutes), total wake time (~41 minutes), total sleep time (~17 minutes), efficiency (~6%); within group effect sizes (*ES*)=.52-1.28], and moderate-large improvements in child subjective sleep [onset latency (~30 minutes), total wake time (~44 minutes), sleep efficiency (~6%); *ES*=.68-1.80], bed/waketime regulation (~30 minutes each, *ES*=.76-2.17), and daytime behavior [irritability, social withdrawal, stereotypy, inappropriate speech; *ES*=.52-.86]. Treatment gains were maintained at 1-month follow-up [*ES*=.25-2.23]. Parent improvements were found in objective total sleep time (~19 minutes, *ES*=.41), subjective sleep [onset latency (~10 minutes), wake after sleep onset (~12 minutes), total wake time (~25 minutes), sleep efficiency (~5%); *ES*=.49-1.01)], and fatigue (~10 points, *ES*=.52). Parent treatment gains were generally maintained with additional objective sleep improvements at 1-month follow-up [onset latency (~5 minutes), wake after sleep onset (~5 minutes), total wake time (~10 minutes); *ES*=.45-.98].

Conclusions: The results of this pilot study suggest that the newly developed CBT-CI-A is an efficacious treatment for insomnia in children with ASD and their families. Sleep markedly improved for children with ASD and their parents according to both objective and subjective measures. Importantly, children's daytime behaviors also improved. These findings suggest that CBT-CI-A is a promising treatment for insomnia in children with ASD. Larger scale studies are needed to further evaluate the effectiveness of this treatment in larger samples using randomized clinical trial designs, active control groups, and long-term follow-up.

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186.216 Emotional Coherence Difficulties in Preschoolers with Autism: Evidence from Internal Physiological and External Communicative Discoordination

***H. J. Nuske**[1], D. Hedley[2], L. Tomczuk[3], E. Finkel[4], P. Thomson[5] and C. Dissanayake[2], (1)Center for Mental Health, University of Pennsylvania, Philadelphia, PA, (2)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (3)Neuroscience Department, Dickinson College, Carlisle, USA, Carlisle, PA, (4)Department of Psychology, University of Pennsylvania, Philadelphia, PA, (5)Olga Tennison Autism Research Center, La Trobe University, Bundoora, Australia*

Background: The ability to communicate stress is important as it signals to others that help is needed and, for young children, creates learning opportunities around managing emotions. Many children with Autism Spectrum Disorder (ASD) have difficulties clearly expressing emotions and communicating these expressions to others. What is not clear, however, is whether this represents a general reactivity difference in this population, or whether this means that despite reacting physiologically, children may not be communicating this stress with expressive behaviors (e.g., facial expressions). Hence, children with ASD may have difficulties with coordinating internal and external reactions, or *emotional coherence*, relative to typically developing (TD) children.

Objectives: The aim in the study was to determine the association between internal physiological emotional reactivity and external communicative emotional reactivity in children with ASD, relative to TD children.

Methods: Preschoolers with autism (ASD) and TD preschoolers watched a relaxing video (resting state task) and participated in a low-level stress task from the Laboratory Temperament Assessment Battery (the Transparent Box Task), whilst wearing a wireless ECG monitor to measure heart rate (beats per minute), as an index of physiological reactivity. Children's emotional communication behaviors (facial, vocal and bodily expressions) were coded offline by reliable coders, who were blind to diagnostic group and study aims.

Results: Preliminary results (n=20 TD, 16 ASD) showed that whilst all children reacted to the low-level stress task, relative to the resting state task, by displaying emotional communicative behaviors, only in the TD group was children's increase in heart rate correlated for facial (r = .36, p = .06) and vocal expressions (r = .33, p = .08; bodily expressions and heart rate were not correlated in the TD group: r =- .06, p = .40.) For the ASD group, no associations were found between their internal physiological and external communicative reactions (heart rate and facial reactivity: r = -.24, p = .21; vocal reactivity: r = -.20, p = .25; bodily reactivity: r = -.19, p = .26). See Figure 1 and 2 for vocal reactivity scatterplots as an example.

Conclusions: Children with ASD may have more difficulty expressing physiological emotional reactions via communicative behaviour, relative to their peers. Given that co-regulation strategies (e.g., driven by a social partner, such as mother) which are prevalent in preschoolers, and associated learning opportunities for emotion management, are reliant on the child first signalling their stress to others, such an expressive impairment may contribute to emotion regulation difficulties downstream. A 2-year follow-up of the sample is currently underway and presentation will include results on prediction of emotional coherence to emotion regulation and challenging behaviour in the children. Given the recent technological advances in wearable biosensing, our results suggest incorporation of heart rate signalling in intervention for children with ASD may show promise, through signalling children's stress on their behalf, allowing parents and teachers to intervene and create learning opportunities for emotional expression and regulation.

217 **186.217** Examining the Impacted of the Severity of Attention Deficit/ Hyperactivity Disorder Symptoms on the Cognitive Flexibility in Children and Adolescents with Autism Spectrum Disorders.

***Y. C. WU*[1]**, *S. S. F. Gau[2] and S. L. Gu Hwang[1], (1)Department of Occupational Therapy, Chang Gung University, Taoyuan City, Taiwan, (2)Department of Psychiatry, National Taiwan University Hospital & College of Medicine, Taipei, Taiwan*

Background: Autism spectrum disorder (ASD) is a lifelong neurodevelopmental disorder. Symptoms of the manifest ASD as impairments in cognitive flexibility, the ability to adaptive switch among multiple representations as a function of changing relevant cues in the environment. One of the most commonly used of cognitive flexibility is the Wisconsin Card Sorting Test (WCST), but the previous studies on ASD have yielded mixed results, some studies showed impairments in cognitive flexibility in ASD than typical development (TD), but some argued that there are no differences between two groups.

Previous studies have described that children with ASD (30-50%) suffer from comorbid with Attention deficit/ hyperactivity disorder (ADHD) symptoms, and several studies showed children with ADHD had poor performance in WCST. To date, only few studies examine the severity of comorbid ADHD symptoms, whether would influence the performance of cognitive flexibility in ASD.

Objectives: Thus, previous studies argued the inconsistencies might be due to differences in participant characteristics like age, IQ, and co-occurring ADHD symptoms.

The aim of this study was: (1) to investigate whether children and adolescents (7-17 years old) with ASD group shows cognitive flexibility impairments than matched TD group on WCST performance, (2) to investigate the influence of comorbid ADHD symptoms on WCST performance.

Methods: A total of 141 ASD and 94 TD were matched by sex (ASD vs TD, male/ female: 126/15 vs 79/15), age (12.22 ± 2.20 vs 12.49 ± 2.08) and Wechsler full-scale intelligence (FIQ) (106.26 ± 11.91 vs 108.57 ± 10.73).

The computerized version of WCST was selected as cognitive flexibility measures. Symptoms in ASD were assessed by Autism Diagnostic Interview-Revise (ADI-R), and in ADHD were assessed by Swanson, Nolan, and Pelham rating scale version IV (SNAP-IV).

For the analysis, firstly, group comparisons of demographic data were used independent t-tests. Secondly, Cohen's *d* was calculated to quantify the magnitudes of group effects in the differences of WCST performance. Lastly, the differences of WCST performance were examined through analysis of covariance (ANCOVA), whereby the analyses were controlled for the effects of the age FIQ and comorbid ADHD symptoms covariates.

Results: A statistical comparison of Demographic revealed no significant difference between ASD and TD group (Table 1).

The independent t-tests showed the ASD group performed significantly worse with the TD group on the WCST index (Figure1), including the trials administered (p<.0001), total correct (p<.0001), total errors (p= 0.062), % perseverative response (p= 0.0011), % perseverative errors (p= 0.0026), and the medium effect size was found (Table 2).

The analysis of ANCOVA revealed the significant differences between the groups in the trials administered, total correct, total errors, %perseverative response, %perseverative errors, and no main and interactive effects of age-FIQ and age-FIQ-comorbid ADHD symptoms of WCST performance (Table 2).

Conclusions: In the present study, we have replicated previous results reporting impairment of the ASD group in cognitive flexibility (WCST performance), and confirmed the deficits of cognitive flexibility were associated with ASD diagnosis, rather than the severity of the comorbid of ADHD symptoms.

218 **186.218** Exploring Shared Mechanisms across Autism and Depression to Inform Emotional Health Interventions in ASD

***K. Gotham*[1]**, *G. T. Han[2], K. E. Unruh[3], R. N. Crist[4] and J. W. Bodfish[5], (1)Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN, (2)Vanderbilt University, Nashville, TN, TN, (3)Kansas Center for Autism Research and Training (K-CART), University of Kansas, Lawrence, KS, (4)Vanderbilt University, Cambridge, MA, (5)Department of Hearing and Speech Sciences, Vanderbilt University Medical Center, Nashville, TN*

Background: Depression is a leading form of clinical impairment for adults with ASD, with reported rates as high as 38-70% in convenience samples. Depressed mood in ASD impairs daily functioning, heightens the need for special services and medications, and places an increased burden on caregivers. By learning about the phenomenology and causal pathways of depression in ASD, we can begin to develop screening, assessment, and intervention protocols tailored to the specific needs of this population, particularly underserved adults with ASD.

Objectives: To identify potential contributors to depressed mood in ASD by comparing adults with ASD, typically developing adults with depressive disorders (TD-dep), and never-depressed controls (TD-con) on several phenomena associated with depression, including repetitive thinking, attentional bias and neural response to negative emotional material, and social anhedonia.

Methods: Our current sample of n=112 will increase significantly by May 2018. This abstract reflects findings from manuscripts in preparation based on a preliminary subset of n=53 adults aged 18-35 with verbal IQ>80. Cohorts included ASD (n=21), TD-dep (n=13), and TD-con (n=19). Participants completed diagnostic assessments (including the Autism Diagnostic Observation Scale, second edition, and the Structured Clinical Interview for DSM-5 Disorders), self-report questionnaires (e.g., Beck Depression Inventory; Ruminative Response Scale; Anticipatory and Consummatory Interpersonal Pleasure Scale), and passive-viewing tasks employing emotionally-expressive faces, during which (1) pupil motility was used to index cognitive-emotional load in response to single faces emoting happy, sad, neutral, or angry expressions presented for 400 milliseconds then masked for 9 seconds, and (2) visual attention to emotional over neutral faces was quantified in a paired preference eye-tracking task.

Results: (1) When looking at brief-then-masked emotional faces, people with elevated depressive symptoms had faster, greater, and longer-lasting increases in pupil-indexed neural activation to sad stimuli *regardless of ASD status* (Figure 1.A). (2) Within ASD, distinct profiles of pupil response differentiated rumination in the context of depression versus general repetitive thinking (Figure 1.B). (3) The ASD group displayed significantly faster fixations to sad over neutral faces (t =-3.66, p=.002), and those with greater repetitive thinking spent more overall time on sad than neutral faces (Cohen’s d=.90, large effect); (4) Both the ASD and TD-dep groups displayed significantly decreased preference for happy faces compared to TD-con (F=15.79, p<.001; Figure 2). (5) Participants with ASD exhibited a similar pattern of social reward functioning as TD-dep, in which greater social ‘wanting’ was associated with the experience of loneliness and depressive symptoms.

Conclusions: We observed several parallels in cognitive, attentional, and emotional processing across our ASD and TD-dep samples in comparison to TD-controls. Specific findings indicate that rumination, negative attention bias, and social anhedonia may be best conceptualized as “depression-like” (rather than autism-specific) in treatment for adults with ASD. We also noted that our pupil results begin to isolate potential biomarkers of depression-specific and autism-specific cognitive-emotional processing. We will discuss existing treatments for rumination that may be adapted for the ASD population, as well as reward-based social skills training that may enhance emotional well-being in adults with ASD.

219 **186.219** First Evidence of the Efficacy of a Novel Positive Emotion Regulation Training for Individuals with Autism Spectrum Disorder

A. C. Samson[1,2], *A. Zaharia*[1] *and D. Sander*[1], *(1)Swiss Center for Affective Sciences, University of Geneva, Geneva, Switzerland, (2)Department of Psychiatry and Behavioral Science, Stanford University School of Medicine, Stanford, CA*

Background: Emotional disturbances including irritability and associated comorbidities are of high prevalence in individuals with Autism Spectrum Disorder (ASD) and posit one of the main reasons why parents of children with ASD reach out for help. Over the past decade, there is mounting evidence that maladaptive emotion regulation plays a crucial role in the emergence of emotional disturbances. Moreover, despite the adaptive functions of positive emotions, none of the interventions targeting emotional disturbances in individuals with ASD had a particular focus on positive emotions.

Objectives: The goal of the present study was to develop and test the efficacy of a novel psycho-educative multi-media training that aims at increasing emotion regulation skills and positive emotions in individuals with ASD.

Methods: Twenty-nine high-functioning individuals with ASD (mean age: 17.76, SD=5.50 years, 5 females) completed three sessions of the psycho-educative positive emotion regulation training with 18 participants in the training group and 11 participants in the waitlist control group. The two groups did not differ regarding age, gender, or ASD symptom severity as assessed with the Social Responsiveness Questionnaire and the Autism Quotient. The training consisted of three individual sessions that aimed at increasing emotional awareness and the use of three adaptive emotion regulation strategies (focus on positive elements in daily lives, positive cognitive reappraisal, and positive emotional expressions) by providing theoretical background information, examples supported by multi-media elements such as animated cartoons, and interactive exercises and homework for the participants. Participants and their parents completed questionnaires on emotion reactivity, well-being, emotion regulation, alexithymia, and problematic behaviors pre- and post training. The training was delivered in person or online (with optional assistance via skype). 55.2% completed the training with in person, 17.2 via skype with assistance, and 27.65% alone.

Results: Compared to the waitlist control group which did not show changes, individuals that completed the training showed an increase in the use of the emotion regulation strategies “focus on positive” ($t(17)=-2.51$, $p<.05$) and cognitive reappraisal ($t(17)=-2.35$, $p<.05$) and as well as a decrease in negative emotions ($t(17)=3.55$, $p<.01$). Interestingly, alexithymia did not have a moderating effect on any of these findings.

Conclusions: This brief psycho-educative training shows promising effects to target emotional disturbances in individuals with ASD. This training may be useful to add to more comprehensive intervention programs targeting emotional disturbances in ASD.

220 **186.220** High Risk for Severe Emotional Dysregulation in Psychiatrically Referred Youth with Autism Spectrum Disorder: A Controlled Study

J. Wozniak[1], *G. Joshi*[2], *M. Fitzgerald*[3], *S. V. Faraone*[4], *R. Fried*[5], *M. Galdo*[5], *A. Belser*[2] *and J. Biederman*[2], *(1)Massachusetts General Hospital / Harvard Medical School, Boston, MA, (2)Pediatric Psychopharmacology and Adult ADHD, Massachusetts General Hospital, Boston, MA, (3)Pediatric Psychopharmacology, Massachusetts General Hospital, Boston, MA, (4)Psychiatry, SUNY Upstate Medical University, Syracuse, NY, (5)Massachusetts General Hospital, Boston, MA*

Background:

Prevalence of ASD is considerably higher in psychiatrically referred populations of youth, ranging from 2-14%. Psychiatric referrals of children with ASD are frequently driven by emotional and behavioral problems. Emotional dysregulation (ED) is characterized by poor self-regulation, including symptoms of low frustration tolerance, impatience, quickness to anger, and emotional reactivity. Within the context of ASD, researchers have defined ED in distinctive ways for assessing deficits in regulation of emotions. We have operationalized different levels of ED using a unique profile of the Child Behavior Checklist (CBCL) (Achenbach, 1991) consisting of elevated scores of the Anxiety/Depression, Aggression, and Attention subscales. The ED profile on the CBCL (CBCL-ED) can help identify moderate [≥1SD and <2SD; Deficient Emotional Self-Regulation (DESR)] or severe [≥2SDs; Severe Emotional Dysregulation profile (SED)] levels of ED in children with emotional and behavioral difficulties. Although deficits in regulation of emotions have been documented in children with ASD the prevalence of ED based on the varying severity levels of CBCL-ED profile and whether the two sub-forms of ED are clinically helpful in distinguishing distinct levels of deficits in children with ASD remains unclear. Considering the empirical nature of the CBCL, its excellent psychometric properties, and its ease of implementation, documenting the magnitude and severity of ED per CBCL operationalized criteria in ASD populations remains an area of very high clinical importance. The knowledge derived from this work could translate into improved recognition and therapeutics for ASD children at risk for differently compromised courses and outcomes.

Objectives:

The main aim of the present study is to: 1) examine the prevalence of the two CBCL based ED profiles in youth with ASD; and 2) investigate whether the two severity levels of CBCL profiles for ED can help distinguish clinically distinct levels of deficits in ASD. We hypothesized that the two CBCL-ED profiles in youth with ASD would identify differentiating patterns of clinical correlates.

Methods:

ASD youth (N=123) were compared to youth with attention-deficit/hyperactivity disorder (ADHD) and healthy controls. We compared the prevalence of the two CBCL-ED profiles in psychiatrically referred population of youth with ASD to those with ADHD and to healthy controls (HC). Furthermore, we directly compared the demographic, psychopathological, and functional correlates associated with the two CBCL-ED profiles in youth with ASD.

Results:

The majority of psychiatrically referred youth with ASD had positive CBCL-ED profile that was significantly higher than in youth with ADHD (82% vs. 53%; p<0.001). The SED profile was significantly greater in ASD youth than ADHD (44% vs. 15%; p<0.001). In the presence of SED profile ASD youth suffered from greater severity of autism, associated psychopathology, and psychosocial dysfunction.

Conclusions:

There is a greater than expected prevalence of SED in psychiatrically referred youth with ASD that identifies distinct clinical correlates associated with severe morbidity and dysfunction.

221 **186.221** Identifying Associations Among Medical Comorbidities in Autism Spectrum Disorder.

A. Neumeyer[1]*, J. S. Anixt*[2]*, J. Chan*[3]*, J. M. Perrin*[4]*, D. S. Murray*[5]*, D. Coury*[6]*, A. Bennett*[7]*, R. A. Parker*[8] *and J. G. Farmer*[9]*, (1)Lurie Center for Autism Massachusetts General Hospital, Lexington, MA, (2)Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, (3)Massachusetts General Hospital, Boston, MA, (4)Harvard Medical School, Boston, MA, (5)Autism Speaks, Boston, MA, (6)Nationwide Children's Hospital, Columbus, OH, (7)Children's Hospital of Philadelphia, Philadelphia, PA, (8)Biostatistics, Massachusetts General Hospital and Harvard Medical School, Boston, MA, (9)Pediatrics, Massachusetts General Hospital, Boston, MA*

Background:

Much research has documented high rates of co-morbid medical conditions in children with autism spectrum disorders. This includes speech disorders, developmental delay, ADHD, hypotonia, seizure disorder, sleep disorders, anxiety, disruptive behavior, gastro-intestinal disorders such as constipation and feeding difficulties, pica, and eczema. Less is known about whether these commonly co-exist in the same children.

Objectives:

To determine clinically meaningful and statistically significant associations among co-occurring medical conditions in children with ASD that, if identified, could lead to better identification, treatment or understanding of the disease process.

Methods:

The Autism Speaks-Autism Treatment Network Registry includes over 7,000 well-phenotyped children with ASD. From the registry, we studied 2114 children between the ages of 17 months to 5 years old and 1221 children 6-17 years old at 20 sites. Diagnoses and problems were reported by clinicians upon subject enrollment, and were grouped into 12 core problems. We determined the observed prevalence (O) of co-occurring conditions and estimated the expected prevalence (E) across the network, adjusting for site variability in the prevalence of individual conditions. We used O/E rather than the relative risk, since O/E is invariant to the ordering of the conditions, whereas the relative risk depends on whether one is estimating relative risk for condition 2 given condition 1 or condition 1 given condition 2. P-values were calculated using a Cochran-Mantel-Haenszel test stratified by site. Once calculations were completed, we identified pairs of conditions co-occurring more frequently than expected (O/E > 1) and highlight those differences which were statistically significant. We also identified pairs of conditions co-occurring less frequently than expected (O/E < 1), but because of the small number of individuals in such a pair these were less likely to be statistically significant (figures 1, 2).

Results:

Among the 66 condition pairs for each age group, we confirmed previously identified associations such as sleep disorders and anxiety symptoms in older children. We found associations not previously described: feeding with sleep disorders (younger children only), constipation with sleep disorders, feeding with speech disorders, and constipation with speech disorders.

Conclusions:

An understanding of medical problems that co-occur in children more frequently than would be expected, as identified through innovative statistical strategies, provides an opportunity to better screen for and treat conditions that could have a related etiology (i.e. sleep and constipation), and, thereby, improve quality of life for individuals with ASD. For example, while feeding problems are frequent in ASD, they are usually attributed to sensory issues with oral motor function less commonly considered. The association of feeding with speech disorders suggests oral motor problems may be more common than typically appreciated. The association of feeding with sleep disorders is clinically recognized but may indicate upper airway or oral motor dysfunction as is seen in obstructive sleep apnea, or could indicate underlying sensory or behavioral regulation issues that impact both feeding and sleep. Children with constipation may experience sleep disruption due to discomfort which could also contribute to feeding problems.

222 **186.222** Longitudinal Study of Sleep and Co-Occurring Problems in Autism Spectrum Disorder

K. N. Medeiros[1]*, M. O. Mazurek*[2]*, A. M. Neumeyer*[3] *and B. A. Malow*[4]*, (1)Health Psychology, University of Missouri, Columbia, MO, (2)University of Virginia, Charlottesville, VA, (3)Pediatrics and Neurology, Massachusetts General Hospital, Lexington, MA, (4)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN*

Background: Autism spectrum disorder (ASD) is characterized by high rates of medical and behavioral comorbidities. Sleep problems are particularly detrimental, contributing to significant distress and impairment over and above the effects of primary ASD symptoms. Prior studies have found that sleep problems are associated with anxiety, stereotypic and challenging behavior, and sensory reactivity among children with ASD. However, the relations among these symptoms are not well understood. Studies to date have been primarily cross-sectional, meaning that directionality and causality cannot be determined. A better understanding of the longitudinal course and correlates of sleep problems in children with ASD would provide important insights into potential mechanisms and targets for treatment.

Objectives: The primary objective of this study was to describe the chronicity of sleep disturbance in children with ASD over time. The secondary objective was to understand the relations among sleep disturbance, internalizing symptoms, behavior problems, and sensory problems over time.

Methods: The data for this study included 514 children and adolescents with ASD (81% male, age M = 5.9, SD = 3.2) who were enrolled in the Autism Treatment Network Registry. Of the 2400 children assessed in this registry, 514 had baseline and longitudinal follow-up data on the variables of interest (M = 3.8 years later, SD = .62). Primary measures included the Children’s Sleep Habit Questionnaire, Child Behavior Checklist, Aberrant Behavior Checklist, and Short Sensory Profile. Structural equation models were used to examine the interrelationships among sleep problems and co-occurring symptoms over time, while controlling for IQ, age, gender, sleep medications, parent education, household income, and time between visits.

Results: Sleep problems at baseline were predictive of future sleep problems, even after controlling for covariates. Over time, 36% of the sample showed intensification of sleep problems and 44.4% showed improvement in sleep problems. Children were more likely to improve if their initial sleep problems were less severe. Neither age [F(2, 343) = .088, p =.915], IQ [F(2, 343) = 1.511, p = .222], gender [χ2 (2) = 1.285, p = .526], nor time between assessments [F(2, 343) = .977, p = .377] were related to the progression of sleep problems. In addition, parent education, household income, and use of sleep medications were unrelated to change in sleep problems (ps > .05). However, individuals were more likely to improve if their initial sleep problems were minor (r = -.490, p < .001). Initial anxiety predicted future sleep problems, and initial sleep problems predicted future attention problems and hyperactivity. Sleep and somatic complaints were interrelated over time; whereas, several other internalizing and externalizing symptoms were independent of sleep problems.

Conclusions: These longitudinal analyses provide insights into the nature, course, and development of sleep and other co-occurring problems in children with ASD, offering new directions for targeted interventions. Although further research is needed, the results suggest that addressing anxiety may improve sleep problems for some children with ASD, and that improving sleep may reduce attention problems and hyperactivity.

223 **186.223** Mapping Anxiety in Minimally Verbal Autistic Pupils

J. Galpin[1], *S. Millar*[2], *T. Andrews*[2], *P. Calzada*[2], *E. Ashcroft*[2] *and J. Gallagher*[3], *(1)The Bridge London Trust, London, United Kingdom, (2)The Bridge School, London, London, United Kingdom, (3)Whittington Health NHS Trust, London, United Kingdom*

Background: Autistic individuals are significantly more likely to experience clinically significant levels of anxiety than neurotypical peers. Better support for autistic individuals in managing anxiety would bring numerous benefits notably in support with behaviours that challenge. Addressing anxiety is also a priority for parents of autistic individuals. Better support requires a better understanding of anxiety 'triggers' for autistic individuals. Recent research in psychopathology has moved towards an understanding that conditions involve highly connected *networks* of symptoms. These networks are created by interactions and causal influences between symptoms. From this perspective, anxiety may develop as a result of prolonged interactions between various triggers. A networked understanding of anxiety may give a better understanding of how to provide more effective support.

Objectives: This study, co-produced by school-based professionals and parents, examined the viability of better understanding anxiety in minimally verbal autistic adolescents through the use of perceived causal relationship (PCR) scaling and network analysis in order to provide more direct support.

Methods: Anxiety triggers were identified for 18 pupils (16 male and 2 female) attending a government funded, special school in inner-city London. Pupils' ages ranged from 14 years 10 months to 17;7 (*M*=15;8, *SD*=1;9). Parents and professionals rated how frequently pupils experienced anxiety as a result of each trigger. The eight response options ranging between "Not at all in the past month" and "Daily or almost daily for most of the day" and scored 0-7, respectively. Parents and professionals then responded to causal association questions - the extent to which "trigger X" caused "trigger Y" and vice-versa. Response options were rated from 0-10 with 0, 5 and 10 denoting "Not at all", "Moderately cause," and "Strong cause" respectively. Mean Causal Association and Mean Causal Effect scores were calculated. To map anxiety a directed network of PCR scores was generated using the R-package qgraph. Nodes represented triggers and PCR scores were represented by edges between the nodes. The direction of the edges represented the direction of the perceived causal effect and the thickness indicated its strength. Centrality measures were used to examine which triggers were most influential (central) in the network.

Results: The network maps provided a clear, visual representation of the inter-relationship between anxiety triggers. Each pupil was readily identifiable from the maps giving a measure of face validity. Qualitative data collected from professionals and parents endorsed the network map as providing a clearer indication of specific triggers to target for support.

Conclusions: This study represents the first time network analysis has been used to map anxiety in minimally verbal autistic adolescents. It has promise as a method of assessing the inter-relationship of anxiety triggers as a means to direct more effective support. Future research should examine the extent to which targeting a high-centrality trigger for support initiates a beneficial therapeutic cascade that mitigates the impact of other triggers, addressing anxiety more effectively in terms of time and resources and more rapidly reducing individuals' distress.

224 **186.224** Measuring Autistic Traits in Adults Who Have Attempted Suicide

G. Richards[1,2], *R. Kenny*[3], *S. A. Cassidy*[1,4], *S. Griffiths*[3], *C. Allison*[1], *D. Mosse*[5], *R. Holt*[3] *and S. Baron-Cohen*[1,6], *(1)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (2)NIHR CLAHRC East of England, Cambridge, United Kingdom, (3)University of Cambridge, Cambridge, United Kingdom, (4)School of Psychology, University of Nottingham, Nottingham, United Kingdom, (5)Department of Anthropology and Sociology, SOAS University of London, London, United Kingdom, (6)CLASS Clinic, Cambridgeshire & Peterborough NHS Trust, Cambridge, United Kingdom*

Background: Previous research suggests that adults with Autism Spectrum Conditions (ASC) have increased risk of experiencing suicidal thoughts and behaviours, and of dying by suicide. However, few studies have investigated the possible role of autistic traits in suicidal behaviour.

Objectives: To quantitatively measure autistic traits in adults who have attempted suicide, and to compare the findings with those reported in the general population.

Methods: An online questionnaire was advertised on suicide prevention websites, a psychology research participant database, and social media. Autistic traits were measured using the Autism Spectrum Quotient (AQ). 245 people accessed the survey, 168 of whom completed the AQ. Of these, 132 specified that they had attempted suicide. AQ scores for these participants were then compared to general population means published by Baron-Cohen et al. (2014).

Results: To determine that any effects observed were not driven by an overrepresentation of people with autism, those with diagnosed or suspected autism were removed from the analysis. After this, it was found that 40.6% of adults who had attempted suicide had an AQ score of 26 or above, which is a cut-off indicating potential clinical significance. AQ scores in this group (*M* = 22.45, *SD* = 8.67) were significantly higher than those of women (*M* = 17.1, *SD* = 7.6; *t*[2658] = 6.8, *p* < 0.001) and men (*M* = 20.3, *SD* = 7.8; *t*[1440] = 2.61, *p* = 0.009) from the general population. AQ scores were also significantly higher in adults who had attempted suicide more than once (*M* = 24.22, *SD* = 8.26) compared to adults who had attempted suicide on one occasion (*M* = 19.09, *SD* = 8.67), *t*(90) = -2.808, *p* = 0.006.

Conclusions: The current findings add to a growing literature that suggests elevated autistic traits are related to the likelihood of experiencing suicidal thoughts and behaviours. A better understanding of this area is urgently required to help reduce suicide risk in people with and without a diagnosis of autism.

225 **186.225** Mechanisms Underlying Thoughts of Self-Harm and Depression in Autism Spectrum Disorder: Findings from a Nationally Representative Sample

D. Hedley[1]*, M. Uljarevic*[2,3,4]*, K. R. Foley*[5,6]*, A. L. Richdale*[1,7] *and J. Trollor*[5,6]*, (1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (3)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, CA, (4)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA, (5)The University of New South Wales, UNSW Sydney, Australia, (6)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Queensland, Australia, (7)Cooperative Research Centre for Living with Autism (Autism CRC), Long Pocket, Australia*

Background: Across the lifespan people on the autism spectrum experience extremely high rates of co-morbid psychopathology, the most common being anxiety and depression (Bellini, 2006; Hofvander et al., 2009; Lever & Geurts, 2016; Uljarevic et al., 2017), and sleep disorders (Humphreys et al., 2013; Richdale & Schreck, 2009). The high rate of depression in the autistic community is particularly concerning as this factor alone is likely to place many individuals at heightened risk of suicide (Hedley, Uljarević, Wilmot, Richdale, & Dissanayake, 2017). Indeed, recent research suggests risk for suicide, including suicidal ideation and death, is elevated in this population (Cassidy et al., 2014; Hirvikoski et al., 2016). However, and although there is emerging and promising work in this area, more theoretical work is needed to identify the mechanisms that might lead to increased risk of poor mental health outcomes, including depression, suicidal ideation and behavior, in the autistic population.

Objectives: The aim of the present study was to examine the associations between loneliness and social support, ASD trait severity, and depression and thoughts of self-harm in an Australian nationally representative sample of people on the autism spectrum.

Methods: Participants were 185 individuals (92 female; M_{age} = 37.11, *SD* = 15.41 years) who were participating in one of two nationwide longitudinal studies (school leavers, adults) into autism. Participants self-reported a formal diagnosis of ASD and, for inclusion in the present study, were required to return a score > 65 on the AQ-Short. Participants also completed the University of California Los Angeles Loneliness Scale-Short Form (ULS-8) (Hays & DiMatteo, 1987), the Social Support Questionnaire-Shortened Version (SSQ-6) (Sarason, Sarason, Shearin, & Pierce, 1987), and the Patient Health Questionnaire-9 (PHQ-9) (Kroenke, Spitzer, & Williams, 2001), which includes a question concerning self-harm.

Results: Forty-nine percent of participants returned scores in the clinical range for depression and 36% reported recent suicidal ideation. Females, comprising almost 50% of the sample, returned higher depression scores than males, however no differences were identified between males and females in terms of self-harm. Regression analyses revealed that loneliness, satisfaction with social support and ASD traits predicted depression scores, and satisfaction with social support and depression predicted thoughts of self-harm. Path analysis showed that ASD trait severity was independently related to depression, the effect of number of social supports on depression was mediated by loneliness and satisfaction with social support, and that effects of loneliness and satisfaction with social support on self-harm were mediated by depression. The pattern of relationships was nearly identical for males and females.

Conclusions: This study identified high rates of depression and self-harm in a nationally representative Australian population sample. The finding that ASD traits independently predict depression suggests that autism may present a risk factor for the development and maintenance of psychiatric disturbance. Our model further suggests that loneliness and social support operate respectively as protective and risk factors for depression and self-harm in autism.

226 **186.226** Parent Ratings of Emotion Regulation in Children with and without ASD Differ Based on Level of Psychosocial Functioning

M. Gurm[1] *and G. Iarocci*[2]*, (1)Psychology, Simon Fraser University, Burnaby, BC, Canada, (2)Simon Fraser University, Burnaby, BC, Canada*

Background: A child's emotion regulation is associated with their psychosocial functioning (e.g., McDowell *et al*., 2002). Parent ratings indicate that children with Autism Spectrum Disorder (ASD) have more challenges with emotion regulation than their typically developing (TD) peers (Rieffe et al., 2011). Difficulties regulating emotions may explain the high co-morbidity with mental health concerns in individuals with ASD (Mazefsky *et al.,* 2013) as compared with their age matched TD peers (e.g., Samson *et al.,* 2015). However, emotion regulation has not been studied in groups of children matched on mental health concerns.

Objectives: The objectives of the current study were to 1) replicate findings of group differences in emotion regulation between ASD and TD groups, and 2) examine group differences in emotion regulation when ASD and TD groups are categorized based on overall psychosocial functioning (as a proxy for mental health).

Methods: Eighty-five children (age 7-12, IQ >80) and their parents were included in this study (43 ASD). Data was collected at a summer research camp over several years. Parents provided family demographic information and completed the Behavioural Symptoms Index (BSI) of the Behaviour Assessment System for Children-2nd edition (Kamphaus & Reynolds, 2004), and the Emotion Regulation subscale of the Multidimensional Social Competence Scale (MSCS;Yager & Iarocci, 2013). The BSI is an overall composite of psychosocial functioning that includes scales on hyperactivity, depression, aggression, atypicality, withdrawal, and attention problems. The MSCS has 7 distinct subscales including emotion regulation and an overall rating of social competence. Children were sorted into four independent groups based on diagnostic status and the BSI: 1) TD with low BSI (n=21), 2) TD with high BSI (n=21), 3) ASD with low BSI (n=21), and 4) ASD with high BSI (n=22).

Results: Compared to TD children, children with ASD had more challenges with emotion regulation (t=2.56, p=.01, d=.56) and higher BSI scores (t=-2.71, p<.01, d=.59). An analysis of variance found significant differences in emotion regulation between the four groups (F=21.59, p<.01). A Tukey post-hoc analysis revealed that both children with and without ASD and high BSI did not differ significantly from one another in their parent-reported emotion regulation (p=.69). Children with and without ASD and low BSI were significantly different in emotion regulation compared to all other groups (p<.03).

Conclusions: Consistent with previous research and the hypothesis that emotion regulation is associated with mental health problems, our results confirm that children with ASD have more challenges with emotion regulation than their non-ASD peers. However, when children with ASD are compared to children without ASD who also have similarly high levels of difficulties in psychosocial functioning, there are no significant differences in emotion regulation between groups. This suggests that there may be important similarities in children with and without ASD with poor psychosocial functioning. By comparing children with and without ASD with similar levels of psychosocial functioning we may be able to learn more about what is common about emotion regulation across groups and also what is unique in children with ASD. Implications for future research will be discussed.

227 **186.227** Predicting Poor Sleep Quality in Young Adults on the Autism Spectrum

A. L. Richdale[1], *L. P. Lawson*[2] *and M. Uljarevic*[3,4], *(1)Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia, (2)Olga Tennison Autism Research Centre, La Trobe University OTARC, Melbourne, Australia, (3)Department of Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (4)Stanford Autism Center, Department of Psychiatry and Behavioral Sciences, Stanford University, CA*

Background: Poor sleep quality, primarily insomnia symptoms, is commonly reported in individuals on the autism spectrum across the lifespan. Poor sleep quality in autism has been associated with problematic behaviours and poor mental health, but most research is in children under 18 years. Arousal has been hypothesised to underlie insomnia symptoms in both autism and in non-autistic populations. Consistent with an arousal hypothesis, anxiety, cognitive and somatic pre-sleep arousal, and sensory modulation have been shown to be associated with poor sleep in children with autism. However, little is known about the predictors of poor sleep quality in older cohorts.
Objectives: Our aim was to examine the ability of factors associated with arousal to predict sleep problem classification in young adults on the autism spectrum.

Methods: Participants were 64 young people on the autism spectrum, with a mean age of 19.06 (SD=2.56) years (70% male) who are members of the Australian Longitudinal Study of School Leavers with Autism (SASLA). Their mean Autism Quotient-Short (AQ) total score was 76.50 (SD=10.25; clinical screening cutoff >65). Our measures associated with arousal were sensory interests (Repetitive Behaviours Questionnaire-Adult [RBQ-Sensory]; 3 items), autonomic symptoms (COMPASS-31; 31 items), and intolerance of uncertainty (transdiagnostic factor underlying anxiety [IU-12]; 12-items). The Pittsburgh Sleep Quality Index (PSQI) was used to classify sleep quality.

Results: All variables except age were significantly associated with PSQI total score (all $p < .01$), and females had significantly higher COMPASS-31 and IU-12 scores than males (all $p < .05$). Fifty percent of males, and 63% of females had a PSQI score greater than 5 ($p = .49$). A logistic regression was used to classify membership of the sleep problem (PSQI > 5) and no sleep problem (PSQI < 6) groups. The independent variables entered were gender, AQ, RBQ-Sensory, COMPASS-31 and IU-12. The model was significant ($p = .001$) and explained between 29.8% and 39.8% of variance, and correctly classified 77.2% of sleep cases with a positive predictive value of 79.3%. Only RBQ-sensory made a significant unique contribution to the model, with an OR of 1.83.

Conclusions: We have identified that factors associated with arousal are significantly associated with poor sleep quality among young adults on the autism spectrum. Further, it was found that sensory interests were uniquely associated with an increased likelihood of having poor sleep quality. Sensory issues have previously been reported to be a predictor of poor sleep in children with autism and non-autistic infants, children and adults. Given the potential deleterious effects of poor sleep, it is important to understand variables associated with poor sleep in autism as this informs development of prevention and intervention strategies, and such variables may be targets for intervention.

228 **186.228** Psychiatric Comorbidity and Sex Bias in Adults with Autism Spectrum Disorder

K. J. Feldman[1], *A. J. Fischer*[1], *J. Davis*[2], *H. Coon*[3] *and D. A. Bilder*[3], *(1)University of Utah, Salt Lake City, UT, (2)Educational Psychology, University of Utah, Salt Lake City, UT, (3)Psychiatry, University of Utah, Salt Lake City, UT*

Background:
Individuals with ASD frequently suffer from co-occurring psychiatric disorders with prevalence estimates ranging from 11-80%. The most commonly reported co-occurring psychiatric conditions are depression, obsessive-compulsive disorder (OCD), and anxiety. Psychiatric comorbidities provide accessible targets for intervention that can improve the quality of life of adults with ASD, necessitating an understanding of their prevalence rates in this population.

Objectives:

The aims of this study were to report the prevalence of co-occurring psychiatric conditions and the sex bias of comorbidity in a large sample of adults with ASD in comparison to a population-based control cohort.

Methods:

ASD case status (N=411) was determined by in-person assessments through ASD phenotyping protocols within the University of Utah Autism Research Program. ASD cases were matched to controls ($N = 2055$) within the Utah Population Database (UPDB) in a 1:5 ratio by age, sex, and duration of Utah residence (overall sample mean age = 31.14, range = 18-65; 87.1% male). Medical record diagnostic codes were used to identify the presence of co-occurring psychiatric disorders by linking cases and controls within the UPDB to diagnostic records from the two largest healthcare systems in Utah. Diagnostic codes were collapsed into the following categories: anxiety, OCD, depression, expansive mood, and schizophrenia. Chi-square analyses were used to compare the comorbidity frequency between cases and controls and between males and females within each cohort. Comparisons were considered statistically significant at the < 0.05 level.

Results:

The most common co-occurring psychiatric conditions in the ASD cohort were anxiety (47.4%), expansive mood (27.7%), and depression (18.0%). Comparison of psychiatric disorders between adults with and without ASD is provided in Table 1. Psychiatric conditions overall and categorically were significantly more prevalent in adults with ASD ($p < 0.001$).

Frequencies of psychiatric conditions were compared by sex within each cohort (Table 2). As expected, females in both cohorts experienced an increased rate of anxiety (ASD $p = 0.021$; control $p = 0.015$). Compared to their male counterparts, females in the control cohort, but not ASD cohort, experienced a significantly higher rate of depression (9.1% vs. 5.3%, $p = 0.013$; 18.9% vs. 17.9%, p = 0.861, respectively). Females in the ASD cohort had higher rates of OCD than males (28.3% vs. 15.9%, $p = 0.027$).

Conclusions:

These results confirm previous findings that adults with ASD experience increased rates of co-occurring psychiatric disorders, demonstrating the importance of identifying, and subsequently treating, these disorders in this population. Sex biases observed in the ASD cohort differed from the control cohort for depression and OCD. Psychiatric disorders commonly reported as having a male bias in the general population appeared in the context of ASD either equally between males and females (schizophrenia) or more commonly in females (OCD). Further in-person assessment is merited to characterize phenotypic and physiologic differences accompanying psychiatric comorbidity in adults with ASD.

229 **186.229** Sleep and Attention in Children with ASD-Associated Gene-Disruptive De Novo Mutations and Idiopathic ASD

ABSTRACT WITHDRAWN

Background: Sleep difficulties are common in autism spectrum disorder (ASD) and are especially evident in children with ASD-associated gene-disruptive *de novo* mutations (LGDMs), such as *CHD8* and *DYRK1A*. Despite extensive knowledge of comorbid sleep issues in ASD, little is known about the complex interplay between the genetic etiologies of ASD, sleep, and daytime attentional skills.

Objectives: We had two primary aims: (1) To characterize neural patterns of attention associated with parent-reported sleep issues; (2) To assess whether these patterns were more severe for children with an ASD-associated LGDM. We hypothesized that children with ASD and sleep problems may showcase poor attention, as evident by reduced discrimination between frequent and novel conditions and faster patterns of habituation on the Novelty P300 experiment. For children with ASD-associated LGDM we expected this pattern to be more robust.

Methods: Participants (*N* = 95) included children with an ASD-associated LGDM and idiopathic children with ASD without a known LGDM (NON; see Table 1 for characterization). Child attention was indexed using EEG while children watched a video and passively listening to sounds in an auditory oddball paradigm with a frequent condition (70%), an infrequent pitch deviant condition (15%), and an infrequent novelty deviant condition (15%). We focused on condition differences between the frequent and novelty deviant condition for the central P3a ERP component (180-350 ms). We used a single-trial approach to track dynamic patterns of attention (i.e., the variability of the P3a over the course of the experiment). Caregivers reported current sleep problems during a structured interview that included subdomains of daytime tiredness, problems with sleep onset, and nighttime awakenings.

Results: Multilevel models revealed a significant interaction between condition and sleep problems, $F(1, 9156) = 8.03$, $p = .004$, indicating less condition discrimination for children with sleep problems. For children with sleep problems, novelty habituation was more rapid (i.e., amplitude reducing more quickly) for children with sleep problems, $F(1, 137) = 3.18$, $p = .07$ (see Figure 1). There were no ERP differences between LGDM and NON among children without sleep problems. However, among those with sleep problems, LGDM children exhibited reduced condition discrimination relative to NON, especially in children who exhibit daytime tiredness and difficulties falling asleep.

Conclusions: These results confirm prior reports that sleep problems interfere with neural mechanisms of daytime attention and extend our understanding to dynamic patterns of daytime attention. Specifically, reduced novelty discrimination (i.e., attention orienting in response to infrequent, novel sounds) in children with ASD and sleep problems is in part due to rapid novelty habituation. Consequences of sleep problems were evident in both NON and LGDM groups; however, children with a LGDM did exhibit more severe attention disruptions particularly related to daytime tiredness and difficulties falling asleep. Further exploration of sleep problems in genetic subtypes of ASD, such as *CHD8* and *DYRK1A*, can inform the interaction between sleep and etiological contributions to ASD. We will discuss the biological implications at the intersection of sleep problems, dynamic attention, and genetic subtypes of ASD.

230 **186.230** Social Anhedonia As a Vulnerability Factor for Depression in Adults with ASD

G. T. Han[1] *and K. Gotham*[2], *(1)Vanderbilt University, Nashville, TN, TN, (2)Psychiatry and Behavioral Sciences, Vanderbilt University Medical Center, Nashville, TN*

Background: Deficits in social reward processing have been associated with the onset, severity, and maintenance of depressive symptoms in the general literature. Social anhedonia, or reduced interest or pleasure in social stimuli, may represent a similar vulnerability factor for co-occurring depressive symptoms in individuals with ASD. In the typically developing (TD) population, lack of motivation to engage in rewarding experiences – or disrupted anticipatory ('wanting') pleasure – has been associated with increased distress due to perceived social isolation, or loneliness. In ASD, a less established body of work has suggested both decreased social anticipatory ('wanting') and consummatory ('liking') pleasure compared to TD counterparts, with some studies suggesting a particular deficit in social 'wanting' that is related to ASD symptom severity.

Objectives: To examine anticipatory and consummatory social and non-social pleasure as contributors to loneliness and depressed mood in adults with ASD compared to typically developing adults with depressive disorders (TD-dep) and never-depressed controls (TD-con).

Methods: A total of n=101 adults aged 18-35 with verbal IQ>80 were recruited from the three cohorts (ASD, n=44; TD-dep, n=28; TD-con, n=29). All participants completed diagnostic screening and testing, as well as self-report measures of capacity to experience social pleasure (Anticipatory and Consummatory Interpersonal Pleasure Scale; ACIPS), non-social pleasure (Temporal Experience of Pleasure Scale; TES), autism spectrum traits (Social Responsiveness Scale; SRS), loneliness (Loneliness in Context Questionnaire; LiCQ), and depressive symptoms (Beck Depression Inventory-II; BDI).

Results: The ASD and TD-dep groups did not differ significantly on measures of social and non-social pleasure, for both anticipatory and consummatory dimensions. However, both ASD and TD-dep groups showed decreased capacity for social and non-social pleasure compared to TD-con. The ASD cohort reported greater loneliness and depressive symptoms than TD-con, but less than TD-dep. In the whole sample (and replicated in ASD alone), there was a significant cross-over interaction between capacity for social pleasure and ASD traits on loneliness ($t(98)=-2.36$, $p=0.02$): individuals with greater capacity for social pleasure demonstrated a positive relation between ASD traits and loneliness, whereas individuals with decreased capacity for social pleasure exhibited the opposite effect (Figure 1). This moderation effect was not present for the measure of non-social pleasure. Finally, the ASD and TD-dep groups were combined to examine predictors of depressive symptoms trans-diagnostically. When controlling for social and non-social pleasure, loneliness, and ASD traits as predictors of depressive symptoms in a multiple regression framework, only loneliness was a significant predictor of BDI-II scores.

Conclusions: Results indicate that individuals with ASD exhibit a similar profile of capacity for social and non-social pleasure compared to TD-dep, in which 'liking' and 'wanting' components are both diminished compared to TD-con. In our transdiagnostic sample, increased ASD traits were associated with greater loneliness for individuals with greater capacity for social pleasure. Interestingly, the opposite effect occurred for individuals with decreased capacity for social pleasure. These findings suggest that social anhedonia may be a shared mechanism across autism and depression populations which may partially explain the experience of loneliness and prevalence of co-occurring mood disorders in ASD.

231 **186.231** Social Vulnerability and Mental Health in Adults with Autism Spectrum Conditions

S. Griffiths[1], *C. Allison*[2], *R. Kenny*[1], *R. Holt*[1] *and S. Baron-Cohen*[2], *(1)University of Cambridge, Cambridge, United Kingdom, (2)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom*

Background: Individuals with autism are at greater risk of developing co-morbid mental health conditions such as anxiety and depression. Social vulnerability may contribute to environmental risk for mental health conditions, by increasing the incidence of experiences such as bullying, domestic abuse, financial hardship, unemployment and difficulties accessing services. It is important to have measures of social vulnerability in order to look at whether this is a contributing factor in the high rates of mental health comorbidities in autism.
Objectives: To create a checklist to measure lifetime social vulnerability and compare responses in a large sample of adults with and without autism.

Methods: A new 'autism vulnerability checklist' was designed using a participatory research method. Items were developed from focus groups with stakeholders. Participants report whether they have experienced any of 60 events in 10 different domains (education, employment, finances, social service contact, criminal justice system contact, childhood victimisation, adulthood victimisation, domestic abuse, mental illness and social support). Adults with and without autism completed the checklist in an online survey. Participants also completed a demographics questionnaire, screening measures for anxiety and depression and a life-satisfaction scale. For each domain, participants' responses were coded according to whether they reported at least one experience, or no experiences. The number of different domains (0-10) endorsed as having at least one experience was calculated. Chi-squared tests for each domain were applied to compare the proportions of participants in each group who had experienced at least one event. T-test were used to compare average number of domains and scores on anxiety, depression and a life-satisfaction measures.

Results: Complete responses were collected from 435 autistic adults (58% female, age M = 43 years sd = 14.60) and 286 controls (73% female, age M = 51 years, sd = 15.47). Across all domains, significantly more autistic adults had experienced at least one event (X^2s > 18.78, ps < .001). The largest difference was for vulnerability in work ($X^2(1)$ = 111.28, OR= 10.01 95% CI = 6.21-16.15). Participants with autism had experienced events across a larger number of domains than controls (autism M = 7, control M = 5, $t(463.81)$ = 14.44, p < .001). They also reported higher rates of anxiety (autism M = 9.45, control M = 6.65, $t(680.59)$ = 11.40, p < .001) and depression symptoms (autism M = 11.52, control M = 6.00, $t(688.93)$ = 11.38, p < .001) and lower levels of life satisfaction (autism M = 13.56, control M = 19.02, $t(633.17)$= 11.43, p < .001) than controls.

Conclusions: Adults with autism are vulnerable to experiencing negative life events across a variety of domains including; education, employment, financial difficulties, social service contact, criminal justice system contact, childhood victimisation, adulthood victimisation, domestic abuse, mental illness and poor social support. These data also confirmed previous findings that adults with autism have high rates of symptoms of anxiety and depression and lower levels of life satisfaction. Future analysis will determine if social vulnerability is associated with mental health symptoms and life satisfaction in this population.

232 **186.232** Suicidal Ideation and Behaviors in Children, Youth, and Young Adults with Autism Spectrum Disorder (ASD): Rates & Outcomes Based on Parent-Report of 996 Individuals with ASD

B. L. Baer[1], *J. K. Law*[2,3,4], *L. Kalb*[5], *R. A. Vasa*[5,6], *H. C. Wilcox*[3,4] *and* ***P. H. Lipkin***[2,3,4], *(1)Interactive Autism Network, Baltimore, MD, (2)Medical Informatics, Kennedy Krieger Institute, Baltimore, MD, (3)Johns Hopkins University School of Medicine, Baltimore, MD, (4)Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, (5)Center for Autism and Related Disorders, Kennedy Krieger Institute, Baltimore, MD, (6)Kennedy Krieger Institute, Baltimore, MD*

Background: Individuals with autism spectrum disorder (ASD) have a higher risk of mental health conditions than individuals without ASD. Recently, there have been growing concerns that individuals with ASD may also have an elevated risk of suicidal thoughts and behaviors, however little is known on this topic, especially in relation to children and adolescents.
Objectives: To determine the rates of suicidal ideation and behaviors in children, youth, and young adults with ASD.

Methods: 996 parent participants in the Interactive Autism Network (IAN)— a large, validated and verified, internet-mediated research registry— completed the Mental Health and Suicidal Behaviors Questionnaire (MHSBQ). The MHSBQ is a proxy-report questionnaire, for parents of verbal children and dependent young adults (≤25) with ASD, which collects information regarding comorbid mental health conditions, medications, service use, family history, and history of suicidal thoughts and behaviors.

Results: The rates of suicidal ideation and behaviors for children and young adults with ASD were reported at higher rates than their typically-developing siblings and the general population. 9.1% of parents reported that their child had a plan or tried to end his or her life. Additionally, 11.5% of parents reported that their child expressed active ideation, or thoughts of wanting to end his/her life (without acting on it), and an additional 21.0% expressed only passive ideation, or thoughts of wanting to die. Significantly higher rates of many comorbid mental health conditions were reported for individuals who experienced suicidal ideation or behaviors, compared to those who did not. Notable conditions include ADHD, anxiety, PTSD, and mood disorders (all $p<0.001$). Likewise, individuals who experienced suicidal ideation or behaviors (grouped together) were prescribed a significantly greater mean number of behavioral medications than those who did not experience any ideation or behaviors, $p<0.001$. There were also increases in lifetime service use for treating "emotional, behavioral, or mood related problems," as individuals progressed from passive ideation, to active ideation, or to plans or attempts, with statistically significant differences in service use between those who experienced ideation or behaviors, and those who did not ($p<0.001$). 8 years or younger was the most commonly reported age of onset for both passive ideation (28.7%), and active ideation (33.9%). Parents whose children tried to end their lives reported the onset of these suicidal behaviors as young as 5, ranging to 19 years old. Of those who tried to end their lives (n=35), 68.6% only tried one time, whereas nearly a third tried twice or more. The reported methods included suffocation (42.9%), poison (28.6%), motor vehicle accidents (20.0%), cuts/stabs (14.3%), falls/jumps (8.6%), and electrocution (5.7%).

Conclusions: Nearly half of those surveyed reported that their child or young adult with ASD had experienced suicidal ideation or behaviors, which indicates an alarmingly high potential for loss of life among this population. Since these behaviors are significantly coupled with comorbid mental health conditions and service use, this study points to the need for more available screenings and mental health services for children, youth, and young adults with ASD.

233 **186.233** The Link between Focused Attention and Emotion Regulation Ability in Children with ASD

A. P. Costa[1]*, C. Couronne*[2] *and G. Steffgen*[3]*, (1)University of Luxembourg, Esch sur Alzette, LUXEMBOURG, (2)University of Utrecht, Utrecht, Netherlands, (3)Institute for Health and Behaviour, University of Luxembourg, Luxembourg, Luxembourg*

Background: Empirical studies have frequently highlighted the importance of attentional mechanisms in the emotion regulation of people with autism spectrum disorder (ASD). For instance, people with ASD present distinct gaze patterns when looking at emotional stimuli. However, far less research has focused on the link between general attentional capacity and the ability to regulate emotions in people with ASD. In the typically developing (TD) literature it is shown that children's focused and sustained attention to non-emotional stimuli is related to a better regulation of negative emotions. Therefore, studying this link in ASD can help understand emotional difficulties in children with ASD.
Objectives: The present study aims to analyse the link between sustained attention to non-emotional stimuli and the use of emotion regulation strategies during a frustration-eliciting situation in children with ASD.

Methods: Thirty-seven children previously diagnosed with ASD (5 female) and 41 TD children (9 female) aged 3 to 13 years old participated in the study. Children first took part in a sustained attention task in which they watched a 3-minute slide presentation of 15 pictures of landscapes, animals, and humans. Then, children took part in a frustration-eliciting situation during which they were presented with attractive toys. After 15 seconds playing with the toys those were removed and placed behind a transparent barrier. Both tasks were videotaped and children's behaviors were coded by two independent observers. In the sustained attention task children were coded regarding the intensity of facial interest (0=not interested, 1=interested, 2=very interested) and the total amount of time in seconds looking at the slide presentation (maximum = 180 seconds). In the frustration-eliciting situation children's behaviors were coded into 12 categories and then grouped into 3 emotion regulation strategies: disruptive behavior (physical objection, crying/venting, defending, infraction, and verbal objection), passive tolerance (staring, doing nothing, self-distraction, and parent/researcher), and active self-regulation (directing situation, alternating activity, and complying).

Results: Regarding attention, children with ASD displayed less interest in the slide presentation [$t(70)=4.118$, $p<.001$, $d=0.96$] and watched the presentation for less time [$t(43)=5.492$, $p<.001$, $d=1.33$] than TD children. Regarding the use of emotion regulation strategies, a significant effect of group was found [$\Lambda=.71$, $F(3,74)=10.26$, $p<.001$, =.29]. Separate univariate ANOVAs revealed that children with ASD used more disruptive behaviors [$F(1,76)=25.24$, $p<.001$, =.25] and less passive tolerance behaviors [$F(1,76)=11.35$, $p<.01$, =.13] than TD children but did not differ regarding active self-regulation behaviors [$F(1,76)=2.03$, $p=.16$, =.03]. Regression analyses revealed that children's total duration of look but not the interest during the attention task significantly predicted children's use of disruptive behavior ($\beta=-1.12$, $p<.01$) and passive tolerance ($\beta=1.26$, $p<.01$) above and beyond ASD diagnosis.

Conclusions: Our results show a significant association between children's capacity for sustained attention and their use of less disruptive behaviors and more passive tolerance behaviors as emotion regulation strategies. However, mutual influences between sustained attention and emotion regulation can occur and should be taken into consideration when interpreting the results. The present results offer new perspectives on intervention programs for children with ASD with emotional difficulties.

234 **186.234** The Relationship between Autism and Depression and the Influence of Worry and Mastery: A Network Analysis

B. F. van Heijst[1]*, M. K. Deserno*[2]*, H. C. Comijs*[3] *and H. M. Geurts*[1]*, (1)University of Amsterdam, Amsterdam, Netherlands, (2)Department of Psychology, University of Amsterdam, Amsterdam, Netherlands, (3)VUMC, GGZ InGeest, Amsterdam, Netherlands*

Background: Autism and depression often co-occur: older adults with a history of depression report more autism symptoms than those without a history of depression, and depression is a common comorbidity for people with autism. Why do we see these two constructs covary so often? Do they influence each other directly, or is there another factor that explains their co-occurrence? Based on the depression literature we hypothesize that both worry and mastery (perceived control over life's stressors) will be of importance when trying to understand the relationship between depression and autism.
Objectives: To better understand the interrelatedness of autism and depression characteristics by investigating mastery and worry as potential bridges between autism and depression in a so called symptomatic network were the interaction between all symptoms are taken into account.

Methods: In study 1 adults with and without a previous diagnosis of depression (N= 375, age 60-90) took part. In study 2 adults with and without a previous diagnosis of autism (N= 202, age 31-89) participated. In both studies, self-report questionnaire data was collected on autism symptoms (AQ-28), depression symptoms (IDS-SR and SCL90 depression subscale, respectively), worry (Worry Scale-R) and mastery (The Pearlin Mastery Scale). A novel network approach, in which symptom interactions are taken into account, was used to create two concentration networks and the accompanying centrality indices.

Results: In the network for Study 1 we see one direct connection between autism (switching) and depression (motivation) characteristics, all other connections go through either mastery or worry nodes. Mastery has the greatest number of ties to other nodes, and the autism specific aspect of switching acts as a bridge between depression and all other autism characteristics. Worry is connected to mastery, depression and autism characteristics. The results of Study 2 differ from Study 1 in that all connections from autism to depression and worry go through mastery, i.e. mastery acts as a bridge. In addition, centrality indices show that mastery is the most central node in this network. In this network worry is no longer connected to autism.

Conclusions: In both studies mastery is an important factor between depression and autism, however it is especially important in the study with participants with autism. This suggests that when someone's toolbox (e.g., coping mechanisms, making use of their social network) to handle perceived stressors is expanded, this could have a positive impact on their sense of mastery and, in return, decrease the risk of developing depressive symptoms.

235 **186.235** The Relationship between Group Belonging, Subclinical Autistic Traits and Suicidal Ideation

K. Monaghan[1] *and A. E. Robertson*[2]*, (1)University of Dundee, Dundee, United Kingdom, (2)Coventry University, Coventry, United Kingdom*

Background:

The prevalence of suicidal ideation in individuals with Asperger syndrome (AS) is estimated to be nine times higher than in the general population (Cassidy et al., 2014). Individuals with AS and Autism Spectrum Conditions (ASC) share behavioural characteristics (autistic traits), which generate difficulties in social integration (Jobe & White, 2006). There is evidence that suicidality and autistic traits are related, and that 'thwarted belongingness' is a key component (Cassidy & Pelton, 2017). In the general population, group identification (the *subjective* feeling of belonging to a group) is a protective factor for mental distress (Sani et al., 2012). However, it is unknown whether autistic traits are related to group identification, and how both of these factors might be associated with suicidal ideation.

Objectives:

H1 – There will be a significant negative relationship between autistic traits and group identification

H2 – Autistic traits and group identification will both significantly predict suicidal ideation

Open-ended questions – The aim was to determine whether there was a difference between any interpersonal stressors reported by those with high and low levels of autistic traits.

Methods:

The Autistic Spectrum Quotient (AQ; Baron-Cohen et al., 2001), Group Identification Scale (GIS: Sani et al., 2015), Beck Scale for Suicide Ideation (BSSI; Beck, Kovacs & Weissman, 1979) were administered to 108 individuals. AQ scores ranged from 4 to 42 (M = 16.68; SD = 8.28). The sample was split at the median, and therefore those with a score of 17 or more were classed as belonging to the 'high' AQ group, with the remainder belonging to the 'low' AQ group. Mean group identification scores ranged from 4 to 27 (M = 19.10; SD = 4.96).

Four open-ended questions were presented to participants. They explored each individual's: i) major life stressors, ii) methods of coping, iii) self-awareness of support required, and iv) knowledge about autism spectrum conditions and experiences of distress.

Results:

BSSI: The overall model demonstrated that gender, autistic traits and group identification statistically significantly predicted suicidal ideation, *F(3,104) = 9.809, p < .001, R2 Adj. = .198*

Open-Ended Questions: A content analysis indicated that those within the high AQ group reported more interpersonal stressors, more self-harm and substance misuse and less socially supported coping methods than those in the low AQ group.

Conclusions:

Autistic traits and group belonging significantly predict suicidal ideation in adults in the general population. Based on the results from this study, we suggest that research should explore the subjective dimension of social integration in ASC, in order to help further our understanding of suicidal thoughts in this population. There is evidence that positive identification with the autistic community is associated with positive mental health outcomes (Cooper et al., 2017), and we suggest that future research also consider other groups.

236 **186.236** Visual Perceptual Correlates of Autistic Traits in Fragile X Syndrome

J. Glennon[1]*, L. Mason*[2]*, H. D'Souza*[2]*, A. Karmiloff-Smith*[2] *and M. S. Thomas*[2]*, (1)Birkbeck, University of London, London, United Kingdom, (2)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom*

Background: Approximately one third of individuals with fragile X syndrome (FXS) reach clinical thresholds for autism, making it the leading known monogenic cause of autism and intellectual disability. Recently, it has been gathering momentum as a useful model for studying the emergence of early autism risk factors when genetic aetiology is constrained. Yet little is known about the nature of this syndromic form of autism. Attentional disengagement difficulties, proposedly due to a featural processing bias, and superior visual search performance, commonly attributed to enhanced perceptual discrimination, are well documented in idiopathic or non-syndromic autism. Critically, it remains unclear whether autism in FXS is associated with this same visuo-perceptual profile.

Objectives: We explore the visuo-perceptual correlates of autistic traits in children with FXS, in the expectation that higher levels of these traits will be associated with delayed attentional disengagement above and beyond the effects of intellectual ability. Conversely, we do not expect an association between autistic traits and visual search performance.

Methods: We apply eye tracking paradigms widely used in the autism literature to document visual search and attentional disengagement performance in children with FXS aged between 6 and 10 years. Autism traits are measured using the Social Responsiveness Scale, second edition. Between-groups cross-sectional trajectory analyses are run, incorporating data from children with non-syndromic autism (n=15) and typically developing controls (n=52) matched on chronological age and intellectual ability.

Results: Autistic traits in FXS are driven by unique visuo-perceptual underpinnings relative to children with non-syndromic autism and typically developing controls.

Conclusions: Our findings serve to illuminate the complex heterogeneity associated with both neurodevelopmental disorders, with clinical implications regarding the application of autism intervention programmes to children with FXS.

237 **186.237** 'Something Needs to Change': Mental Health in Young Autistic Adults

L. Crane[1]*, F. Adams*[2]*, G. Harper*[2]*, J. Welch*[2] *and E. Pellicano*[3]*, (1)Centre for Research in Autism and Education, UCL Institute of Education, University College London, London, United Kingdom, (2)Ambitious about Autism, London, United Kingdom, (3)Macquarie University, Sydney, Australia*

Background: Given that rates of mental health problems are disproportionately high in young people generally, and that young adults display poor help-seeking behaviours, there is an urgent need to explore mental health in young autistic adults, who may be an especially vulnerable group. Indeed, the transition from childhood to adulthood is a challenging time for young autistic people in general, with high rates of bullying and victimisation, as well as low rates of post-secondary education, employment, social participation and quality of life. Particularly worrying is that even autistic adults with "good" outcomes (e.g., higher rates of employment, marriage/partnership, and independent living) show strikingly high rates of co-occurring mental health conditions.

Objectives: The aims of the current research were to: (1) investigate young autistic people's views and experiences of mental health problems and services; and (2) identify possible ways of supporting young autistic people who are experiencing poor mental health. These aims were achieved through the use of a community-based participatory research (CBPR) approach. CBPR involves a partnership between, for example, community members and academic researchers, in which different types of expertise are valued equally, and ownership of the research is shared. In this research, a group of young autistic people from an autism charity developed a research project in collaboration with a team of academic researchers.

Methods: In total, 130 young autistic adults between the ages of 16 and 25 years took part in the research: 109 young people (M age = 20.57 years; 33 male, 56 female, 17 non-binary, 3 did not disclose) completed an online survey and 21 young people (M age = 20.90 years; 9 male, 10 female, 2 non-binary) took part in in-depth interviews. Data were collected, analysed and interpreted by the researchers and young autistic people, in partnership.

Results: Consistent with previous research, high rates of mental health problems (80.7%) were found among our sample of young autistic adults. Yet these young people reported feeling unhappy and depressed, worthless, under strain, unable to overcome their difficulties, unable to face up to problems, and lacking in confidence generally – irrespective of whether they were experiencing mental health problems. As such, they reported finding it difficult to recognise the signs and symptoms of poor mental health. More worryingly, when the young people identified that they needed support for their mental health problems, they reported high levels of prejudice and discrimination, and encountered severe obstacles (e.g., lack of available services, delays, services not tailored to their needs).

Conclusions: Young autistic people are already potentially at a disadvantage simply because society does not understand what it is like to be autistic. This research clearly suggests that young autistic people may be doubly disadvantaged due to the mental health challenges that confront them. The results have implications for improving clinical services, including: (1) more initiatives to reduce stigma associated with autism and mental health; (2) increased training for professionals; and (3) greater autistic involvement in the design and delivery of services that directly affect them.

238 **186.238** Heightened Neural Processing of Errors Uniquely Relates to Social Anxiety Symptoms in Youth with ASD

T. Rosen[1] *and M. D. Lerner*[2]*, (1)Stony Brook University, Stony Brook, NY, (2)Psychology, Stony Brook University, Stony Brook, NY*

Background: Individuals with autism spectrum disorder (ASD) often experience symptoms associated with generalized anxiety disorder (GAD), obsessive-compulsive disorder (OCD), and social anxiety disorder (SA; Hallett et al., 2013). In other populations, these symptoms are associated with a larger error-related negativity (ERN; Weinberg, Riesel, & Hajcak, 2012), an event-related potential in the scalp-derived electroencephalogram (EEG) that indexes endogenous threat sensitivity (Weinberg, Riesel, & Hajcak, 2012). As such, the ERN may relate to the clinical presentation of anxiety in ASD. However, studies examining these associations in youth with ASD have yielded mixed results (see Hüpen, Groen, Gaastra, Tucha, & Tucha, 2016). This may be due to a focus on broad measures of anxiety, rather than specific symptoms associated with the ERN. In addition, factors known to affect ERN magnitude, such as depression, age, and verbal abilities (Henderson et al., 2006; Meyer, Weinberg, Klein, & Hajcak, 2012), are rarely modeled in this literature.
Objectives: Therefore, the present study aimed to extend this literature by clarifying the relationship between the ERN and anxiety in ASD. This was achieved by examining the relation of the ERN to *specific* anxiety symptoms, as well as relevant demographic and clinical variables that could affect this relationship, among youth with ASD.

Methods: Fifty-one youth (38 males), ages 8-17 (M_{age} = 12.15, SD_{age} = 2.94) with Autism Diagnostic Observation Schedule – 2 (ADOS-2; Lord et al., 2012) confirmed ASD diagnoses and FSIQ ≥ 70 (per the Kaufman Brief Intelligence Test-2; Kaufman & Kaufman, 2004) completed a modified Flanker task, from which the ERN component was obtained (see Figure 1). Parents and children reported on anxiety, depression, and ASD symptoms (see Table 1).

Results: Of the anxiety scales examined, the $\mathrm{ERN}_{\mathrm{Res}}$ only correlated with self-reported SA symptoms (see Table 1). The relation between SA symptoms and the $\mathrm{ERN}_{\mathrm{Res}}$ was evident for the SA performance fears subscale, and not the SA humiliation rejection fears subscale. The relation between performance fears and the $\mathrm{ERN}_{\mathrm{Res}}$ was robust to controlling for self-reported depression symptoms, parent-reported ASD symptoms, verbal IQ, and age in a hierarchical regression, with a medium effect (B = -.26, p < .01).

Conclusions: Self-reported performance fears related to a larger $\mathrm{ERN}_{\mathrm{res}}$; this relation was robust to controlling for age, verbal IQ, depression, and ASD symptoms. Findings suggest that heightened threat sensitivity may be representative of the ambiguous SA presentation in ASD, characterized by social fearfulness and discomfort *without* fear of negative evaluation (Kerns, Kendall, et al., 2016). Interestingly, no associations were found between the $\mathrm{ERN}_{\mathrm{res}}$ and GAD or OCD symptoms. In some youth with ASD, obsessive and compulsive behaviors are more closely related to restricted interests and repetitive behaviors (Spiker, Lin, Van Dyke, & Wood, 2012) rather than anxiety (Kerns et al., 2014), while GAD symptoms may more specifically relate to intense preoccupations (Kerns et al., 2016). Thus, self-reported OCD and GAD symptoms in youth with ASD may reflect a different etiopathology than that which drives the OCD- and GAD-ERN associations in typically developing individuals.

239 **186.239** Symptom Presentation of Children with Autism Spectrum Disorder after Maltreatment and Trauma

A. Barrett *and T. W. Vernon, University of California Santa Barbara, Santa Barbara, CA*

Background: Children with disabilities are 3.4 times more likely to be maltreated than nondisabled peers, with children diagnosed with Autism Spectrum Disorder (ASD) encompassing a significant proportion of these children (Sullivan & Knutson, 2000). Families with a child with ASD experience several maltreatment risk factors, including increased parental stress, limited social support, increased isolation, and financial burden. Although children with other disabilities may experience more frequent episodes of maltreatment, victims with ASD may go unidentified due to impairments in verbal communication and existing externalizing behaviors that may mask common red flags of trauma. Paradoxically, there are several characteristics of ASD that may exacerbate posttraumatic stress response in this population, such as pre-existing anxiety-related conditions and poor emotion regulation abilities. Despite this knowledge, very few studies have examined posttraumatic response in individuals with ASD and results are inconsistent.
Objectives: This study examined how children with ASD respond to trauma and maltreatment compared to typically developing children. It also explored similarities and differences in symptom presentation compared to children with ASD who have not experienced maltreatment or trauma.

Methods: Participants included a nationwide sample of parental guardians of children ages 3-12 years who are a) a victim of maltreatment or trauma, or b) have a diagnosis of autism spectrum disorder, which resulted in three participant groups: ASD trauma, TD trauma, ASD no trauma. Parents completed the Adverse Childhood Experiences Survey to assess for experiences of abuse, neglect, witnessing domestic violence, or trauma. Parents also completed the Trauma Symptom Checklist for Young Children to measure emotional-behavioral and posttraumatic stress symptoms, the Social Responsiveness Scale to measure autism-related symptoms, and items of the Repetitive Behavior Scale to measure for self-injurious, compulsive, and ritualistic behaviors. Two-way MANOVAs were conducted to assess for differences in symptom presentation between the three groups. Analyses included moderators to assess the impact of age, trauma type, and verbal ability on posttraumatic stress response.

Results: Data collection and data analysis are ongoing and will continue to identify significant group differences. Preliminary analyses suggest that children with ASD who have experienced trauma will demonstrate elevations in anxiety- and emotion dysregulation-related posttraumatic stress symptoms. Within this group, it is also predicted that victims with increased social cognition and social awareness will experience stronger posttraumatic stress symptoms than those with decreased social cognition and awareness. Lastly, preliminary data suggests that victimized ASD participants with lower age and reduced verbal abilities are suspected to demonstrate higher levels of externalizing symptoms compared to the victimized typically developing and non-victimized ASD groups.

Conclusions: To our knowledge, this study is the first study to compare posttraumatic stress response between children with autism and typically developing peers. It is hoped that these results will contribute to a gap in the literature regarding posttraumatic response in children with ASD. By understanding how this vulnerable population responds to maltreatment and traumatic experiences, psychologists and practitioners may be better equipped with the knowledge needed to identify victims and provide appropriate care.

240 **186.240** Exploring the Prevalence of Callous-Unemotional Traits in Young People with Autism and Their Association with Conduct Problems

*Y. Mahadevan[1], **W. Mandy**[2], A. McKenna[3], K. Stevenson[3], M. Bindman[3], M. Murin[4] and D. H. Skuse[5], (1)UCL, London, United Kingdom, (2)University College London, London, United Kingdom of Great Britain and Northern Ireland, (3)Great Ormond Street Hospital, London, United Kingdom, (4)Great Ormond Street Hospital for Children, London, United Kingdom of Great Britain and Northern Ireland, (5)Behavioural and Brain Sciences Unit, Population Policy and Practice Programme, UCL Great Ormond Street Institute of Child Health, University College London, London, United Kingdom*

Background:

Most autistic children and adolescents experience additional neurodevelopmental, behavioural and mental health difficulties, and these have a significant impact on their wellbeing and functioning. Identifying and understanding such co-occuring difficulties is therefore of the upmost importance. Conduct problems are common amongst autistic youths, but the mechanisms underlying these are not currently well understood, which limits efficacy of treatment. One possibility is that in some instances, conduct problems may reflect the presence of callous-unemotional (CU) traits, conceptualised as atypical emotional processing leading to indifference to the suffering of others. To date, only one study has explored the link between CU-traits and ASD, finding a positive correlation in an adolescent-only sample. However, the potential role played by CU traits in the development of conduct problems of autistic young people has not been investigated.

Objectives:

To use gold-standard measures to investigate: (1) the prevalence of CU traits amongst a clinical population of autistic children and adolescents; and (2) the association between CU traits and conduct problems in autistic young people.

Methods:

Participants were 80 children and adolescents meeting diagnostic criteria for autism spectrum disorder who had IQs in the normal range. Autistic symptoms were measured using the Developmental, Dimensional and Diagnostic Interview (3Di) and the Autism Diagnostic Observation Schedule, Second Edition (ADOS-II). IQ was measured using Wechsler Scales. CU-traits were quantified with parent and teacher versions of the Inventory of Callous-Unemotional Traits. Conduct problems were assessed using DSM checklists, and the Strengths and Difficulties Questionnaire.

Results:

In this sample of autistic children and adolescents, CU-traits scores were common, normally distributed and unrelated to autism symptom severity and IQ. They were strongly and significantly predictive of oppositional behaviours and emotional dysregulation. In addition they were significantly associated with more severe conduct problems indicative of a conduct disorder, including bullying, stealing and lying. These associations between CU-traits and conduct problems persisted when we controlled for autism symptom severity, IQ and symptoms of attention deficit/hyperactivity disorder.

Conclusions:

CU-traits appear to represent a key dimension of variability amongst autistic children and adolescents, and are highly predictive of conduct problems. Autistic young people, and especially those with co-occurring conduct problems, should be assessed for CU-traits in order to enhance clinical formulation.

241 **186.241** Autistic Features and Gender-Specific Eating Behavior throughout Childhood: The Generation R Study

***M. van 't Hof**[1,2,3,4], W. A. Ester[4,5], F. Serdarevic[2,6], M. Hillegers[7], H. Tiemeier[6,8,9], H. W. Hoek[10] and P. W. Jansen[6,11], (1)Erasmus MC-University Medical Center, Department of Child and Adolescent Psychiatry / Psychology, Rotterdam, Netherlands, (2)The Generation R Study Group, Erasmus University Medical Center, Rotterdam, Netherlands, (3)Sarr Expert Centre for Autism, Lucertis Child- & Adolecent Psychiatry, Rotterdam, Netherlands, (4)Parnassia Psychiatric Institute, The Hague, Netherlands, (5)Sarr Expert Centre for Autism, Lucertis Child- & Adolecent Psychiatry, Rotterdam, Netherlands, Rotterdam, Netherlands, (6)Department of Child and Adolescent Psychiatry / Psychology, Erasmus MC-University Medical Center, Rotterdam, Netherlands, (7)Department of Child and Adolescent Psychiatry / Psychology, rasmus MC-University Medical Center, Rotterdam, Netherlands, (8)Department of Epidemiology, Erasmus MC-University Medical Center, Rotterdam, Netherlands, (9)Department of Psychiatry, Erasmus MC-University Medical Center, Rotterdam, Netherlands, (10)Department of Psychiatry, University of Groningen - University Medical Center Groningen, Groningen, Netherlands, (11)Department of Psychology, Education and Child Studies, Erasmus University Rotterdam, Rotterdam, Netherlands*

Background: Children with autism often exhibit problematic eating behaviors. It is unclear whether this relation is also present among children with non-clinical autistic features, whether this is a prospective relationship and whether any gender differences are present.
Objectives: To investigate the relationship between autistic features and eating behavior throughout childhood and their sex-specificity, in a general population sample.

Methods: This study was embedded in Generation R, a prospective population-based cohort study from fetal life onwards. Children born in Rotterdam between April 2002 and January 2006 were followed up until age ten years. We included 4413 mother-child dyads with cross-sectional information on autistic features and eating behavior at age of three/four years. For 3559 mother-child dyads, prospective information was available on autistic traits at age six and eating behavior at age ten years. We collected parental reports of Pervasive Developmental Problems at age three and autistic traits at age six years. Eating behavior was assessed at ages four and ten years.

Results: Cross-sectional analyses showed that maternal reported Pervasive Developmental Problems score of preschool children was positively associated with Satiety Responsiveness, Food Fussiness, Emotional Undereating, Emotional Overeating and Food Responsiveness, and negatively with Enjoyment of Food (e.g. per 1 SD Pervasive Developmental Problems score, adjusted B for Food Fussiness SD-score = 0.12; 95% CI, 0.09 to 0.15). Prospective analysis showed that autistic traits at six years were positively associated with Picky Eating and Food Responsiveness at age ten years in both boys and girls (e.g. B for Picky Eating = 0.05; 95% CI, 0.01 to 0.09), and with Emotional Undereating (B = 0.10; 95% CI, 0.02 to 0.17) and Emotional Overeating (B = 0.16; 95% CI, 0.08 to 0.23) in girls only.

Conclusions: Preschool autistic features were associated with eating behavior problems in early and middle childhood, with results pointing to a gender-specific presentation. This suggests that eating behavior problems need more attention in the diagnostics of autism, particularly in girls.

Oral Session - 11A
Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
188 - School-Based Interventions
1:45 PM - 2:35 PM - Grote Zaal

1:45 **188.001** Modular Approach to Supporting Students with ASD in Classrooms: Feasibility and Preliminary Efficacy of the Saage Intervention

__S. Iadarola__[1], B. Cavanaugh[1], K. Fontechia[2], R. Haynes[3], L. Levato[1], R. J. Martin[4], L. A. Oakes[1], C. M. Anderson[4], R. Iovannone[2] and T. Smith[5], (1)University of Rochester Medical Center, Rochester, NY, (2)University of South Florida, Tampa, FL, (3)Southern Illinois University, Carbondale, IL, (4)May Institute, Randolph, MA, (5)University of Rochester, Rochester, NY

Background: Although behavioral strategies have been shown to be useful for teaching new skills to children with autism spectrum disorder (ASD), they are seldom implemented in public schools (Kasari & Smith, 2013). Barriers include low buy-in, inadequate training, and resource limitations that lead to poor fidelity. However, increases in teacher fidelity and improvements in children's classroom behavior have been reported when interventions involve collaboration between school teams and ASD specialists for setting goals, adapting strategies, and providing in-vivo coaching (Iadarola et al., 2017). We incorporated these features into a framework, Students with Autism Accessing General Education (SAAGE), which aims to promote the success of students with ASD in classrooms and reduce potential barriers to less restrictive environments. Consistent with interventions that have been successful with other populations, SAAGE is organized into "modules" that address core and associated features of ASD. Each module comprises a small, targeted set of empirically supported behavioral strategies directed at a particular problem, with decision rules or assessment procedures for selecting which modules to implement and under what circumstances. SAAGE implementation is guided by a coach who assists the school team to assess student needs, identify student goals, select relevant modules, and receive in-vivo guidance on module implementation.
Objectives: Pilot SAAGE and evaluate (1) feasibility (i.e., recruitment/retention, fidelity, buy-in) and (2) preliminary outcomes.

Methods: We conducted a quasi-experimental design across three sites, participants were 14 students (12 boys, 2 girls) with ASD, *M(SD)* age = 9.45(2.42) years and 14 teachers. Research personnel served as coaches. Coach-teacher dyads engaged in a systematic process of (1) selecting goals and modules based on student and classroom needs, (2) participating in up to 12 hours of in-vivo coaching per module, (3) evaluating student progress and intervention buy-in. To measure student progress, an independent evaluator administered the Teacher-Nominated Target Behaviors (TNTB) interview and an observation based on the Global Assessment Scale (GAS). Buy-in was assessed from the 29-item Usage Rating Profile (URP), rated from 1 (strongly disagree) to 6 (strongly agree), and a 10-item scale of coaching quality, rated from 0 (lowest quality) to 4 (highest quality).

Results: Teacher Fidelity: Across 51 observations by study personnel, teacher adherence to intervention procedures averaged 93% (8.2%), and quality of implementation averaged 99% (4.8%). Buy-in: On the URP, teachers highly rated SAAGE acceptability, *M(SD)* = 5.22(.31), usability, *M(SD)* = 5.61(.10), and feasibility, *M(SD)* = 5.47(.27). The mean rating of coaching quality was 3.84(.07). Student Outcomes: On the TNTB, teachers rated 11 of 14 students as "much improved" or "very much improved" on at least one target behavior; 8 were rated as "much" or "very much improved" on all three target behaviors. On the GAS, the percentage of students who demonstrated improvement was 38% at midpoint 1 and 50% at midpoint 2.

Conclusions: SAAGE was implemented with high fidelity, and educators rated the process positively. Preliminary outcome data for the students are encouraging. These results indicate that modular interventions with in-vivo coaching may be a promising approach for schools to effectively support students with ASD.

1:57 **188.002** A School-Based Sensory Intervention for Food Selectivity in Young Autistic Pupils

__J. Galpin__[1], L. Osman[2] and C. Paramore[3], (1)The Bridge London Trust, London, United Kingdom, (2)The Bridge School, London, London, United Kingdom, (3)Nutrition and Dietetics, The Whittington Hospital NHS Trust, London, United Kingdom

Background: Feeding difficulties are twice as prevalent in autistic children as in neurotypical children. Food selectivity is the most common feeding difficulty in this population and has a significant association with disruptive mealtime behaviour. There is also strong correlation between mealtime behaviour and parental stress. Furthermore, parents of autistic children identify diet as a priority area for support. A limited diet has a

negative impact upon nutritional intake, cognitive development and overall health. The need for food selectivity interventions to address the sensory components of eating is underlined by the increasing evidence supporting the causal relationship between sensory differences and food selectivity.
Objectives: To aim of the study, produced by school-based professionals, was to examine the impact of a sensory based intervention to address food selectivity in autistic pupils that could be integrated into the school day and delivered by existing staff in the school setting.

Methods: 19 children (3 girls and 16 boys) from the same government-funded, special school in inner-city London took part. Participants ranged in age from 4 years 10 months to 10 years 7 months (*M*=6 years; 5 months; *SD*=1;7). The intervention focused on encouraging tactile and oral exploration of foods, looking to normalise sensation, as the first of a sequence of steps to address food selectivity. It was delivered daily over 12 weeks by existing school staff following a brief training session. 30% of sessions were observed by the school dietitian to ensure fidelity to the intervention. Baseline and Post intervention measures were taken in terms of: number of foods eaten across 17 categories (based on food group and texture); and scores on the Brief Autism Mealtime Behaviour Inventory (BAMBI).

Results: There was a significant difference between the number of food categories eaten following the intervention ($F(1,36)=10.46$, $p=.003$, $\eta^2=.23$). The average number of categories before the intervention (*M*=5.53, *SD*=3.64) was significantly lower than post intervention (*M*=9.26, *SD*=3.48). Total BAMBI scores of the participants were significantly lower post-intervention (*M*=31.00, *SD*=9.37) than at baseline (*M*=38.53, *SD*=12.49), $t(18)=4.66$, $p<.001$, $d=1.07$. Similarly, the Food Selectivity score was significantly lower post-intervention (*M*=11.37, *SD*=4.31) than at baseline (*M*=14.00, *SD*=4.67), $t(18)=5.06$, $p<.001$, $d=1.16$. Food Refusal scores were also significantly lower on average post-intervention (*M*=5.53, *SD*=2.04) than at baseline (*M*=7.26, *SD*=2.85), $t(18)=3.18$, $p=.005$, $d=0.73$. Disruptive Mealtime Behaviour scores were also significantly lower post-intervention (*Mdn* = 7, range: 5-14) than at baseline (*Mdn* = 10, range: 5-21), $Z=-2.46$, $p<.05$, $r=-0.4$.

Conclusions: The results from the study are promising and indicate that sensory-based intervention can successfully reduce selective eating in primary school aged autistic pupils. Furthermore, it demonstrated that school staff can deliver the programme to fit in with the existing school day, with little disruption and few financial, time or staff resources required. The lesson plans developed for the study could therefore be easily adopted by more schools to support selective eating. Further research is needed to see if the method can be extended to main meals and the results generalised to a home setting.

2:09 **188.003** Efficacy of a School-Based Treatment Model for Adolescents with Autism: Effects on School Quality

S. Odom[1], *K. Hume*[1], *L. E. Smith DaWalt*[2], *B. Kraemer*[3] *and L. J. Hall*[3], *(1)Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, Chapel Hill, NC, (2)University of Wisconsin-Madison Waisman Center, Madison, WI, (3)Special Education, San Diego State University, San Diego, CA*

Background: The increased prevalence of autism spectrum disorder (ASD) has created a demand for efficacious treatment services for children and youth with ASD, and one context in which most participate is the public schools. While much research has been conducted on comprehensive treatment models (CTM) for preschool and early school age children with ASD, few programs have been developed and evaluated for adolescents with ASD. This has created a gap in the field between needed effective services and treatment approaches that are evidence-based.
Objectives: The purpose of this study was to examine the efficacy of a comprehensive treatment model designed to improve the quality of educational programs for adolescents with ASD attending high school.

Methods: The Center for Secondary Education for Students with ASD (CSESA) designed a CTM for high school students with ASD that consisted for four program features: Academics, Independence, Social Competence, and Transition/Families. After training on the model, an "autism team" at the school implemented the program over a two year period. A primary feature of the CSESA model was to improve the overall quality of the program, which would serve as the foundation for the four features of the CSESA model. The Autism Program Environment Rating Scale (APERS) was the primary measure used to assess program quality. The APERS is a 66-item, five-point Likert-type scale that provides a total quality rating score and also four composite scores that reflect the quality of program features noted previously.
Design: Following a randomized clinical trial design, sixty high schools located in North Carolina, California, and Wisconsin were randomly assigned to the CSESA and a Services as Usual (SAU) condition. A total of 546 high school students with ASD participated in the study. The APERS was administered at the beginning of the school year and again at the end of the subsequent school year (~18-20 months later), with CSESA schools implementing the CTM and SAU schools following the practices they typically employed.
Results:

Examinations of reliability yielded Cronbach alpha scores of .94 for the total rating and an average of .76 for domain scores. Inter-observer agreement, collected on 20% of the sample, was 85% for agreement within one point and 76% for exact agreement. An ANCOVA was used to create adjusted posttest means, with the pretest as the control, for the two groups. The total mean item rating (d=.99) and the four composite scores [academic (d=.71), social (d=1.32), independence (d=.69), and transition/families (d=.83)] were significant at the p> .05 level (with Bonferonni adjustment), with mean rating favoring the CSESA group (see figure below).

Conclusions: This study demonstrated the efficacy of the CSESA model for improving the quality of the program environment for high school students with ASD. The next steps in this research will be to examine the relationship of program quality to the fidelity with which program features and evidence-based practices are implemented and the impact on the adolescents with ASD.

2:21 **188.004** Does Peer-Mediation Increase Effectiveness of the PEERS Curriculum? A Pilot Randomized Control Trial Examining Social Function, Well-Being and Classroom Social Network Centrality

N. L. Matthews[1], *E. Rotheram-Fuller*[2], *B. Orr*[1], *K. Warriner*[3], *M. DeCarlo*[1], *M. Sorensen*[1], *J. Laflin*[1] *and C. J. Smith*[4], *(1)Southwest Autism Research and Resource Center, Phoenix, AZ, (2)Arizona State University, Tempe, AZ, (3)Comprehensive Behavioral Programs, Southwest Autism Research and Resource Center, Phoenix, AZ, (4)Southwest Autism Research & Resource Center, Phoenix, AZ*

Background: PEERS (Laugeson & Frankel, 2010) is one of the most well-studied social skills interventions for intellectually-able adolescents with autism (ASD). However, the potential for increasing effectiveness using peer mediation strategies remains unexamined. Also, the majority of previous research has relied on questionnaires to the exclusion of more objective outcome measures (Hood et al., 2017).
Objectives: (1) To compare change in adolescent- and parent-reported social functioning and well-being from pre-to-post intervention and at a

4-month follow-up among participants who completed PEERS, a peer-mediated PEERS model (PMP), or a delayed treatment control (DTC) group. (2) To compare classroom social network centrality (SNC; Farmer & Rodkin, 1996) among study groups at immediate and 4-month follow-ups.

Methods: Participants were 34 intellectually able (IQ ≥ 70) adolescents with ASD randomly assigned to PEERS, PMP, or DTC (see Table 1); one parent of each adolescent; 16 typically developing peer mentors, and 562 general education (GE) classmates of participants with ASD. PEERS and PMP were administered identically except for the peer-mediation strategies of proximity and peer initiation (Odom & Strain, 1984) in PMP using a 1:1 ratio of typically developing peer mentors. Questionnaires were collected pre- and post-treatment, and at a 4-month follow-up. SNC data were collected post-treatment and at a 4-month follow-up in a subsample whose schools approved research procedures. Interviews were conducted with GE classmates in one classroom of each participant with ASD to generate SNC scores (0-Isolated; 1-Peripheral; 2-Secondary; 3-Nuclear).

Results: Reported in Table 1, MANOVAs indicated greater improvement at immediate follow-up in parent-reported social skills and problem behaviors, adolescent-reported social skills knowledge, and loneliness in PMP relative to DTC. PEERS participants demonstrated greater improvements in adolescent-reported social skills knowledge, loneliness, and hosted get-togethers relative to DTC. Improvements in social skills, problem behaviors, and social skills knowledge were maintained by PMP at the 4-month follow-up, as were improvements in social skills knowledge and adolescent-reported get-togethers by PEERS participants. Notably, number of actual get-togethers did not differ between PEERS and PMP at either follow-up. Table 2 reports SNC scores. When PEERS and PMP were collapsed into one treatment group, Fisher's exact tests indicated significantly less isolation in treatment participants relative to DTC at the immediate follow-up (p = .05), but not at the 4-month follow-up (p = 0.56).

Conclusions: Findings suggest a modest improvement parent-reported social skills and problem behaviors when PEERS was implemented using peer mediation strategies. When PEERS and PMP were collapsed into one treatment group, treatment participants were less isolated in their classrooms relative to DTC at the immediate follow-up, but these levels of engagement were not maintained. SNC findings provide initial evidence for generalization of acquired skills to the classroom that requires replication with a larger sample. Not a single participant with ASD received a nuclear rating, and very few were rated as secondary. This suggests the need for additional efforts to improve peer acceptance of high school students with ASD in GE classrooms. To our knowledge, this is the only study to examine SNC of PEERS graduates.

Oral Session - 11B
Interventions - Non-pharmacologic - School-Age, Adolescent, Adult
189 - Improving Employment Outcomes for Adults
2:40 PM - 3:30 PM - Grote Zaal

2:40 **189.001** Evaluation of the BOOST-a Transition Planning Program for Adolescents on the Autism Spectrum: Quasi-Randomised Controlled Trial and Process Evaluation

*M. Hatfield[1], **M. Falkmer**[2], T. Falkmer[3] and M. Ciccarelli[4], (1)Curtin University and Autism CRC, Perth, Australia, (2)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (3)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia, (4)Curtin University, Perth, Australia*

Background: The Better OutcOmes & Successful Transitions for Autism (BOOST-A^{TM}) is an online, autism-specific, transition planning program that prepares students for leaving school. The program was developed as the majority of existing transition planning programs are focused on people with a disability in general and may not meet the specific need of adolescents on the autism spectrum. In addition, there are methodological limitations to many of the studies determining their effectiveness.

Objectives: A quasi-randomized controlled trial was conducted to evaluate the effectiveness of BOOST-A^{TM} in enhancing self-determination. In addition, a process evaluation was conducted to determine the effectiveness, usability, and barriers and facilitators to using BOOST-A^{TM}.

Methods: Participants were adolescents on the autism spectrum enrolled in Years 8 to 11 in Australian schools (N=94). Participants were blinded to the trial hypothesis and were allocated to a control (n=45) or intervention (n=49) group. Over a 12 month period, the intervention group used BOOST-A^{TM} while the control group engaged in regular practice. The primary outcome was self-determination and secondary outcomes included career planning and exploration, quality of life, environment support, and domain specific self-determination. Data were collected from parents and adolescents. A process evaluation was conducted after the trial to allow adolescents on the autism spectrum (n=33) and their parents (n=39) from the intervention group to provide feedback via an online questionnaire. Of these, 13 participants were interviewed to gain further in-depth information about their experiences using BOOST-A^{TM}. Data were analysed using descriptive statistics and thematic analysis.

Results: No significant differences were found in overall self-determination between groups. Significant differences in favor of the intervention group were found in three areas: opportunity for self-determination at home (parent report); career exploration (parent and adolescent report); and transition-specific self-determination (parent report). Themes identified in the process evaluation found that the BOOST-A^{TM} encouraged participants to take action to overcome an inertia that accompanied their fear leaving school. It also supported the development of new insights about interests and strengths that led to clearer plans for the future. Adolescents described feeling empowered in the transition planning process as a result of the strengths-focus of BOOST-A^{TM}. Some participants did not find the program helpful; mainly because they did not have a champion to support them to take action in the transition planning process.

Conclusions: The findings provide preliminary evidence that BOOST-A^{TM} can enhance some career-readiness outcomes. Overall self-determination was not significantly greater in the intervention group and the process evaluation revealed why BOOST-A^{TM} was beneficial for some participants more than others.

2:52 **189.002** Evaluating the Effectiveness of an Autism-Specific Workplace Tool

***M. T. Scott**[1,2], M. Falkmer[3,4,5], T. Falkmer[2,6,7] and S. J. Girdler[2,8], (1)School of Occupational Therapy and Social Work, Curtin University, Perth, Australia, (2)Cooperative Research Centre for Living with Autism (Autism CRC), Brisbane, Australia, (3)School of Occupational Therapy and Social Work, Curtin University, Perth, Western Australia, Australia, (4)School of Education and Communication, CHILD programme, Institute of Disability Research, Jönköping University, Jönköping, Jönköping County, Sweden, (5)Curtin University, Bentley, Australia, (6)School of Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Australia, (7)Department for Rehabilitation, Jönköping University, Jönköping, Sweden, (8)School of*

Occupational Therapy, Social Work and Speech Pathology, Curtin University, Perth, Western Australia, Australia

Background: Employment is a highly desirable social achievement for most individuals, including those on the autism spectrum. Work facilitates economic independence, engendering a sense of a purpose and accomplishment. However, for many adults on the autism spectrum the process of finding and securing a job remains challenging. A variety of environmental factors may influence the employment process, particularly employers, who play a central role in hindering or facilitating work participation for individuals on the autism spectrum. Yet, few studies exist exploring employers' capacity in hiring and supporting employees on the autism spectrum, and even fewer have considered interventions and strategies targeting employers' skills, abilities and knowledge in enhancing employment opportunities.
Objectives: To evaluate the effectiveness of an autism-specific workplace tool, the Integrated Employment Success Tool (IEST^{TM}), in improving employers' self-efficacy and knowledge in modifying the work environment to meet the specific needs of their employees on the autism spectrum.

Methods: A two-armed randomised controlled trial (RCT) was employed to evaluate the effectiveness of the IEST^{TM} intervention, by comparing employers (N=84) who used the IEST^{TM} with employers receiving employment support services as usual. Measurements were obtained at baseline and 12-weeks later at post-test. Measurements included self-efficacy in relation to implementing autism-specific workplace modifications using the Employment Self-Efficacy Scale and attitudes towards disability in the workplace using the Scale of Attitudes Toward Workers with Disabilities**.**

Results: Intention-to-treat analysis revealed a significant improvement in self-efficacy within the IEST^{TM} group between baseline and post-test (p=0.016), indicating participants increased their confidence in supporting employees on the autism spectrum by modifying the work environment. At post-test, there were no significant differences between groups in relation to self-efficacy in implementing autism-specific workplace modifications and employer attitudes towards disability in the workplace. Subgroup analyses were conducted to further explore whether then intervention dosage of the IEST^{TM} effected self-efficacy and attitudinal outcomes. Results were found to be similar to the intention-treat-analysis, with no significant differences between groups at baseline and post-test respectively.

Conclusions: The RCT found evidence that an autism-specific workplace tool for employers led to significant improvements in their confidence in modifying the work environment to meet the specific needs of their employees on the autism spectrum. These findings are consistent with the concept that implementing an intervention that increases knowledge, increases self-efficacy. While no significant attitudinal improvements were found, participants generally held favourable attitudes towards autism in the workplace, most likely influenced by previous experience, larger organisations and external support. Lastly, the IEST^{TM} was considered a useful tool for both new and existing employers in assisting them in modifying and managing the workplace, particularly during the interim of their regular assigned visits from disability employment service providers. The findings of the current study could be enhanced by further conducting a process evaluation to better interpret the outcomes of the interventions.

3:04 **189.003** A School-Based Transition Intervention for Adolescents with ASD: A Pilot Efficacy Study

K. M. Dudley[1]*, L. G. Klinger*[2]*, G. Osborne*[3]*, T. Dawkins*[4]*, R. K. Sandercock*[5] *and M. R. Klinger*[6]*, (1)Department of Psychology & Neuroscience, UNC Chapel Hill; TEACCH Autism Program, Carrboro, NC, (2)TEACCH Autism Program; Psychiatry, University of North Carolina, Chapel Hill, NC, (3)UNC TEACCH Autism Program, Greensboro, NC, (4)University of North Carolina at Chapel Hill, Chapel Hill, NC, (5)Department of Psychology & Neuroscience, University of North Carolina at Chapel Hill, Chapel Hill, NC, (6)UNC TEACCH Autism Program, Chapel Hill, NC*

Background: Research indicates that persons with high functioning autism spectrum disorder (HFASD) have poor employment and post-secondary outcomes (Roux et al., 2013). Taylor et al. (2012) reported that only five evidence-based intervention papers addressed vocational skills in adults with ASD and all were of poor quality. For students enrolled in the general education high school curriculum, there has been little opportunity to support the soft skills difficulties (e.g., executive function, social competence, and emotion regulation) that are associated with poor college and employment outcomes.
Objectives: The current study used a waitlist control design to examine the efficacy of a 21-session, manualized high school-based transition intervention (TEACCH School Transition to Employment and Post-Secondary Education Program; T-STEP) addressing executive function (EF), social competence, and emotion regulation skills.

Methods: Participants were 37 high-schoolers (32 males; *M* age=16.79) with HFASD (FSIQ>85). Participants received 21 group intervention sessions (twice weekly for 90 minutes). Interventionists were a university-clinic therapist partnered with a special educator. At baseline, an abbreviated IQ test (WASI-II) and ASD diagnostic measures (ADOS-2, SRS-2) were completed. At baseline and post-testing (20 participants received the intervention; 17 were in the waitlist control group), caregivers completed a measure of real-world executive function (BRIEF) and a measure of employability skills including EF and interpersonal relations (Becker Work Adjustment Profile, BWAP). Additionally, teens participated in a semi-structured, 1-hour mock employment observation developed for this project (Job Skills Assessment Profile; JSAP) that incorporated presses for executive function, social, and emotion regulation skills targeted by the intervention. JSAP videos were coded by blind raters for 26 participants, and coding is ongoing for remaining participants.

Results: There were no significant differences between groups on IQ or ASD symptom variables (*p*'s=.26-.99). Three separate 2(time) X 2(condition) ANOVAs (BRIEF, BWAP, JSAP) were conducted to examine whether those in the intervention group showed more improvement compared to those in the waitlist control group. Significant time-by-condition interactions with medium-large effect sizes were obtained across all measures: BWAP, *F*(1,34)=3.98, *p*=.05; BRIEF Composite, *F*(1,34)=3.96, *p*=.06; and JSAP Composite, *F*(1,23)=4.18, *p*=.05. Largest effects were seen for the BWAP Work Performance (*p*=.02) and Interpersonal Relations (*p*=.05) subscales, for the BRIEF Metacognitive Index (*p*=.04), and the JSAP emotion regulation (*p*=.03) subscale. No effects were observed in areas that were not targeted by the intervention (e.g., the Cognitive Skills and Work Habits indices of the BWAP).

Conclusions: This pilot study provides promising evidence for the efficacy of the T-STEP as a transition intervention for high school students with ASD who are completing a general education high school curriculum. Improvements were found across both parent report and blind observation measures of the executive function, social competence, and emotion regulation skills targeted by this intervention. Results also support the feasibility of implementing the T-STEP in a school-based setting. Future research is needed to replicate these findings within a larger sample, to examine moderators of treatment effectiveness (e.g., symptom severity, intellectual functioning), and to follow students through graduation to examine long-term postsecondary and employment outcomes.

3:16 **189.004** Communityworks Canada® (CWC): A Volunteer, Pre-Employment Program for Youth with ASD

W. Mitchell[1], *C. Dudley*[1], *D. B. Nicholas*[2] *and R. Zulla*[3], *(1)Sinneave Family Foundation, Calgary, AB, Canada, (2)University of Calgary, Edmonton, AB, Canada, (3)University of Alberta, Edmonton, AB, Canada*

Background:

Evaluation of interventions that foster vocational skills in conjunction with social skills to prepare youth with Autism Spectrum Disorders (ASD) for employment are needed (Walsh, Lyndon & Healey, 2014). Community*Works* Canada® (CWC), a federally funded, peer supported program for youth aged 15-21 years aims to improve employment prospects through pre-employment training and exposure to volunteer work experiences. The 12-week program, delivered once per week for 2.5 hours is modeled after a volunteer training program developed by the Southwest Autism Research and Resource Center (SARRC) in Phoenix, USA.

Objectives:

Does the program influence the work readiness skills and social skills of participants?

Methods:

A convergent parallel mixed methods design (Creswell, 2014), involving in-depth interviews and quantitative data from questionnaires was used to complementarily examine outcomes and perceptions of participants involved in CWC. Qualitative data were transcribed verbatim and analyzed using NVivo 10 (QSR International, 2012) and questionnaire data identified pre/post differences. Questionnaires included:

1. The *Work Readiness Inventory (WRI*; Brady 2010), a 36-item self-report that identifies six areas crucial to work readiness: Responsibility, Flexibility, Skills, Communication, Self-view, and Health and Safety. Higher scores suggest increased concerns or areas of weakness.
2. The *Social Skills Improvement System (SSIS*; Gresham & Elliot, 2008), a parent-report questionnaire, measures behaviors that may interfere with an individual's ability to perform or acquire social skills using standardized scores (*M*=100, *SD*=15).

Fifty-one participants from six Canadian provinces were included in the preliminary data analysis (Table 1) and X participants, x participant's parents completed an interview.

Results:

Qualitatively, gains by participants were primarily noted in work preparedness and social skills, the primary foci of the program. Participants and parents indicated that the program enabled participants with ASD to explore employment particularly by learning about different types of jobs, learning about work preferences, and differentiating between work and leisure. Gaining work experience provided affirmation to individuals with ASD about their ability to complete job tasks and work with others, and increased self-confidence was a recurrent topic. Employment related gains were noted on the WRI (Table 2) that corroborated qualitative data. Social skills gained, as reported by participants with ASD and observed by parents, peer mentors and community partners, included: learning to interact (e.g. how to approach people), building communication skills (e.g. learning to listen quietly and take turns), fostering co-operation (e.g. learning to build motivation among others) and learning the value of social cues (e.g. understanding the importance of personal space). Results from the SSIS approached significance (p= .062; Table 2).

Conclusions:

Overall, findings demonstrate benefits from engaging youth with ASD in employment-oriented, inclusive efforts fostering individual skill building and employment exposure. Program outcomes include core skill acquisition and constructive experiential gain toward youth proficiency and comfort within work settings.

Oral Session - 12A
Cognition: Attention, Learning, Memory
190 - Challenging Theories of ASD
1:45 PM - 2:35 PM - Willem Burger Zaal

1:45 **190.001** Contextual Priors Do Not Modulate Action Anticipation in Children with Autism

L. Amoruso[1,2], ***A. Narzisi***[3], *M. Pinzino*[4], *A. Finisguerra*[5], *F. Fabbro*[5], *A. Volzone*[6], *S. Calderoni*[7], *F. Muratori*[4] *and C. Urgesi*[8,9], *(1)Univerisity of Udine, Udine, Italy, (2)Basque Center of Cognition, Brain and Language, San Sebastian, Spain, (3)IRCCS Fondazione Stella Maris, Calambrone (Pisa), Italy, (4)IRCCS Stella Maris Foundation, Calambrone (Pisa), Italy, (5)University of Udine, Udine, Italy, (6)Scientific Institute IRCCS Eugenio Medea, San Vito al Tagliamento, Italy, (7)Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy, (8)Dipartimento di Lingue e Letterature, Comunicazione Formazione e Società, Uniersity of Udine, Udine, Italy, (9)Scientific Institute (IRCCS) E. Medea, Bosisio Parini, Italy*

Background: Current influential models on action comprehension postulate that optimal intention inference requires the combination of two sources of information:
(a) the observers' prior expectations about the likely intention driving other's behaviors, given past experiences; (b) the sensory evidence conveyed by online perceptual movement kinematics.

Objectives: Here, we aimed to investigate the ability of children with ASD to extract regularities from the environment and use them to build-up prior expectations about other's behavior.

Methods: 22 High-functioning ASD children were evaluated with the ADOS-2. Non-verbal IQ scores were derived, in ASD and Typycal control group (n=22), from the Raven's Colored Progressive Matrices. Paradigm: (1) Familiarization Phase (Fig.1): Implicit Probabilistic Learning Task. Children observed videos (1slong) depicting a child actor grasping common objects to perform different actions and we asked them to recognize actor's intention. Importantly, we implicitly biased action-contextual cues associations in terms of their probability of co-occurrence (i.e., given the presence of an orange plate, it was highly probable that the child would grasp the apple for eating); (2) Testing Phase: Action Prediction Task. Children observed the same videos but, in this case, the secondhalf remained occluded from view (500mslong) and participants were asked to predict action unfolding. During this phase, all possible action-contextual cues associations were equally presented. We reasoned that during this phase, where movement kinematics were partially occluded, children's responses would be biased to contextual priors acquired during the familiarization phase, thus compensating perceptual uncertainty.

Results: A) An independent t-test comparing the overall accuracy during the familiarization phase revealed no differences (t(46) = -1.34, p = 0.18) between ASD (M = 0.87, SEM = 0.03) and typically developing (TD, M = 0.93, SEM = 0.02) children in recognizing actor's motor intention. B) The RM-ANOVA revealed a significant Group by cooccurrence probability interaction [F(3, 138)=2.89, p=0.03]. Black solid lines indicate between-group comparisons, grey dotted lines within-group comparisons. Bars denote SEM.

Conclusions: No differences were observed between groups in recognizing actor's intention during the familiarization phase. However, when perceptual evidence was ambiguous, only TD children were able to combine it with contextual priors and successfully predict action unfolding in a probabilistic modulated fashion. Collectively, our results suggest that ASD children have an impairment in building contextual priors and do not benefit from them (i.e., integrate with perceptual evidence) when predicting other people's actions under situations of perceptual uncertainty.

1:57

190.002 Visual Motion Prediction and Verbal False Memory Performance in Autistic Children

*F. G. Tewolde, D. V. Bishop and **C. Manning**, Department of Experimental Psychology, University of Oxford, Oxford, United Kingdom*

Background: Recent theoretical accounts propose that atypical predictive processing has a causal role in many aspects of the autism phenotype, from sensory processing to social symptoms (e.g., Sinha et al., 2014). Moreover, difficulties making predictions may be related to reduced contextual processing, as the ability to make good predictions requires using contextual information about the situation at hand, and generalising from similar situations experienced previously. Despite the potential of these new theoretical accounts, there is relatively little empirical evidence for disordered prediction in autism.

Objectives: In this study we tested three hypotheses. First, we hypothesised that autistic children would make less precise (i.e., more variable) predictions than typically developing children in visual extrapolation tasks, and that group differences would become more pronounced as children were required to make predictions over longer timescales. Second, we hypothesised that autistic children would be less susceptible to false memories, in line with reduced contextual processing. Third, we hypothesised that reduced precision in the prediction task would be related to increased sensitivity in the false memory task.

Methods: The study was pre-registered prior to data collection (https://osf.io/pv4w6/register/565fb3678c5e4a66b5582f67). Thirty autistic children aged 6-14 years and 30 typically developing children matched in age and non-verbal IQ completed visual extrapolation and verbal false memory tasks to assess predictive abilities and contextual processing, respectively. In the visual extrapolation tasks, children were asked to predict when an occluded car would reach the end of a road and when an occluded set of lights would fill up a grid. In the false memory task, children were asked to remember word lists and were then given a recognition test including semantically related, non-presented items. Where non-significant group differences were obtained, we used Bayesian analyses to quantify evidence for the null hypothesis.

Results: In the extrapolation tasks, autistic children made predictions that were just as precise as those made by typically developing children, across a range of occlusion durations. In the false memory task, the autistic and typically developing children did not differ significantly in their discrimination between items presented in a list and semantically related, non-presented items, although the data were insensitive, suggesting the need for larger samples. Insofar as there were relationships between performance in the two tasks, they were opposite to our hypothesis, with children who were more sensitive in the false memory task showing less variable performance in the extrapolation tasks. This relationship may reflect domain-general factors (e.g., motivation) or the involvement of a memory component.

Conclusions: Our findings provide an important test of rapidly developing theories and suggest that autism is not characterised by pervasive impairments in prediction. Prediction difficulties may well become apparent when making predictions between events that are more weakly associated, such as those involved in social interactions, or when it is important to decide what information is relevant to use for prediction. Further studies will be required to assess the relationship between predictive processing and context use in autism, and to establish the conditions under which predictive processing may be impaired.

2:09

190.003 Interoceptive Impairments Do Not Lie at the Heart of Autism or Alexithymia

***T. Nicholson**[1], D. M. Williams[2], C. Grainger[3], S. B. Gaigg[4], B. Calvo-Merino[4] and J. F. Christensen[5], (1)University of Kent, Canterbury, England, United Kingdom, (2)University of Kent, Canterbury, United Kingdom, (3)University of Stirling, Stirling, United Kingdom, (4)City, University of London, London, United Kingdom, (5)Psychology, City, University of London, London, United Kingdom*

Background: Background: Quattrocki and Friston (2012) argued that abnormalities in interoception–the process of bringing internal physiological states to awareness–could lie at the heart of autism, because of the critical role interoception plays in the ontogeny of social-affective processes. This proposal drew criticism from proponents of the alexithymia hypothesis, who argue that social-affective and underlying interoceptive impairments are not a feature of autism per se, but of alexithymia (a condition characterised by difficulties describing and identifying one's own emotions), which commonly co-occurs with autism. Despite the importance of this debate, direct empirical evidence is scarce and inconsistent.
Objectives: To test competing theories of autism (and self-awareness in this disorder).

Methods: Experiment 1 examined in a sample of 137 neurotypical individuals the association among autistic traits (measured using the Autism-spectrum Quotient; AQ), alexithymia (measured using the TAS-20), and interoceptive accuracy (using a standard heartbeat tracking measure). The heartbeat tracking measure required participants to close their eyes and, without taking their pulse, silently count their heartbeat during four different time intervals (25, 35, 45 and 100 sec). A pulse oximeter attached to participants' index finger measured actual heart rate. The closer the estimated heartbeats to the actual number of heartbeats during each interval, the better the interoceptive accuracy. In Experiment 2, interoceptive accuracy was assessed in 46 adults with ASD (27 of whom had clinically-significant alexithymia) and 48 neurotypical adults. Bayesian analyses were employed to complement null hypothesis significance testing ($BF_{10} < 1$ = evidence for the null; $BF_{10} > 3$ = evidence for the alternative hypothesis).

Results: Experiment 1 confirmed strong associations between autistic traits and alexithymia ($r = .42$, $p <.001$, $BF_{10} > 100$), but yielded no evidence to suggest that either was associated with interoceptive difficulties (rs < -.11, ps > .22, $BF_{10} < 0.22$). Those participants with scores above the cut-off alexithymia on the TAS-20 were assigned to a "high alexithymia" group ($n = 30$) and those with scores below the cut-off to a "low alexithymia" group ($n = 107$). There were no significant differences between these two groups in terms of levels or patterns of performance on the heartbeat tracking task, contrary to the alexithymia hypothesis (ps > .30, ds < 0.22, $BF_{10} < 0.35$). Reliability of all findings was confirmed by randomly splitting the total sample into two groups of $n = 68$ and 69 participants and re-analysing the data in each sub-sample. Results were identical in each subsample and always supported the null. Similarly, Experiment 2 provided no evidence for interoceptive impairments in autistic adults ($p = .53$, $d = 0.13$, $BF_{10} = 0.26$), and neither was interoceptive accuracy associated with either AQ (or ADOS) score or TAS-20 score in either diagnostic group.

Conclusions: The observations pose a significant challenge to notions that interoceptive impairments constitute a core feature of either ASD or alexithymia, at least as far as the direct perception of interoceptive signals is concerned. Instead, they support the theory that detection of physical states is undiminished in ASD.

2:21 **190.004** Domain-Specific Impairment in Flexible Value Learning in Young Children with ASD

Q. Wang[1]*, L. DiNicola*[2]*, P. Heymann*[1]*, M. Hampson*[3] *and K. Chawarska*[1]*, (1)Child Study Center, Yale University School of Medicine, New Haven, CT, (2)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (3)Yale School of Medicine, Yale University, New Haven, CT*

Background: Limited selective attention toward social objects such as faces constitute one of the core symptoms of autism. Evidence from both human and primate studies suggests that the process of selecting objects for processing is guided by the appraisal of object values. Here we tested a hypothesis that impairments in selective attention in ASD may reflect a disruption of a system supporting learning about object values in social domain.

Objectives: To compare the value learning in social (faces) and nonsocial (fractals) domains on selective attention in young children with ASD and typically developing (TD) controls.

Methods: Participants included children with ASD (n=26, age M=44.0±17.3) and TD controls (n=28, age = 38.3±13.6). All children were tested with a novel gaze-contingent task employing instrumental reversal learning. The task design was inspired by a value learning task previously developed and validated in non-human primates (Kim et al., 2013). The task consisted of 4 blocks, each block consisted of training and testing trials (Subplot A). Training: The same two objects, either two fractals or two faces, were presented in all blocks. Within each block, one object was assigned an *a priori* high-value (HV) and the other one a low-value (LV). If a child looked at a HV object, the object became dynamic, turning into a smiling face (Social) or a colorful fractal animation (Nonsocial). Fixation on the LV object resulted in no changes. Test: The two HV and LV objects from the training trials were presented simultaneously. A saccade toward the HV object activated its dynamic display; a saccade toward the LV object resulted in no change of the display. The proportion of test trials during which a child fixated on the HV object #HV /(#HV + #LV) across all testing blocks served as a dependent variable (%HV).

Results: An ANOVA on %HV revealed no significant effect of diagnosis ($F(1, 43)=2.21$, $p = .144$), or condition ($F(1, 43)=.59$, $p=.542$ but a significant diagnosis x condition interaction ($F(1, 43)=8.88$, $p=.005$). Between-group comparisons showed no significant difference in the Nonsocial condition ($p=.577$, $d=.29$) but a significant TD group advantage in the Social condition ($p = .007$, $d = .85$).(Subplot B) Within-group contrasts showed that, following training, the bias toward HV objects in the TD group in the Social condition was stronger compared to the Nonsocial condition ($p=.007$), but this bias was comparable between conditions in the ASD group ($p=.164$). A significant correlation between performance in the Social and Nonsocial conditions was found in the ASD group ($r(22) =.47$, $p=.025$) but not in the TD group ($r(24) = .086$, $p=.689$).(Subplot C).

Conclusions: Children with ASD exhibit domain-specific impairments in value learning which may impact their attention in natural environments. Unlike their typically developing peers, children with ASD's learning in social and nonsocial domains may rely on the same underlying neural mechanism. These findings have implications for designing novel treatments targeting impaired selective attention to social targets and for studies of neural mechanisms of value learning in autism.

Oral Session - 12B
Cognition: Attention, Learning, Memory
191 - From Cognition to Symptoms

2:40 PM - 3:30 PM - Willem Burger Zaal

2:40 **191.001** Children with Autism Spectrum Disorder Prefer Looking at Repetitive Movements in a Preferential Looking Paradigm

Y. Hu[1]*, Q. Wang*[1]*, D. Shi*[1]*, Y. Zhang*[2]*, X. Zou*[3]*, S. Li*[1]*, F. Fang*[1] *and L. Yi*[4]*, (1)Peking University, Beijing, China, (2)Peking University, beijing, China, (3)The Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou, China, (4)School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China*

Background: Individuals with ASD have been reported to show abnormal visual attention, including reduced attention at others' faces and eyes (e.g., Frazier et al., 2017; Tanaka & Sung, 2016), and abnormal visual preference for non-social objects (e.g., Chawarska et al., 2013; Sasson & Touchstone, 2014). Unlike the abnormal attention related to social stimuli, the visual abnormality related to the restricted interests and the repetitive behaviors has attracted limited research attention. The assessment of repetitive behavior in ASDs was mostly based on subjective reports from parents or clinical observations (e.g., Autism Diagnostic Observation Schedule; Lord et al., 2000). Several studies have examined the repetitive behaviors related stimuli (RBRS) in ASD by displaying RBRS and social stimuli simultaneously (Pierce et al., 2011; Pierce et al., 2016; Sasson & Touchstone, 2014). Considering the limitation of the interference of social stimuli in previous studies, the present study aimed to examined the visual preference for the repetitive movements in young children with ASD.

Objectives: The present study was designed to examine the visual preference for the repetitive movements in young children with ASD.

Methods: Twenty young children with ASD (2.74 - 5.24 years old) and 20 IQ- and age-matched typically-developing (TD) children were presented simultaneously with repetitive movements (e.g., a butterfly flying in a circle route) and random movements (e.g., the same butterfly flying in a random route). A Tobii Pro X3-120 eye tracker recorded children's eye movements simultaneously. Two areas of interest (AOIs) were defined for the two different moving patterns in each trial: the repetitive movement AOI and the random movement AOI. We analyzed total looking time on the repetitive and the random movements for each trial, and computed the average proportional looking time on the repetitive AOI against the total looking time on both the repetitive and the random AOIs, defined as dynamic repetitive preference index (RPI). we also conducted a temporal course analysis of the RPI by dividing each trial into three phases (early, middle, and late phases, each phase lasting for approximately 31 seconds). A well above chance level (50%) RPI represents a looking preference for the repetitive movements over the random movements. Parent

reports were accessed using Repetitive Behavior Scale-Revised (RBS-R; Bodfish et al., 2000).

Results: As shown in Figure 1 and Figure 2, We found that: (1) children with ASD spent significantly more time fixating on the repetitive movements than the random movements, whereas TD children showed no preference for either type of movements; (2) temporal course analysis further revealed that, this preference for the repetitive movements in ASD emerged as early as the first 30 seconds; (3) children's preference for repetitive movements was correlated with the severity of repetitive behaviors based on parent reports, but not with their ages and cognitive functions.

Conclusions: Our findings not only reveal the gaze abnormality of ASD beyond the previously reported atypical social attention, but also show a promise in using the preferential looking as a potential indicator for the repetitive behaviors and aiding early screening of ASD in future investigations.

2:52 **191.002** Reconciling the Co-Occurrence of Impulsivity and Insistence on Sameness in ASD

D. J. Bos[1], *M. R. Silverman*[1], *E. Ajodan*[1], *C. Martin*[2], *B. Silver*[3], *A. Di Martino*[4] *and R. M. Jones*[3], *(1)Sackler Institute for Developmental Psychobiology, New York, NY, (2)Weill Cornell Medicine, White Plains, NY, (3)Weill Cornell Medicine, New York, NY, (4)The Child Mind Institute, New York, NY*

Background: Children with autism spectrum disorder (ASD) often have intense or odd interests that can negatively impact adaptive behavior and social interactions. It is unknown whether such interests can bias self-control in children with ASD.

Objectives: The aim of this study was to investigate impulse control towards interests in ASD. We expected children with ASD would show a greater sensitivity, reflected by increased impulsivity, towards stimuli depicting their interests versus their non-interests.

Methods: 100 children aged 6-12 yrs who were either typically developing (TD) or had ASD performed a novel go/nogo task to cues of their interest versus cues of non-interest on an iPad. Children chose their favorite (interest) and least favorite hobby/activity (non-interest) from 23 options. One category of cues served as the go-stimulus (e.g. interests) to which participants were instructed to touch the image on the iPad-screen as fast as possible and the other category of cues served as the nogo-stimulus (e.g. non-interests) for which participants withheld their response. Go and nogo stimuli were counterbalanced across two runs. False-alarm rate was calculated as the number of erroneous button presses to the nogo cue in each run. D-prime (*d'*) was calculated as the normalized hit rate (go-accuracy) – normalized false alarm rate. Using Linear Mixed-Effects models differences in hit rate, false alarms and *d'* were tested with task condition, diagnostic status and age as fixed factors, and within subject variability as a random factor. Caregivers also completed the Repetitive Behavior Scale - Revised (RBS-R) to provide a measure of the severity of repetitive behaviors and the Strengths and Weaknesses of ADHD symptoms and Normal behavior (SWAN) to measure the children's inattention and hyperactivity/impulsivity.

Results: Children with ASD were more impulsive towards their interests as shown by an interaction effect between task condition and diagnostic status on *d'* ($F_{(1,73)}$ = 5.4, p = .024). This interaction was driven by a lower *d'* to interests as compared to non-interests in children with ASD (ß = -0.29, s.e. = 0.11, p = .012, 95% CI = -.52 - -.07), in combination with lower *d'* to interests in children with ASD compared to TD children (ß = -0.39, s.e. = 0.18, p = .029, 95% CI = -.74 - -.04)(Figure 1). Interestingly, impulsivity towards interests (*d'*) was specifically associated with higher caregiver reports of insistence on sameness behaviors on the RBS-R in children with ASD (r = -.39 , p = .016; Figure 2). Furthermore, across TD children and children with ASD, symptoms of ADHD measured by the SWAN specifically correlated with *d'* to interests (r = -.46 , p < .001). There were no correlations with d' to non-interests.

Conclusions: These findings suggest some children with ASD may present with both insistence on sameness behaviors and difficulties with impulsivity, two behaviors that could be perceived as mutually exclusive. As interests negatively influenced self-control in children with ASD, using a child's personalized interest as a reinforcer during clinical intervention may be challenging.

3:04 **191.003** Cross-Domain Cognitive Subgroups of Autism Spectrum Disorder Show Differences Both in Terms of Their Clinical Symptom Profile and Neurofunctional Characteristics: Evidence from the EU-AIMS LEAP Cohort

E. Loth[1], *C. Moessnang*[2], *J. Ahmad*[1], *S. Baumeister*[3], *L. Mason*[4], *D. V. Crawley*[1], *C. H. Chatham*[5], *H. L. Hayward*[6], *A. San Jose Caceres*[1], *B. Oakley*[1], *T. Charman*[7], *J. Tillmann*[8], *E. J. Jones*[4], *R. Holt*[9], *C. Bours*[10], *M. C. Lai*[11], *M. V. Lombardo*[9], *C. B. Beckmann*[12], *M. J. Brammer*[13], *W. Spooren*[14], *S. Baron-Cohen*[15], *M. H. Johnson*[16], *H. Tost*[2], *A. Meyer-Lindenberg*[2], *J. K. Buitelaar*[17], *D. G. Murphy*[18] *and G. Dumas*[19], *(1)Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Department of Psychiatry and Psychotherapy, Central Institute of Mental Health, University of Heidelberg, Mannheim, Germany, (3)Department of Child and Adolescent Psychiatry and Psychotherapy, Central Institute of Mental Health, Medical Faculty Mannheim/Heidelberg University, Mannheim, Germany, (4)Centre for Brain and Cognitive Development, Birkbeck, University of London, London, United Kingdom, (5)Neuroscience, Ophthalmology, and Rare Diseases (NORD) Roche Pharma Research and Early Development. Roche Innovation Center Basel, Hoffmann La Roche, Basel, Switzerland, (6)Institute of Psychiatry, Psychology and Neuroscience, King's College London, King's College London, London, United Kingdom, (7)Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (8)Institute of Psychiatry Psychology & Neuroscience, London, United Kingdom, (9)University of Cambridge, Cambridge, United Kingdom, (10)Nigmegen Medical Centre, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (11)Centre for Addiction & Mental Health, University of Toronto, Toronto, ON, Canada, (12)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Department of Cognitive Neuroscience, Nijmegen, Netherlands, (13)Centre for Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (14)Behavioural Pharmacology and Preclinical Imaging at Hoffmann-La Roche, Basel, Switzerland, (15)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (16)Centre of Brain and Cognitive Development, Birkbeck College, University of London, London, United Kingdom, (17)Radboud University Medical Center Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen, Netherlands, (18)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (19)Human Genetics and Cognitive Functions Unit, Institut Pasteur, Paris, France*

Background: The immense clinical and etiological diversity among people with Autism Spectrum Disorder (ASD) is now well established. This has shifted the research focus from identifying *diagnostic* markers to the discovery of *stratification* markers to parse the umbrella condition into more homogeneous subgroups. For example, at the cognitive level, no single marker has been found that characterizes all individuals with ASD. We recently highlighted this by contrasting case-control comparisons with normative modeling approaches on a set of cognitive tasks tapping theory of mind (ToM), executive function (EF), and weak central coherence (WCC). Akin to growth curves, normative modeling allows one to define each individual in terms of their deviation from age-expected means. Despite significant mean-group differences on each of these tasks, the

majority of people with ASD in fact performed within 1 Standard Deviation of their age-expected TD group means (Fig 1 a,b). Next, we used hierarchical clustering to identify cognitive subgroups based on individual performance profiles across cognitive domains. This yielded three clusters, which can be characterized as Subgroup 1: EF impairments, Subgroup 2: intact cognition across-the-board, and Subgroup 3: impaired ToM+EF (Fig 1c). We then demonstrated significant differences in the clinical symptom profile between the three groups, such that Subgroup 3 had significantly more severe ASD core symptoms than the two other groups (Fig 1d) while Subgroup 2 had significantly fewer associated ADHD symptoms and higher levels of adaptive behavior than the two other groups. (Fig 1f). However, one important question remained: do these subgroups also differ in their neurobiological underpinnings?
Objectives: To investigate neurofunctional differences between cognitive subgroups on 1) an fMRI ToM “Animated Shapes Task”, and 2) an fMRI executive function “Flanker/NoGo Task”.

Methods: The present analyses focused only on individuals with a clinical diagnosis of ASD. Participants were assessed as part of the multi-site EU-AIMS LEAP cohort and included in this project if data on the cognitive subgrouping analyses as well as fMRI data on the ToM task (N=139) and/or Flanker task (N=123) were available. fMRI data from all study centres were preprocessed in a common pipeline using SPM12. To investigate differences in functional activation between the three subgroups we used both region-of-interest approaches (comprising areas involved in the ToM and EF networks, respectively) and exploratory whole-brain voxel-wise analyses. Site was included as covariate throughout.

Results: On the Animated Shapes task (contrast “ToM> random”) we found a significant activation difference between subgroups 3 and 1 (whole brain p<corr>=.01; ROI p_{corr}=.01) in the right middle temporal gyrus; a region previously implicated in ToM processing (Fig 1e). On the Flanker Task (contrast “[NoGo+incongruent] >[neutral+congruent]”) whole-brain analyses showed a significant effect of cluster (p_{FWE}=.017) on right superior frontal gyrus- with subgroup 2 showing significant deactivation compared to subgroup 1 (Fig 1g).

Conclusions: We herein report first evidence for cognitive subgroups that differ on average in both clinical symptom profile and neurofunctional characteristics. To validate these cross-domain cognitive subgroups as stratification marker for ASD, replication of findings will be essential.

3:16 **191.004** Flexibility Explains Adaptive Behavior in Youth with Autism Spectrum Disorder

J. R. Bertollo[1], *J. F. Strang*[2], *S. Seese*[3], *L. Kenworthy*[3], *G. L. Wallace*[4,5] *and B. E. Yerys*[1], *(1)Center for Autism Research, Children's Hospital of Philadelphia, Philadelphia, PA, (2)Center for Autism Spectrum Disorders, Children's National Health System, Washington, DC, (3)Children's National Health System, Washington, DC, (4)National Institutes of Health- National Institute of Mental Health, Bethesda, MD, (5)The George Washington University, Washington, DC*

Background: Adaptive behavior, the ability to function independently in everyday life, is an important measure of functional outcomes for individuals with autism spectrum disorder (ASD). Individuals with ASD tend to achieve poorer outcomes and exhibit worse adaptive behavior than groups with other developmental disorders, to a degree that cannot be explained by IQ alone. Prior research points to the importance of flexibility, an executive function skill, as an important factor predicting adaptive behavior in school-age youth with ASD. However, this research was limited to an 8-item informant-report measure of flexibility that was not designed to measure specific flexibility skills (e.g., flexibility in thought, routines, or social behavior). With our team’s recent publication of the Flexibility Scale, we now have a multi-dimensional parent-report measure. Identifying which flexibility skills relate to adaptive behavior will help us better tailor treatments to increase an individual’s ability to function independently in daily activities.
Objectives: To examine specific flexibility skills that relate to an individual’s level of adaptive behavior.

Methods: Participants included 216 individuals with ASD (mean age=10.67 years, 83.3% male). Adaptive behavior was measured by the Vineland Adaptive Behavior Scales, First and Second Editions. Flexibility was assessed by the Flexibility Scale-Revised, which includes 27 items pertaining to Social Flexibility, Routines and Rituals, Transitions/Change, Special Interests, and Generativity. Flexibility skills, captured on the 8-item Shift scale from the Behavior Rating Inventory of Executive Function (BRIEF), were also examined, to check for replicability from prior research that utilized this measure. To evaluate the role of flexibility above and beyond covariates of age, IQ, and gender, three stepwise regressions were conducted, one for each Vineland domain. The first step evaluated covariates; the second step added the five Flexibility Scale-Revised Subscales. We hypothesized replicating prior findings of BRIEF-Shift scale scores associating with Vineland Socialization skills, while further specifying this association as driven by Social Flexibility deficits, using the more granular Flexibility Scale-Revised.

Results: In line with prior literature, the BRIEF-Shift scale was significantly associated with Vineland Socialization skills ($p<0.001$). When examining the multi-dimensional Flexibility Scale-Revised, as hypothesized, Social Flexibility accounted for significant variance in Socialization skills, as did Generativity and Routines and Rituals. Together, the Flexibility Scale-Revised subscales contributed 26.8% of variance in Socialization skills ($p<0.001$). Additionally, Flexibility Scale-Revised subscales explained 9.3% of variance in Daily Living Skills ($p<0.001$), with Generativity reaching statistical significance. Flexibility Scale-Revised subscales, particularly Generativity, Routines and Rituals, and Transitions/Change, explained 15.9% of variance in Communication skills ($p<0.001$).

Conclusions: As predicted, a more granular measure of flexibility impairments replicated and specified prior relationships with social adaptive functioning skills. It also showed strong relationships with other areas of adaptive behavior that were not seen with the BRIEF-Shift scale alone. Future studies should examine both the predictive value of specific flexibility skills with longitudinal outcomes, and convergence with performance-based measures at a single time point. Furthermore, dismantling the construct of flexibility into its subcomponents is critical for supporting a personalized treatment approach, so that children with flexibility deficits can receive more targeted supports to improve outcomes.

Oral Session - 13A
Genetics
192 - Genetics
1:45 PM - 2:35 PM - Willem Burger Hal

1:45 **192.001** Genome-Wide SNP and Environment Interaction Study in Autism Spectrum Disorder

C. Ladd-Acosta[1], *K. S. Benke*[2], *B. K. Lee*[3], *A. Singer*[4], *B. K. Sheppard*[5], *A. M. Reynolds*[6], *D. Schendel*[7,8,9], *G. C. Windham*[10], *L. Schieve*[11], *L. A. Croen*[12], *C. J. Newschaffer*[13,14] *and M. D. Fallin*[1,2], *(1)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public*

Health, Baltimore, MD, (2)Mental Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Epidemiology and Biostatistics, Drexel University, Philadelphia, PA, (4)University of North Carolina - Chapel Hill, Chapel Hill, NC, (5)Johns Hopkins School of Public Health, Baltimore, MD, (6)University of Colorado Denver School of Medicine, Aurora, CO, (7)Public Health, Aarhus University, Aarhus, Denmark, (8)Economics and Business, National Center for Registry-based Research, Aarhus University, Aarhus, Denmark, (9)Aarhus University, Aarhus, Denmark, (10)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (11)Centers for Disease Control and Prevention, Atlanta, GA, (12)Division of Research, Kaiser Permanente, Oakland, CA, (13)AJ Drexel Autism Institute, Philadelphia, PA, (14)A.J. Drexel Autism Institute, Philadelphia, PA

Background: Despite high heritability estimates for autism spectrum disorder (ASD), several recent studies show environmental factors, especially exposures during the prenatal window, play a larger role in ASD risk than previously thought. Genome-wide studies integrating genetic and environmental factors could provide further understanding of the contribution of environmental and genetic factors to ASD risk. Both technical and practical limitations have hindered this type of integrated study in the past. However, recent advances in gene-environment interaction (GxE) methods, as well as availability of environmental exposure, genetic, and phenotypic information on a large representative population of children, now make a genome-wide GxE study (GEWIS) for ASD feasible.

Objectives: Our primary study objective was to identify single nucleotide polymorphisms (SNPs) whose effects on ASD risk vary across levels of selected prenatal environmental exposures, including maternal alcohol, tobacco, and medication use, and maternal infections.

Methods: The Study to Explore Early Development (SEED) is a US multisite epidemiologic study of ASD with comprehensive phenotyping, broad prenatal environmental exposure information, and biospecimens available for DNA measurements. A total of 1,321 children, aged 2-5, enrolled in SEED phase 1 with a classification of ASD or population control (POP) were genotyped on the Illumina Omni1M or Affymetrix Axiom genome-wide genotyping platforms. After applying our rigorous quality control and imputation pipelines, using SHAPEIT, IMPUTE2, and the 1000 genomes reference panel (version3), we had a final analytic dataset of 1,307 samples (582 ASD and 725 POP) and over 16 million SNPs available for GxE analyses. Prenatal environmental exposure data were derived from retrospective maternal self-report using a structured interview. Specific exposures included maternal use of tobacco, alcohol, β-2 adrenergic receptor agonist or antidepressant medications, and any of 36 specific maternal infections. GxE analyses used two approaches: (1) a case-control likelihood ratio test (LRT) that allows for genetic main effects to be modified by exposures, and (2) a case-only LRT that overcomes problems with gene-environment dependence assumptions by utilizing an empirical Bayes-type shrinkage estimator. These two approaches were specifically designed to handle millions of genomic loci making this GEWIS effort on a moderately sized sample plausible.

Results: Using the case-only LRT, we identified a genome-wide significant interaction ($P<1\text{x}10^{-07}$) for prenatal exposure to alcohol and a locus on chromosome 15 within the *TRPM1* gene. This locus also reached a suggestive association threshold level using the case-control LRT method. The interaction effect estimate for both tests suggest a synergist interaction between the genetic variant and prenatal exposure. Several loci on chromosome 6 also reached suggestive significance ($P<1\text{x}10^{-05}$) for increased ASD risk among individuals with prenatal exposure to maternal infections. These were not located near the major histocompatibility genes but instead are located near a long non-coding RNA shown to have brain-region specific expression in the Genotype-Tissue Expression project.

Conclusions: We identified a genomic locus on chromosome 15 whose effect on ASD risk varies by levels of alcohol exposure during pregnancy, as well as an intergenic region on chromosome 6 showing suggestive association with ASD risk in the context of prenatal exposure to infection.

1:57 **192.002** DNA Methylation and Cross-Tissue Integration Shows Utility Of Blood-Based Epigenetic Research for ASD

M. D. Fallin[1], *S. Andrews*[2], *B. K. Sheppard*[3], *K. M. Bakulski*[4], *D. Schendel*[5], *L. Schieve*[6], *G. C. Windham*[7], *L. A. Croen*[8], *I. Hertz-Picciotto*[9], *S. Warren*[10], *P. Chopra*[10], *R. Alisch*[11], *S. Ellis*[12], *J. Mill*[13], *E. Hannon*[14], *C. J. Newschaffer*[15], *D. Arking*[16] *and C. Ladd-Acosta*[1], *(1)Wendy Klag Center for Autism and Developmental Disabilities, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (2)Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, (3)Johns Hopkins School of Public Health, Baltimore, MD, (4)University of Michigan, Ann Arbor, MI, (5)Aarhus University, Aarhus, Denmark, (6)Centers for Disease Control and Prevention, Atlanta, GA, (7)Environmental Health Investigations Branch, California Department of Public Health, Richmond, CA, (8)Division of Research, Kaiser Permanente, Oakland, CA, (9)University of California at Davis, Davis, CA, (10)Human Genetics, Emory University, Atlanta, GA, (11)Psychiatry, University of Wisconsin, Madison, WI, (12)Johns Hopkins University, Baltimore, MD, (13)University of Exeter Medical School, University of Exeter, Exeter, United Kingdom, (14)Exeter Medical School, University of Exeter, Exeter, United Kingdom, (15)AJ Drexel Autism Institute, Philadelphia, PA, (16)Johns Hopkins University School of Medicine, Baltimore, MD*

Background: Epigenetic mechanisms have been implicated in ASD, including evidence from rare-variant genetics findings. Further, common variant GWAS studies for ASD have recently increased in size and precision. Few have integrated genetic and epigenetic findings in the same study of ASD, partly due to skepticism about the utility of blood-based DNA methylation studies for this brain-based disorder.

Objectives: This work aimed to take genome-wide approaches at the DNA methylation (epigenome-wide, EWAS) and SNP variant (GWAS) levels and to integrate information from both to elucidate biological insights not possible via either type of information in isolation.

Methods: DNA methylation was measured on 968 child blood samples from the Study to Explore Early Development (SEED 1) and 343 child-sibling pairs from the Simons Simplex Collection (SSC) using the Illumina 450K Beadchip array. We performed EWAS meta-analysis, after extensive data cleaning and adjustment, and compared top EWAS results to those from brain-based results. We also used a combination of GWAS SNP data and 450K array DNAm data measured on infant cord blood from the EARLI study and SEED child blood to identify SNPs associated with DNA methylation (meQTL lists) in these tissues. We tested for enrichment of methylation-QTL (meQTL) CpG targets in our EWAS results. We also took the reverse approach of exploring the most recent PGC-AUT GWAS results for enrichment of meQTLs across cord, peripheral blood and publicly available fetal brain and lung meQTL lists. We further assessed biological pathways implicated by ASD-specific meQTLS and their CpG targets.

Results: While no single CpG met epigenome-wide statistical significance ($p < 1.12\text{x}10^{-7}$) in our EWAS meta-analysis, 7 showed differences at $p < 1\text{x}10^{-5}$ and 48 at $1\text{x}10^{-4}$. Of the top 7, 5 showed brain-based ASD associations, often with larger effect sizes. We also observed suggestive evidence for enrichment of CpG sites controlled by SNPs (meQTL targets) among the EWAS hits. When considering GWAS hits, we previously discovered enrichment of ASD-associated SNPs for fetal brain (OR = 3.55; $P < 0.001$) and peripheral blood meQTLs (OR = 1.58; $P < 0.001$). The CpG targets of ASD meQTLs across cord blood, peripheral blood, and brain tissues showed enrichment for immune-related pathways, consistent with other expression and DNAm results in ASD, and revealed pathways not implicated by genetic findings alone. We will update these enrichment findings with the latest PGC-AUT GWAS hits for INSAR presentation.

Conclusions: We report the largest case-control EWAS study of ASD to date. Our results suggest the potential to observe disease associations from blood-based samples, given the concordance of findings between blood and brain EWAS among suggestive hits. However, the greater current utility may be in using DNAm data to inform GWAS results, where we observed enrichment of ASD-associated SNPs for meQTLs and showed involvement of immune biology when considering the epigenetic targets of these ASD SNPs. Our joint analysis of genotype and DNAm demonstrates the potential of both brain and blood-based DNAm for insights into ASD.

2:09

192.003 Genome-Wide Analyses of DNA Methylation in Autism Brains Suggest Epigenetic-Mediated Effects in GABA Signaling

__J. I. Young__[1], A. J. Griswold[2], C. Brandenburg[3], J. P. Hussman[4], M. A. Pericak-Vance[2], G. J. Blatt[3] and J. M. Vance[5], (1)John P. Hussman Institute for Human Genomics, University of Miami, Miami, FL, (2)John P. Hussman Institute for Human Genomics, University of Miami Miller School of Medicine, Miami, FL, (3)Hussman Institute for Autism, Baltimore, MD, (4)Hussman Institute for Autism, Catonsville, MD, (5)Hussman Institute for Human Genomics, Miami, FL

Background: Ample evidence supports involvement of the striatum and cerebellum in autism pathophysiology. Emerging evidence implicates altered DNA methylation as a likely contributing factor to autism etiology.
Objectives: In order to gain understanding of the role of DNA methylation and transcriptional regulation in autism, we profiled the methylome and transcriptome of striatal and cerebellar tissue from autistic and neurotypical individuals.

Methods: DNA and RNA were extracted from frozen striatum and cerebellar tissue from 5 autism cases and 5 neurotypical individuals obtained from the Maryland Brain and Tissue Bank. Samples were matched for age, sex and post-mortem interval. Methylation profiles were analyzed using MethylationEPIC bead arrays. As CpG methylation is often correlated amongst neighboring sites, we used differentially methylated regions (DMR) for this analysis. Differential gene expression was assayed through RNA-seq analysis. Differentially methylated genes (containing DMRs) as well as genes differentially expressed were further analyzed to determine functional pathways and ontology enrichment using the Enrichr web tool. In addition, transcription factor binding site enrichment was identified using oPOSSUM and GATHER-based analysis of TRANSFAC motifs.

Results: We found significant DMRs between cases and controls, including DMRs in genes previously implicated in autism. Pathway analysis of genes containing DMRs in the striatum indicates significant enrichment in the Kegg pathway “GABAergic synapse”, whereas the Kegg pathway “endocytosis” is enriched in the cerebellum. Both pathways have been previously postulated to contribute to autism pathophysiology.

RNA-seq based analysis of differential gene expression identified differentially expressed genes (DEG) with FDR <0.05 in both brain regions, including several that have been implicated in autism. Interestingly, pathway analysis found that striatal DEG genes were enriched for the Kegg pathway “Neuroactive ligand-receptor interaction” and the gene ontology category “GABA-A receptor activity”. Analysis of TFBS revealed enrichment of *PAX6* binding to striatal DEG genes. Our data also shows that *PAX6* contains a significantly hypomethylated DMR in striatum in autism individuals as well.

Conclusions: We have identified tissue-specific epigenomic alterations in autism brains, including alterations in known autism-associated genes. The etiology of these changes are not known, but could be inherited or due to environmental exposures during development. Both DMR and differential gene expression point to GABA signaling mechanisms as important in autism pathophysiology. These pilot data suggest that epigenetic evaluation of selected brain regions has high potential for autism studies. In addition, converging molecular alterations may provide insight into mechanisms of disease even with smaller sample sets than those required for genetic studies.

2:21

192.004 Characterization of SCN2A Haploinsufficiency in Early Neurodevelopment Using Transcriptomic Analyses and Systems Biology

J. Y. An[1], S. Fazel Darbandi[1], D. M. Werling[2], G. B. Schwartz[1], C. M. Keeshen[3], K. J. Bender[4] and __S. Sanders__[1], (1)Psychiatry, University of California San Francisco, San Francisco, CA, (2)Psychiatry, UCSF, San Francisco, CA, (3)UCSF, San Francisco, CA, (4)Department of Neurology, UCSF, San Francicso, CA

Background: *SCN2A* is a voltage-gated sodium channel gene that encodes neuronal sodium channel $Na_V1.2$ and plays a critical role in early neurodevelopment and action potential initiation. Large-scale genomic studies have demonstrated that *SCN2A* is associated with autism spectrum disorder (ASD), developmental delay, and seizures. Integrative analysis using electrophysiology and cellular data showed that ASD mutations impaired neuronal excitability in the developing brain ($Na_V1.2$ loss-of-function).
Objectives: To understand the functional consequence of SCN2A loss-of-function mutation during the neurodevelopment, and whether transcriptional changes in SCN2A haploinsufficiency converge on biological pathways related to ASD neurobiology, suggesting that biological findings may be relevant to ASD in general.

Methods: From a heterozygous SCN2A deletion mouse model (*Scn2a1*$^{wt/-}$), we collected samples from two developmental stages (postnatal day 7 (P7) and P30), equivalent to infancy and early adulthood in humans, and two brain regions (cortex and cerebellum). RNA-seq was performed on two biological replicates of these samples using a 50bp paired-end library. After adjusting for covariates, we identified differentially expressed genes in SCN2A deletion compared with wild-type littermates (SCN2A-DEX, ±1.5-fold change in expression; p-values ≤0.05 after Benjamini-Hochberg correction).

Results: We found distinct spatiotemporal gene expression changes in *Scn2a1*$^{wt/-}$ mice, largely for genes related to neuronal functions. Specifically, we found that SCN2A-DEX genes in the developing (P7) cortex are enriched for co-expression modules of synaptic genes in the ASD human postmortem cortex (Parikshak et al. 2016), as well as FMRP binding targets (Darnell et al. 2011). In addition, gene set enrichment analysis using cell type-specific expression profiles (Xu et al. 2014) showed that SCN2A-DEX genes are enriched in cortical projection neurons, particularly in layer 5 and 6 pyramidal neurons. This is consistent with our previous observation that SCN2A variants associated with ASD impair neuronal excitability in the developing pyramidal cell model (Willsey et al. 2013).

Conclusions: Our analysis of RNA-Seq data in this mouse model shows that *SCN2A* disruption in the developing cortex impacts numerous genes that have been highlighted in ASD pathology, suggesting that *SCN2A* and other causes of ASD may converge on common pathological pathways. Further characterization of *SCN2A* function may therefore provide an important window into the neurobiology of ASD.

Oral Session - 13B
Service Delivery/Systems of Care
193 - Service Access and Patterns of Care Across Service Systems
2:40 PM - 3:30 PM - Willem Burger Hal

2:40 **193.001** Using Diffusion of Innovation Theory to Improve Adoption of Evidence Based Practice in Community Settings: A 10-Year Case Study in PRT

***M. Stolte**, Centre for Autism Services Alberta, Edmonton, AB, Canada*

Background: Barriers to adoption of evidence-based practice in autism spectrum disorder treatment are numerous and there is a need for research on how better to bridge this gap between science and practice. Diffusion of innovation theory (Rogers, 2003) has been used to understand the adoption and rejection of new practices in a wide range of disciplines, such as agriculture and computing science, though has only rarely been applied to understanding autism treatment (Dingfelder & Mandell, 2011). This case study frames the adoption process of an evidence-based practice (EBP) over a 10-year period - Pivotal Response Treatment [PRT] (Koegel et al., 2006) - currently under dissemination in Western Canada by a large, non-profit autism service provider. This study extends previous research on evaluating EBP in community settings.
Objectives:

1. To summarize five key characteristics of diffusion of innovation theory: relative advantage, compatibility, complexity, trialability, and observability.
2. To apply these key characteristics to the adoption of PRT in a community-based setting, identifying successes and barriers in the adoption process.
3. To share these observations with other treatment providers and researchers to improve the adoption of EBP in community-based settings.

Methods: Using a case study framework, the 10-year adoption process of PRT was summarized, highlighting specific training models and methods of implementation of a large service provider in Western Canada. Diffusion of innovation theory was used to frame key aspects of the adoption process, highlighting successes and areas of difficulty. The primary focus was on the persuasion component of diffusion of innovation theory. Persuasion is associated with increased likelihood of adoption of an EBP, and by identifying key aspects, it is hypothesized this will allow other treatment providers to better understand how to use implementation science as a means of improving EBP adoption.

Results: A timeline of events was provided, including successes and setbacks in PRT adoption, in this practice setting. A clear description of the different implementation models trialed by the service provider were described, as well as training programs, quality control mechanisms, and areas of conflict and success. For each component of the persuasive element of diffusion of innovation theory, contrasting successes and sources of disagreement were identified. Themes emerged identifying agreement as well as challenges with the adoption process by program staff. Even 10 years after the adoption of this technology at a management level, full adoption of PRT at a practice level staff was still only partial, highlighting the challenges in disseminating EBP in existing practice environments.

Conclusions: Bridging the research to practice gap is difficult. This case study summarizes the experience of a large service provider in Western Canada with the adoption process of an EBP in this practice setting. Using diffusion of innovation theory, the adoption process is better understood, highlighting areas of success, as well as past and future challenges. This study demonstrates how difficult the implementation of EBP may be in community-based practice settings, and provides a framework for better understanding how to improve the implementation process of science-based practices in these settings.

2:52 **193.002** High Impact Vocational Services to Achieve Employment More Rapidly

***D. Nord**[1] and K. Hamre[2], (1)Indiana Institute on Disability and Community, Indiana University, Bloomington, IN, (2)School of Social Work, Indiana University, Bloomington, IN*

Background: Employment plays a critical role in social, emotional, and financial well-being for people with autism. With the various challenges associated with autism, many people face significant barriers to obtaining and maintaining a competitive job in the community. In the United States, this results in people with autism experiencing considerably lower employment outcomes. Central to improving employment for this population, it is critical to understand what services and key individual variables relate to quality outcomes.
Objectives: To identify high impact vocational services that increase the odds of employment for people with autism. To describe how education and age interact on the length of time to obtain a job. To test the moderating effect of high impact vocational services on the effect of education on the length of time to obtain employment.

Methods: This study analyzed a national vocational dataset from the U.S. Department of Education, Rehabilitation Services Administration. Subjects included all service users with autism as a primary or secondary impairment, who were unemployed at program entry. The resulting sample included 5,182 subjects. Analyses included logistic regression to model the odds of employment of all subjects and linear regression to model the months to achieve employment for the subsample that obtain a job prior to program exit (n = 2,695). Key variables were controlled in analyses, including significance of disability and educational policies affecting age cohorts.

Results: The study found people with autism entering the Vocational Rehabilitation Services program experienced 10 to 22 times higher odds ($p < .001$; pseudo $R^2 = .34$) of obtaining employment, compared to the reference group, if they received a combination of two or all three following three high impact supports; job search assistance, job placement assistance, and on-the-job supports. Additionally, subjects averaged 25 months to obtain employment. Education and age had a significant interaction effect ($p < .001$; $R^2 = .196$) on the number of months to obtain a job. The effects of education on reducing time to job acquisition are considerably stronger for older people with autism than younger. Finally, holding all else constant, high impact supports significantly moderated education's effect on the months to obtain employment ($p < .01$; $R^2 = .24$) by achieving the outcome four to 17 months sooner than those with the same education that did not receive the support.

Conclusions: Searching and obtaining a job is a difficult process, thus it is critical to target interventions and effort in ways that can produce effective and efficient results. This study highlighted the important relationships between specific high impact employment services and job attainment, a finding with direct policy and practice implications. Additionally, this study focuses needed attention on the relationship of education, age, high impact services, to investigate key variables that can reduce the time to obtain employment. These results have implications that can guide future causal research, as well as inform systemic policy and practices.

3:04 **193.003** The Influence of Individual and Family Characteristics on Intervention Access for People on the Autism Spectrum: A RI-CART Study

C. E. McCormick[1,2] *and S. J. Sheinkopf*[3,4,5,6]*, (1)Human Development and Family Studies, Purdue University, West Lafayette, IN, (2)Rhode Island Consortium for Autism Research and Treatment (RI-CART), Bradley Hospital, East Providence, RI, (3)Brown Center for the Study of Children at Risk, Women and Infants Hospital, Providence, RI, (4)Pediatrics, The Warren Alpert Medical School of Brown University, Providence, RI, (5)Department of Psychiatry and Human Behavior, The Warren Alpert Medical School of Brown University, Providence, RI, (6)Rhode Island Consortium for Autism Research and Treatment (RI-CART), East Providence, RI*

Background: If services were based solely on need, family characteristics would not influence intervention utilization; however, serval characteristics besides symptoms or functioning have been identified as influencing access to services (Bishop-Fitpatrick & Kind, 2017). Few studies have combined several child and family characteristics within the same model to examine which characteristics have the most influence on service utilization for people with Autism Spectrum Disorder (ASD).

Objectives: The goal of this study was to simultaneously examine factors related to service utilization in a large heterogeneous sample community based sample of participants with ASD.

Methods: Participants consisted of 521 individuals (N female = 106) from the Rhode Island Consortium for Autism Research and Treatment (RI-CART) who completed questionnaire information on service usage. Participants ranged in age from 2-20 years (M = 10.30, SD = 4.35). All participants received an Autism Spectrum Disorder (ASD) diagnosis in the community and met criteria for ASD on the ADOS-2. Parents or guardians indicated whether the following services had ever been used: Applied Behavior Analysis (ABA), Individual Family Services Plan/Early Intervention Plan, Individual Education Plan, occupational therapy, speech and language therapy, physical therapy, summer services, other (examples of services described when other selected included social skills and music therapy).

Poisson and logistic regressions were used to examine number of services endorsed and specifically whether ABA had been received. The following independent variables were included in the models: ADOS comparison score, sex, age, Vineland Adaptive Behavior Composite (VABS), age at ASD diagnosis, whether the mother had a partner (i.e. married or living with partner), participant identified as Hispanic, African American, or Asian, English as the primary language in the household, and maternal education (High school or less, some college or BA/BS, advanced degree).

Results: Identifying as Hispanic was associated with reduced likelihood of ABA utilization (OR=0.49, 95% CI 0.99, 0.24) and was associated to a marginal degree with reduced total services utilization (OR = 0.88, 95% CI 1.01, 0.77). Age of diagnosis was negatively associated with both total services (OR = 0.97, 95% CI 0.98, 0.95) and utilization of ABA (OR = 0.84, 95% CI 0.91, 0.77). Full model results are reported in Table 1.

Conclusions: The only family characteristic significantly associated with service utilization was identifying as Hispanic. The more significant barriers faced by this group stand out even when accounting for difficulties specific to families where English is not the primary language spoken in the home. When controlling for ASD symptoms and functioning, the participant's age of diagnosis was also a predictor of service utilization. Participants who received their diagnoses at older ages were less likely to receive services in both the model predicting total services and when predicting ABA service utilization. These findings highlight the importance of early identification by demonstrating how health disparities at one level of service delivery can have cascading effects.

3:16 **193.004** Care Coordination:Testing Associations between Social Networks and the Perceived Transition Success for Low Resource Children with ASD

E. McGhee Hassrick[1]*, W. I. Shih*[2]*, C. Friedman*[1]*, Z. Shamsi*[3]*, S. F. Vejnoska*[4]*, B. Bronstein*[5]*, D. E. Linares*[6]*, K. M. Carley*[7]*, A. C. Stahmer*[8]*, T. Smith*[9]*, P. Mundy*[10]*, D. S. Mandell*[11] *and C. Kasari*[2]*, (1)Drexel University A.J. Drexel Autism Institute, Philadelphia, PA, (2)University of California, Los Angeles, Los Angeles, CA, (3)Drexel University, Phialdelphia, PA, (4)University of California, Davis, Sacramento, CA, (5)University of Pennsylvania, Philadelphia, PA, (6)Maternal and Child Health Bureau, Office of Epidemiology and Research, Health Resources and Services Administration, Rockville, MD, (7)Carnegie Mellon University, Pittsburg, PA, (8)Psychiatry and Behavioral Sciences, University of California at Davis MIND Institute, Sacramento, CA, (9)University of Rochester Medical Center, Rochester, NY, (10)University of California at Davis, Sacramento, CA, (11)Center for Mental Health, University of Pennsylvania, Philadelphia, PA*

Background: Parents and providers face challenges preparing children with ASD for school transitions (Boyd, McDowall, & Cooper, 2002; Tehee, Honan, & Hevey, 2009). Social relationships among a child's key supporters could provide important resources to improve transition success. Social network analysis offers powerful ways to examine dimensions ofthese relationships such as sharing and problem-solving (Fischer 1982; Rodrique et al 1990; Laumann and Pappi 1976; Breiger 1981). Network approaches have been applied in studies of health or health behavior (Bearman & Moody 2004; Bearman, Moody & Stovel 2004; Christakis & Fowler 2007, 2008; Coleman, Elihu & Menzel 1966) as well as health information-seeking (Colon-Ramos et al 2009) and communication and decision-making among health care personnel (Creswick, Westbrook & Braithwaite 2009; Fattore et al 2009; Scott et al 2005). Our study tests associations between structural dimensions of social relationships and transition success for children with ASD, thereby informing systematic attempts to improve school transitions for these children.

Objectives: Use ego-centric social network techniques to test the association between the perception of transition success and different types of social relationships, including instrumental relationships such as problem-solving networks and affective relationships such as trust networks. We test the hypothesis that problem solving networks and trust networks among home/school/community care providers are associated with perceptions of transition success.

Methods: 47 participants completed social network interviews, conducted 6 weeks before the end of the child's school year at the old school, including 8 parents and 39 providers. We interviewed key participants using the **SoDI: The Social Dynamics of Intervention Measure (**McGhee Hassrick et al 2018; McGhee Hassrick and Carley 2015), where each participant reported frequency of problem solving and degree of trust for each person on the team roster. Using ORA network analysis software (Carley et al 2004), we computed egocentric problem solving and trust measures for each participant, including **in-degree** (# of team members who seek out the participant), **out-degree** (# of team members that the participant seeks out) and **eigenvector centrality** (degree of connectivity that the participant had with well-connected team members). Participants also rated **perceived transition success** on a 5-point Likert scale, where 1 = not successful and 5 =very successful. We used OLS regression to test associations between our outcome measure of perceived transition success and our egocentric network predictor variables.

Results: Perceived transition success was positively and modestly associated with out-degree centrality in trust networks, positively and significantly associated with eigenvalue centrality in trust networks and negatively associated with in-degree centrality in trust networks. It was also positively associated with indegree, outdegree and eigenvector centrality in problem solving networks, but these associations were not significant.

Conclusions: Trust was an important predictor for transition success. When participants trusted team members who themselves where highly trusted, their perception of the child's transition success was significantly higher. This finding suggests that building trust for key leaders on a child's team might increase the perception of transition success.

Oral Session - 14A
Brain Structure (MRI, neuropathology)
194 - Brain Structure: Sex Differences & Twin Modelling
1:45 PM - 2:35 PM - Jurriaanse Zaal

1:45 **194.001** Sex Related Brain Structure of Social Cognition: An Autism Twin Study

*A. van't Westeinde[1], **E. Cauvet**[2], J. Neufeld[3], R. Toro[4], R. Kuja-Halkola[5], K. Mevel[6] and S. Bolte[7], (1)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Stockholm, Sweden, (2)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Karolinska Institutet, Stockholm, Sweden, (3)Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Institutionen för kvinnors och barns hälsa (KBH), Center of Neurodevelopmental Disorders at Karolinska Institutet (KIND), Srockholm, Sweden, (4)Pasteur Institute, Human Genetic and cognitive function, Paris, France, (5)Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden, (6)Laboratory for the Psychology of Child Development and Education, Paris-Descartes University, Paris, France, (7)Center for Neurodevelopmental Disorders (KIND), Center for Psychiatry Research, Department of Women's and Children's Health, Karolinska Institutet, Stockholm, Sweden*

Background:

A normative female advantage in social cognition skills has been proposed to contribute to the reduced risk of females to develop autism spectrum disorder (ASD) (Baron-Cohen et al., 2005; Christov-Moore et al., 2014). However, it is unclear if differences in brain structure related to social cognition exist between the sexes, and if such potential differences are associated with autistic trait severity. Further, studies on social cognition in ASD have often used tasks with low ecological validity, that are not challenging enough for higher functioning subjects (Dziobek et al., 2006).

Objectives:

The present study therefore aimed to investigate the relationship between brain structure and social cognition skills, assessed with a more complex, ecologically valid, social cognition task, as well as autistic traits, in males and females along the continuum of ASD. By using a co-twin control design, we were able to control for familial confounding factors (e.g. age, socio-economic status, etc.).

Methods: From the Roots of Autism and ADHD Twin Study Sweden (RATSS) 57 twin pairs (24 female and 33 male pairs), mean age 17.57 (range 12.52 - 23.69), completed the movie for the assessment of social cognition (MASC). In addition, autistic traits related to social cognition difficulties were assessed with a subscale from the parent-report Social Responsiveness Scale-2 (SRS-2). Twin pairs were either discordant or concordant for ASD, discordant or concordant for other neurodevelopmental disorders, or concordant for neurotypical development. Surface based morphological estimates including cortical surface, thickness and volume were computed from T1 anatomical images. Across and within-pair associations were calculated between social cognition and anatomical structure in the cerebral social network.

Results:

Females displayed better social cognition skills (MASC) compared to males, but there was no sex difference in the amount of autistic traits associated with social cognition difficulties (SRS-2). After controlling for shared factors within twin pairs, overall autistic traits predicted reduced social cognition skills only in males. In line with this, only in males were decreased social cognition skills (MASC) associated with increased thickness of the left inferior frontal, insula, mid temporal and right fusiform gyri. These associations between social cognition skills and brain structure were largely replicated in a subsample consisting of ASD discordant pairs (6 female and 8 male pairs). In contrast, autistic traits (related to social cognition difficulties (SRS-2)) were associated with reduced volume and surface area of most regions of interest only in females.

Conclusions: When controlling for familial factors, variation in social cognition skills was associated with brain structure mostly in males, while autistic traits related to social cognition difficulties were associated with brain structure only in females. Our findings therefore point at potential differences between males and females in autism phenotype and associated underlying neural structure. Finally, the results highlight the power of using a co-twin control design to detect subtle associations between brain structure and behavior, and suggest the importance of non-shared environmental factors in the relationship between neuroanatomy and social cognition skills.

1:57 **194.002** Sex Differences in Structural Brain Development Underlying a Female Protective Effect

***D. Yang**[1,2], A. Jack[1], P. E. Ventola[3], E. H. Aylward[4], M. Dapretto[5], D. Geschwind[6], J. S. Duncan[7], G. L. Wallace[1], S. J. Webb[8], S. Y. Bookheimer[5], L. Kenworthy[9], C. Torgerson[10], Z. Jacokes[10], C. A. Nelson[11], J. Van Horn[10], T. Girls' Neurogenetics Network Team[1] and K. Pelphrey[1], (1)The George Washington University, Washington, DC, (2)Children's National Medical Center, Washington, DC, (3)Yale Child Study Center, Yale University School of Medicine, New Haven, CT, (4)Seattle Children's Research Institute, Seattle, WA, (5)Dept of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, Los Angeles, CA, (6)University of California, Los Angeles, Los Angeles, CA, (7)Biomedical Engineering/Radiology, Yale University, New Haven, CT, (8)Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, (9)Children's National Health System,* *Washington, DC, (10)University of Southern California, Los Angeles, CA, (11)Boston Children's Hospital, Boston, MA*

Background: Autism Spectrum Disorders (ASD) disproportionately affect males over females. Our NIH Autism Center of Excellence Girls' Neurogenetics Network has contributed to understanding this bias at the levels of gene structure and expression, neural dynamics, brain function, and connectivity. The skew may be explained in part via mechanisms that confer a Female Protective Effect (FPE), combined with normative sexually dimorphic brain development, environmental factors, and potential measurement biases. This work is important because characterizing the FPE may help illuminate and treat ASD in both sexes.

Objectives: We sought to model and evaluate cortical thickness in males and females with ASD and age-, sex-, and cognitive-ability matched typically-developing (TD) comparison participants.

Methods: The sample included 219 children and adolescents (age: M = 13.01y, SD = 2.91y, range = 8.03-17.99y; IQ: M = 107.50, SD = 17.87, range = 75-167) recruited from four research sites (Yale, Harvard, UCLA, Seattle). There were 54 ASD females, 52 TD females, 59 ASD males and 54 TD males. The four groups were well-matched on age and IQ. Females (F) and males (M) with ASD were well-matched on ASD symptom severity, language ability and adaptive behaviors. F-ASD and F-TD were well-matched on intracranial volume (ICV), so were M-ASD and M-TD. All participants underwent a T1-weighted structural scan. Cortical thickness was estimated using FreeSurfer v6.0.0 and fwhm=15mm. Quality of the structural MRI images were independently rated by two researchers, blind to group membership; 30 subjects (6 F-ASD, 5 F-TD, 17 M-ASD, 2 M-TD) exhibiting obvious head motion were discarded. Age was centered before entered into analysis. Results were thresholded at $Z>1.96$ (vertex-level) and $p<.05$ (cluster-level) (two-sided), while site, IQ, and ICV were included as covariates of no interest.

Results: The analysis showed that across all participants, as expected, there were widespread age-related reductions in cortical thickness during this developmental epoch. In males, the whole-brain analysis revealed a significant Age × Diagnosis interaction localized to the right pSTS and nearby regions as outlined in **Figure 1**. However, in girls, there were no surviving regions across the whole brain showing a significant Age × Diagnosis interaction, while the Age × Diagnosis interaction in the outlined region was not significant in girls, $p=.21$. Finally, the 3-way Age × Diagnosis × Sex interaction effect in the outlined region was significant, $p=.04$, partial $\eta^2 = .024$. The scatterplots are also presented for this region.

Conclusions: Consistent with prior, published reports, males with ASD relative to same-sex TD exhibit accelerated age-related cortical thinning specifically in the right pSTS region during late childhood and adolescence. However, this atypicality is not present in girls with ASD. These findings suggest evidence for one of the developmental brain differences underlying the FPE in ASD.

2:09 **194.003** Multi-Class Pattern Classification Discriminates Young Males and Females with Autism Spectrum Disorder Based on Cortical Morphology

H. Hosseini[1], *A. Annapureddy*[1], *L. Libero*[2], *J. K. Lee*[2], *N. Sharma*[3], *C. C. Coleman*[4], *D. G. Amaral*[2], *F. Hoeft*[5] *and C. W. Nordahl*[2], *(1)Psychiatry and Behavioral Sciences, School of Medicine, Stanford University, Stanford, CA, (2)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (3)Psychiatry and Behavioral Sciences, University of California at Davis, MIND Institute, Sacramento, CA, (4)Department of Psychiatry & Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, University of California, Davis, Sacramento, CA, (5)Psychiatry, UCSF School of Medicine, San Francisco, CA*

Background: Autism spectrum disorder (ASD) is diagnosed much more frequently in males than in females. One prevailing theory for explaining the male bias in ASD is the multifactorial liability model, which suggests that multiple liability factors shift the vulnerability threshold for ASD higher in females, such that a smaller proportion of females reach clinical diagnosis. One prediction from this model is that females with ASD will exhibit a higher liability of neural alterations and will deviate further from typically developing (TD) females than their male counterparts. There is growing evidence supporting distinct pattern of neural alterations in females with ASD in older individuals, but studies of very young children are lacking.

Objectives: We utilized cortical surface area, thickness, and volumetric measurements to evaluate within- and between-sex and diagnosis differences in a large cohort of preschool-aged children with ASD and TD controls.

Methods: We acquired structural T1-weighted MRIs in 213 children with ASD (150 male, 63 female) and 101 age-matched TD controls (54 male, 47 female). Mean age at time of MRI acquisition was 39 months. Cortical reconstruction and volumetric segmentation were performed within FreeSurfer v5.1.0. Cortical gray matter volumes, cortical thicknesses and surface areas were extracted for 68 gyral regions (Desikan-Killiany atlas). A multi-class linear discriminant model was used to identify patterns of brain regions that discriminate between sex and diagnosis (ASDf, ASDm, TDf, TDm). The validity of the model was tested using a leave-four-out cross-validation (leave one sample from each and every of the four groups out) to avoid overfitting with biased sample size. This process also allowed the training and test cases to remain independent. Finally, permutation analysis was performed to empirically determine if the obtained classification accuracy was significantly greater than chance. We report: (1) classification accuracy of test sets, (2) feature weights that contributed to the classification, and (3) the overlap and non-overlap in brain regions across different comparisons.

Results: Our preliminary results suggest that the multi-class linear discriminant model could achieve an accuracy of 47.2% which was significantly higher than chance (p = 0.001, null accuracy = 27.4%). Interestingly, the two most-discriminant vectors for the multiclass model distinguished sex and diagnosis, respectively (Figure 1). Regions specific to diagnosis comparison (ASD vs. TD) included regions in neural systems related to understanding mental states of others, expressive language and reception of facial communication (right temporal pole, bilateral lateral occipital, bilateral fusiform) as well as bilateral transverse temporal, left entorhinal, and superior parietal lobule. Regions specific to sex comparison included right pars triangularis, posterior cingulate, superior temporal sulcus, and left lingual gyrus. Regions overlapping across sex and diagnosis comparison included bilateral middle frontal gyurs, left rostral anterior cingulate, precuneus, and inferior temporal gyri. Surface area measures contributed the most to the classification.

Conclusions: These preliminary data suggest that females and males with ASD have patterns of cortical alterations that are distinguishable from TD males and females. In addition, neural patterns of diagnostic differences are more pronounced in females than in males, providing support for the multifactorial liability model.

2:21 **194.004** Genetic and Environmental Influences on Cortico-Striato-Thalamo-Cortical Circuits in Twins with Autism

J. P. Hegarty[1], *M. Gu*[2], *D. M. Spielman*[2], *S. C. Cleveland*[1], *J. F. Hallmayer*[1], *L. C. Lazzeroni*[1], *M. M. Raman*[1], *T. W. Frazier*[3], *J. M. Phillips*[1], *A. L. Reiss*[1] *and A. Y.*

Hardan[1], (1)Psychiatry and Behavioral Sciences, Stanford University, Stanford, CA, (2)Radiology, Stanford University, Stanford, CA, (3)Autism Speaks, New York, NY

Background:

Cortico-striato-thalamo-cortical (CSTC) circuits are involved with carrying out goal-directed behaviors and disruption of these pathways is associated with aberrant behaviors, such as obsessive thinking and repetitive behaviors. The structures that comprise these circuits include cortical (orbitofrontal (OFC) and anterior cingulate (ACC) cortices), striatal (caudate, putamen, and globus pallidus), and thalamic regions. Although limited, investigations of individuals with autism spectrum disorder (ASD) support a potential relationship between abnormalities in these regions and restricted and repetitive behaviors (RRB).

Objectives:

The goal of the current investigation was to examine CSTC regions in twins with and without ASD to determine whether abnormalities in these circuits are related with RRB symptoms and associated with genetic or environmental influences.

Methods:

Data were acquired as part of a large-scale neuroimaging study of same-sex twin pairs that included monozygotic (MZ) and dizygotic (DZ) twins with ASD and typically-developing (TD) control twins. Measures of autism-related symptom severity included the Social Responsiveness Scale (SRS) and Repetitive Behavior Scale-Revised (RBS-R). A structural T1-weighted spoiled grass gradient recalled (SPGR) 3D MRI was acquired on a 3 Telsa GE scanner and cortical reconstruction/segmentation was performed using FreeSurfer. Morphometric differences between groups were examined with mixed effects models and correlations between regional measurements and RRB symptoms were assessed. Additionally, intra-class correlations (ICC) were compared between MZ and DZ twin pairs. ACE and AE models for broad sense heritability (a^2=additive genetics) and environmental influences (c^2=shared family environment, e^2=unique environment) were then calculated to provide an estimate of the proportion of variation associated with genetic/environmental factors.

Results:

In this preliminary analysis, valid segmentations were available from 48 twin pairs with ASD (21 MZ/27 DZ) and 33 TD pairs (19 MZ/14 DZ). The ASD and TD samples included children and adolescents (age range: 6-15 years) that were adequately matched as there were no group differences in age or gender, p>0.05. Examining volumes of CSTC regions, the largest differences were found in striatal regions with larger volumes in ASD compared to TD, particularly the putamen (M_{ASD}= 6350.32,SD= 769.94; M_{CTRL}= 6040.69,SD= 589.86; p<0.001). Within twin pairs discordant for ASD, there were additional indications of volumetric abnormalities with larger volumes in cortical regions, such as the ACC (M_{ASD}= 2761.50,SD= 524.31; M_{CTRL}= 2562.67,SD= 575.35; p<0.007), but smaller volumes of thalamic regions, (M_{ASD}= 8174.92,SD= 1232.92; M_{CTRL}= 8837.24,SD= 863.91; p<0.007). Additionally, CSTC volumes were associated with RRB symptoms (e.g., OFC and RBS-R Restricted Behaviors, r=0.29, p=0.009). Finally, genetic factors accounted for the largest proportion of variance in the size of striatal and thalamic regions (~0.60-1.00) but exerted less influence on some cortical structures (~0.20-1.00), with potentially relevant differences between twins with ASD and controls.

Conclusions:

Consistent with previous reports, preliminary data from this investigation indicate that children and adolescents with ASD exhibit volumetric abnormalities in CSTC circuits, which may be associated with RRB symptom presentation. More importantly, comparisons between twin pairs indicate that genetic susceptibility for ASD, as opposed to environmental factors, likely influence abnormalities in striatal and thalamic structures but that environmental factors may exert more influence on prefrontal cortex abnormalities.

Oral Session - 14B
Brain Structure (MRI, neuropathology)
195 - Brain Structure: General Neuropathology & Case-level Prediction
2:40 PM - 3:30 PM - Jurriaanse Zaal

2:40 **195.001** Reduced Ratio of Inner to Outer Surface Area of the Brain in Autism Spectrum Disorders (ASD)

***C. Mann**[1], A. Bletsch[1], D. S. Andrews[2], E. Daly[3], C. M. Murphy[3], M. Gudbrandsen[3], D. G. Murphy[4] and C. Ecker[1,3], (1)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (2)Department of Psychiatry and Behavioral Sciences, The Medical Investigation of Neurodevelopmental Disorders (MIND) Institute, UC Davis School of Medicine, University of California Davis, Sacramento, CA, (3)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (4)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

The neuroanatomy of ASD is both complex and multifaceted, affecting multiple aspects of the neural architecture *in vivo* (Ecker, 2017). Among others, neuroanatomical abnormalities in ASD also include differences in cortical folding (e.g. Wallace et al., 2013; Ecker et al., 2016, Schaer et al., 2013). While several different mechanisms have been suggested to mediate cortical folding (for review see Lewitus et al., 2013), there is evidence to suggest that local gyrification is driven by a differential expansion of upper vs. lower neural layers (Richman et al., 1975; Kriegstein et al., 2006). This hypothesis is also of relevance to recent genetic investigations suggesting that ASD-related genes are not equally expressed across all cortical layers, but predominantly affect the superficial cortical layers (e.g. Parikshak et al., 2013).

Objectives:

The present study therefore aimed to establish whether the ratio of the inner to outer surface area ($R_{outer:inner}$) of the brain significantly differs in ASD individuals from neurotypical controls during childhood and adolescence.

Methods:

73 right-handed males with ASD (diagnosed using ADI-R (Lord et al., 1994)), and 75 neurotypical controls, aged 8-25 years were recruited and assessed at the Institute of Psychiatry, Psychology, and Neuroscience, King's College, London. Both groups were matched for age, handedness, and full-scale IQ. For all 148 participants, high-resolution structural T1-weighted volumetric images were acquired.

Cortical surface models were derived using the FreeSurfer image analysis suite (http://surfer.nmr.mgh.harvard.edu/). The $R_{outer:inner}$ was calculated as the ratio of inner (i.e. white matter) to outer (i.e. grey matter) surface area. Parameter estimates for $R_{outer:inner}$ were estimated by regression of a general linear model (GLM) at each vertex with (1) group as categorical fixed-effects factor, (2) linear age, as well as an age-by-group interaction, and (3) FSIQ as continuous covariate. Corrections for multiple comparisons across the whole brain were performed using random-field theory (RFT)-based cluster-corrected analysis for non-isotropic images using a p=0.05 (two-tailed) cluster significance threshold.

Results:

There were no significant group differences in age [$t(146) = -1.69$, $p = 0.09$], or FSIQ [$t(146) = 1.77$, $p = 0.08$] between ASD individuals and controls. We found that $R_{outer:inner}$ was significantly decreased in ASD individuals relative to controls in several clusters, which predominantly included prefrontal and temporal regions. Moreover, we observed significant age-by-group interactions in the (1) right middle temporal gyrus, (2) left anterior cingulate cortex, and in the (3) right superior cortex (RFT based cluster corrected, $p<0.05$). In addition, ASD individuals also had significantly reduced vertex-wise measures of absolute inner and outer surface area compared to healthy controls.

Conclusions:

Our findings suggest that a differential expansion of the inner and outer surface area in the brain of individuals with ASD may mediate the differences in local gyrification that have previously been reported in the condition. The $R_{outer:inner}$ might also be used to guide future studies into the genetic and molecular underpinnings of ASD, and for the stratification of ASD individuals into biologically more homogeneous subgroups.

2:52 **195.002** Examining Associations between Brain Morphology and Social Function in ASD, ADHD, OCD, and Typical Development Using Machine Learning: Analysis of Pond Network Data

A. Kushki[1,2], *M. Komeili*[3], *S. Panahandeh*[4], *E. Anagnostou*[5] *and J. P. Lerch*[6], *(1)Bloorview Research Institute, Toronto, ON, Canada, (2)Institute of Biomaterials and Biomedical Engineering, University of Toronto, Toronto, ON, Canada, (3)University of Toronto, Toronto, ON, Canada, (4)Institute of Biomaterials and Biomedical Engineering, University of Toronto, Vaughan, ON, Canada, (5)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (6)Mouse Imaging Centre, Hospital for Sick Children, Toronto, ON, Canada*

Background: There is significant variability in biology and behavior *within* the autism spectrum. At the same time, autism spectrum disorder (ASD) shares biological and behavioral traits with other neurodevelopmental disorders including attention deficit/hyperactivity disorder (ADHD) and obsessive compulsive disorder (OCD). This challenges existing diagnostic categories and motivates a diagnosis-agnostic and data-driven approach to characterizing variability across the autism spectrum and related neurodevelopmental disorders.

Objectives: The objectives of this study were two-fold: 1) characterize variability in brain-behaviour associations across ASD, ADHD, OCD, and typical development (TD) using a data-driven and diagnosis-agnostic approach, and 2) examine whether or not diagnostic labels are associated with distinct brain-behaviour patterns.

Methods: Data from a sample of 218 participants in the POND Network studies were used for analysis (n_{ASD}=104, age:11.3±2.7; n_{ADHD}=62, age:10.9±2.5; n_{OCD}=35, age:12.1±2.3; n_{TD}=17, age:10.9±2.7). Brain data included cortical thickness measurements from 76 regions of the brain obtained using the CIVET pipeline, and corrected for total brain volume, age, and site. Behavioural data were total scores on the Social Communication Questionnaire (SCQ). Analyses were performed using a novel machine learning pipeline comprising two steps: 1) a feature selection step, using sequential feature forward selection, to determine the brain regions whose variability best aligned with that of the behavioural data, and 2) discovery of clusters that were aligned across brain and behaviour data using co-regularized multi-view spectral clustering. To ensure stability of the found patterns, the analyses were run on 500 random partitions of the data, each including 90% of the participants. Only participants who were assigned to the same cluster over 50% of the time (significantly higher than chance) were considered connected in the final analysis.

Results: The results revealed a complex pattern of brain-behaviour association, characterized by a many-to-many mapping. Five groups emerged based on clustering. Cluster boundaries were not crisp for groups 2-5. Groups generally contained participants from all diagnostic categories (% dx (ASD:ADHD:OCD:TD): group 1 - 37:3:6:0, group 2- 23:19:9:6, group 3- 35:18:6:6, group 4- 4:29:34:29, group 5- 2:31:46:59). The groups differed significantly on SCQ scores and IQ (p<0.0001), but not age. Group 5 had the lowest SCQ score and the highest IQ, whereas group 1 had the highest SCQ and lowest IQ. There were also significant group differences in cortical thickness in the left lingual gyrus and the right precuneus, the two regions that best aligned the brain and behavioural data (p<0.0001). Three groups with the largest proportion of ASD participants (35%, 37%, and 23%) showed varying SCQ scores (16.5+4.4; 26.9+3.1; 13.9+4.7) and cortical thickness values (Lingual gyrus (z-score): 0.4+0.1; -0.2+1.0;-0.7+0.7).

Conclusions: Examining brain and behavioural data from a sample of children with neurodevelopmental disorders, this study revealed a complex and many-to-many association among cortical thickness and social function measured by the Social Communication Questionnaire. The results suggests that brain-behaviour patterns are shared among ASD and ADHD, OCD, and typical development, supporting biological and behavioural overlap among these disorders, as well as a a dimensional model of traits that extends into typical development.

3:04 **195.003** Neurite Orientation Dispersion and Density Imaging in Autism Spectrum Disorders

D. C. Dean[1], *J. Villaruz*[1], *A. Freeman*[1], *N. Adluru*[1], *K. Kellett*[1], *K. Kane*[1], *J. B. King*[2], *M. B. Prigge*[2], *B. A. Zielinski*[2], *J. S. Anderson*[3], *J. Taylor*[2], *S. Schrodi*[4], *N. Matsunami*[2], *E. Bigler*[5], *M. Leppert*[2], *N. Lange*[6], *J. E. Lainhart*[1] *and A. L. Alexander*[1], *(1)University of Wisconsin - Madison, Madison, WI, (2)University of Utah, Salt Lake City, UT, (3)Radiology and Imaging Sciences, University of Utah, Salt Lake City, UT, (4)Marshfield Clinic Research Institute, Marshfield, WI, (5)Brigham Young University, Provo, UT, (6)McLean Hospital, Cambridge, MA*

Background: Diffusion tensor imaging (DTI) is an integral neuroimaging technique to assess white matter microstructure and has been influential to the study of white matter alterations in ASD. However, one of the major limitations of DTI is that the quantitative measures estimated via this technique are inherently non-specific; that is, a variety of microstructural or biochemical processes could lead to similar DTI parameter estimates. As a result, the ability to identify specific microstructural features using DTI is limited. Biophysical modeling techniques, such as neurite orientation dispersion and density imaging (NODDI), may improve the level of microstructure specificity available and thus could provide new insights into the microstructural changes observed in ASD.

Objectives: We sought to investigate, for the first time, white matter microstructural differences between individuals with and without a ASD diagnosis using the NODDI imaging technique.

Methods: Participants for this study consisted of 108 individuals between 5 and 42 years of age, 41 of which were diagnosed with ASD. A threeshell diffusion weighted imaging (DWI) protocol was acquired with b-values of 350, 800, and 2000 s/mm^2 at 63 non-collinear diffusion encoding directions on a 3.0 Tesla GE MR750 scanner. Following acquisition, DWI images were corrected for eddy-current distortions and head motion and subsequently fit to the NODDI model, yielding parameter maps of intracellular and isotropic volume fractions (v_{IC}, v_{ISO}, respectively), and orientation dispersion index (ODI). These maps were nonlinearly aligned to a population specific template using DTI-TK, while permutation testing adjusted by age and a threshold free clustering approach was used to examine voxelwise differences between the ASD and typical development (TD) groups.

Results: Comparison of NODDI measures yielded widespread differences between the ASD and TD groups (Fig. 1). Specifically, TD controls were observed to have higher v_{IC} within regions including the internal capsules, thalamus, brain stem and pons ($p<0.05$, TFCE-adjusted). Differences in ODI were mixed. For example, controls were observed to have higher ODI with deep white matter areas, such as the internal capsules and brain stem, while the ASD group was observed to have higher ODI in more peripheral white matter, including the genu of the corpus callosum, and regions of parietal white matter ($p<0.05$, TFCE-adjusted). Isotropic volume fraction was observed to be higher in the ASD group extensively across the brain ($p<0.05$, TFCE-adjusted).

Conclusions: Our preliminary findings suggest a reduction of v_{IC} and ODI in regions of the internal capsules, thalamus and brain stem within the ASD group, while having increased ODI and v_{ISO} in more widespread brain regions. These findings agree well with the current DTI literature that describe alterations of white matter microstructure associated with ASD, while also suggesting the possibility that these white matter alterations may stem from alterations to the neurite architecture, such as decreased neurite density and/or increased white matter angular dispersion. Future analyses will investigate the age-related relationships of these neurobiological changes and the behavioral processes that may be involved with these alterations.

3:16 **195.004** Towards Personalized Medicine in Autism Diagnosis: Anatomical Abnormalities Analysis Using a Deep Learning Based Approach

O. Dekhil[1], *M. Ghazal*[2], *A. Shalaby*[3], *A. Switala*[4], *A. S. El-Baz*[4], *A. Khalil*[5] *and G. Barnes*[6], *(1)Bioengineering, university of Louisville, Louisville, KY, (2)Electrical and Computer Engineering, Abu Dhabi University, Abu Dhabi, United Arab Emirates, (3)Bioengineering, University of Louisville, Louisville, KY, (4)University of Louisville, Louisville, KY, (5)Information Technology and Computer Science, Abu Dhabi University, Abu Dhabi, United Arab Emirates, (6)University of Louisville School of Medicine, Louisville, KY*

Background: Background. Autism spectrum disorder (ASD) is a neurodevelopmental syndrome that affects both communication and social interaction. Although there is no well-defined cause of ASD, there are many proposed theories and hypotheses aiming to explain ASD causes; for example structural abnormalities, connectivity abnormalities and functional activation are widely studied.
Objectives: In this study data from structural MRI (sMRI) was used to identify anatomical characteristics distinguishing ASD from typically developing (TD) subjects in a demonstration of Sight software for computer-assisted diagnosis (CAD) of ASD, developed at our laboratory.

Methods: The Sight processing pipeline begins by isolating the brain from a T1-weighted MRI using Fsl Bet with post-processing to validate the result. The test brain is aligned with a library of previously segmented data, which are used to derive prior shape information to guide the segmentation of the cerebral cortex. A triangulated mesh of the cortical surface is output. Mesh vertex coordinates are re-parameterized in terms of spherical polar coordinates in order to analytically approximate the surface by spherical harmonic series. Three shape descriptors are obtained per Brodmann area: (a) truncation error as a function of order of spherical harmonic approximation, (b) distribution of mean curvature, and (c) distribution of Gaussian curvature. Features are input to a stacked autoencoder, producing higher-order representations, which are input to a second network with a softmax classification layer, trained to recognize features consistent with ASD on a local level. The higher-order representations from all areas are also concatenated for input to another classifier to obtain the overall decision. The Sight classifier was trained and tested using scans of 202 individuals downloaded from the National Database for Autism Research (NDAR), 78 of whom were diagnosed with ASD.

Results: ASD and TD subgroups both ranged in age from 7 to 17 years, and had similar proportions of male and female individuals. Using two-fold cross validation the Sight software correctly classified 78 of 78 ASD cases and 90 of 124 TD cases. Some brain regions were found to have significant influence on classification. Using supramarginal gyrus, pars triangularis, or inferior prefrontal gyrus, to the exclusion of all other regions, produced classifiers with 76%, 77%, and 79% accuracy, respectively. The most influential areas are highly correlated with functional deficits in autism, such as speech and syntax processing and emotional responses.

Conclusions: Sight is an important step towards personalized medicine, where each localized brain region is studied separately to allow better way to allocate each subject on the autism spectrum and enables better prediction to the affected brain functionality based on the affected areas, but expansions to the framework are already in progress to: (1) incorporate dwMRI- and fMRI-based descriptors into a multimodal CAD system that can better resolve ASD endophenotypes and (2) distinguish ASD from other disorders such as childhood epilepsy.

Tech demo. There will be live demonstration of Sight CAD software. All procedure steps from segmentation to report generation will be performed, and intermediate output will be available for inspection.

Oral Session - 15A
Interventions - Pharmacologic
196 - Pharmacological Interventions in ASD and Related Conditions (need to verify title)

1:45 PM - 2:35 PM - Arcadis Zaal

1:45 **196.001** Long-Term Efficacy and Safety of Pediatric Prolonged-Release Melatonin for Insomnia in Children with Autism Spectrum Disorder

A. Maras[1], *B. A. Malow*[2], *T. Nir*[3], *N. Zisapel*[3] *and P. Gringras*[4], *(1)Yulius Academy, Yulius Mental Health Organization, Barendrecht, Netherlands, (2)Sleep Disorders Division, Department of Neurology, Vanderbilt University Medical Center, Nashville, TN, (3)Neurim Pharmaceuticals, Tel Aviv, Israel, (4)Children's Sleep Medicine, Evelina London Children's Hospital, Guy's and St Thomas', London, United Kingdom*

Background: A recent double-blind randomized placebo-controlled study demonstrated 3-months' efficacy and safety of novel pediatric-appropriate prolonged-release melatonin minitablets (PedPRM; 2/5 mg) vs. placebo in children and adolescents with Autism Spectrum (ASD) and Neurogenetic Disorders (NGD) suffering from insomnia.

Objectives: To investigate the long term maintenance of PedPRM efficacy, safety and dosing in patients receiving 1 year of study medication.

Methods: A prospective 9-months open-label follow up study of efficacy and safety of PedPRM in community dwelling patients with ADS/NGD. Sleep measures included the validated caregivers' Sleep and Nap Diary (SND) and Composite Sleep Disturbance Index (CSDI).

Results:

95 patients aged 2-17.5 years [mean age 9 ± 4.24, 74.7% males] who completed the 3 months double-blind trial (51 from PedPRM arm and 44 from the placebo arm) received open-label PedPRM at final 2/5 mg dose with optional dose adjustment to 2-10 mg/day after 3 months. By the end of the follow up period, 41 of the PedPRM randomized group completed 1 year of PedPRM and 38 of the placebo randomized group completed 9 months of PedPRM. The improvements in total sleep time (TST), sleep latency (SL) and duration of uninterrupted sleep (longest sleep episode) seen in the double blind-phase were maintained throughout the follow up period with mean improvement of 44.35 minutes in TST($p=0.002$), -41.36 minutes in SL ($p<0.001$) and 78.63 minutes in uninterrupted sleep ($p<0.001$) over baseline. In addition, CSDI measured sleep disturbance and parent satisfaction of their child's sleep patterns, were significantly improved ($p<0.001$ for both). There was no evidence of tolerance to PedPRM. Overall 75% of patients in the 9 months follow up had clinically relevant improvement in TST of 45 minutes or more, or reduction in sleep latency of 15 minutes or more, or both, compared to 69% by the end of the DB phase. Of the 71 completers who provided SND data, 53 (75%) achieved an overall improvement of one hour or more in TST, SL or both, over baseline. The average daily dose was 5.3 mg (range 2-10 mg). PedPRM was generally safe; daytime somnolence was more commonly reported treatment-related adverse event, with PedPRM than placebo.

Conclusions:

PedPRM is an effective and safe treatment option for long term treatment of children with ASD suffering from insomnia.

1:57 **196.002** Antidepressants Modulate Brain Activation Differently in Autism Compared to Controls

R. H. Wichers[1], *J. Findon*[2], *V. Giampietro*[3], *V. Stoencheva*[1], *C. M. Murphy*[1], *G. M. McAlonan*[2], *C. Ecker*[4], *K. Rubia*[5], *D. G. Murphy*[6] *and E. Daly*[1], *(1)Department of Forensic and Neurodevelopmental Sciences, and the Sackler Institute for Translational Neurodevelopment, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (2)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom, (3)Department of Neuroimaging, Institute of Psychiatry, Psychology, and Neuroscience, King's College London, London, United Kingdom, (4)Department of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy, Goethe-University Frankfurt am Main, Frankfurt, Germany, (5)Department of Child and Adolescent Psychiatry, King's College London, Institute of Psychiatry, Psychology and Neuroscience, London, United Kingdom, (6)Department of Forensic and Neurodevelopmental Sciences, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom*

Background:

Individuals with autism spectrum disorder (ASD) often suffer from psychiatric comorbidities such as anxiety and depression. Current treatments for these conditions are identical to those in neurotypical populations and include selective serotonin reuptake inhibitors (SSRIs). The effectiveness of SSRIs in ASD is controversial as; 1) limited treatment response and increased adverse events have been reported (Williams et al. 2013), and 2) disruptions in the serotonergic system have been widely described. Furthermore, we demonstrated that reducing serotonin by acute tryptophan depletion normalizes brain function abnormalities in ASD (Daly et al. 2014). Therefore, treatment with an existing drug that reduces serotonin - such as the selective serotonin reuptake enhancer (SSRE) tianeptine - may be more appropriate. Furthermore, it has been suggested that differences in the serotonergic system may underlie altered neurocognitive function in ASD. Hence, investigating the modulating role of serotonergic antidepressants on neurocognitive functions in ASD may help to explain the differences in treatment response, which could lead to better tailored interventions.

Objectives:

To test the effect of the SSRI citalopram and the SSRE tianeptine, on sustained attention and inhibitory networks in ASD.

Methods:

Nineteen right-handed adult males with ASD (diagnosed using the ADI-R and ADOS) and 19 typically developed controls (TD) were included. Pharmacological magnetic resonance imaging (phMRI) was used to compare brain activity during a sustained attention task and a Go/No-Go task under an acute dosage of 20 mg citalopram, 12.5 mg tianeptine and placebo in a randomized, double-blind, crossover procedure. The phMRI data were analyzed using a nonparametric approach (c.f. http://brainmap.it) and significance was defined as $p <.05$ (corrected for multiple comparisons).

Results:

There were significant interaction effects of BOLD signal response between drug status (placebo, citalopram and tianeptine) and group (TD, ASD) during both the sustained attention and Go/No-Go task. During sustained attention both citalopram and tianeptine significantly downregulated brain activation in the right thalamus in the control group. In contrast, both drugs upregulated brain activation in the right thalamus in individuals with ASD. During response inhibition both citalopram and tianeptine decreased brain activation in the anterior cingulate cortex in the control group whereas both drugs increased brain activation in ASD.

Conclusions:

Our findings support the evidence that antidepressant treatments commonly used in neurotypical populations may not be as 'translatable' to individuals with ASD as currently assumed. Thus, pharmacological interventions affecting the serotonergic system need to be tested specifically in the ASD population.

2:09 **196.003** Bumetanide to Ameliorate Hyperexcitable Behavior in Tuberous Sclerosis Complex

D. M. van Andel[1], *C. Vlaskamp*[2], *J. J. Sprengers*[1], *F. E. Jansen*[3], *B. Oranje*[2] *and H. Bruining*[4], *(1)Brain Center Rudolf Magnus, Department of Psychiatry, UMC Utrecht, Utrecht, Netherlands, (2)Department of Psychiatry, Brain Center Rudolf Magnus, NICHE Lab, University Medical Center Utrecht, Utrecht, Netherlands, (3)Department of Child Neurology, Brain Center Rudolf Magnus, University Medical Center Utrecht, Utrecht, Netherlands, (4)Brain*

Centre Rudolf Magnus, Amsterdam, Netherlands

Background:
Selective treatment in Autism Spectrum Disorder (ASD) may be based on genetic or molecular information. Here we present a rational treatment for tuberous sclerosis complex (TSC), a monogenetic disorder strongly associated with ASD. Preclinical studies have identified signs of excitatory $GABA_AR$ transmission in tubers and perituberal cortex of TSC patients indicating disturbed chloride homeostasis. These imbalances may be a common mechanistic pathway and underlie the observed (hyper)excitability in these neurodevelopmental disorders. Bumetanide, a selective NKCC1 antagonist, may enhance GABAergic transmission by correcting intracellular chloride concentration. We present results of an open-label trial testing the effect of bumetanide on behavior, cognition, resting state EEG and event related potentials (ERP) in a sample of children with TSC with and without formal ASD diagnosis.

Objectives:

Open label trial testing bumetanide to improve behavioral, cognitive and neurophysiological adaptation in TSC patients.

Methods:

Add-on open-label trial in which 12 TSC patients (aged 8-21) were treated with bumetanide for 3 months, followed by a 1-month wash-out phase. Treatment effect was evaluated by a broad range of behavioral and cognitive endpoints, including autism symptom questionnaires. Novel advanced electroencephalography (EEG) markers were where possible used to objectify treatment effect and to identify candidate prognostic biomarkers.

Results:

An overall beneficial effect on behavioral functioning was obtained, that could be substantiated by individual EEG parameters in several cases. Improvements were analyzed in relation to EEG markers of hyperexcitability and sensory processing abnormalities.

Conclusions:

(Add on) bumetanide treatment is a novel treatment consideration to improve daily functioning for patients with TSC. Improvement in neural imbalances and sensory reactivity may indicate overlap in common treatment targets between TSC and idiopathic ASD.

2:21 **196.004** A RCT of Tideglusib Vs Placebo: Data from the Pond Network

E. Anagnostou[1], *R. Nicolson*[2] *and T. Bennett*[3], *(1)Holland Bloorview Kids Rehabilitation Hospital, Toronto, ON, Canada, (2)University of Western Ontario, London, ON, Canada, (3)Offord Centre for Child Studies, McMaster University, Hamilton, ON, CANADA*

Background:
Molecular pathways and neuropathology findings implicated in ASD suggest abnormalities in postsynaptic elements and postsynaptic protein synthesis among others. Several rare but highly penetrant mutations recently associated with ASD have targets in the postsynaptic space, with certain pathways being modulated by GSK-3 activity (e.g. ERK, mTOR, Akt)

Tideglusib is a GSK-3β inhibitor. To consider the utility of tideglusib for a heterogeneous disorder such as ASD, we approach the problem by examining its potential effects on single gene syndromes that may be associated with ASD, in addition to examining pathways highlighted by the genomic approach. Pharmacological agents that can deplete GSK-3β such as Tideglusib have been shown to rescue the phenotype of the Fragile X – FMR1 knockout transgenic mouse. Rescued or improved domains included learning and memory, hyperactivity, anxiety and fear conditioning, as well as repetitive behaviors (Franklin et al., 2013) In addition, Tideglusib is brain penetrant and can be orally administered. It has been subject to investigation in Alzheimer's Disease and Progressive Supranuclear Palsy. More than 480 patients have been exposed to tideglusib for more than a year and preliminary results suggest some favorable effects on brain volume and downstream targets (e.g. Höglinger et al., 2014, Martinez et al., 2011). It has been generally well tolerated.

Objectives: TO evaluate the efficacy of tideglusib vs. placebo for the treatment of core symptom domains in adolescents with ASD.

Methods: This is a phase II randomized, placebo controlled, multisite trial. Participants were recruited across 3 sites and were randomized to drug or placebo in 1:1 fashion. Safety was evaluated using the SMURF, safety blood work and ECG. Efficacy was evaluated using the ABC – SW as a primary measure. Secondary measures included the Vineland-II, YBOCS, RBS-R as well as measures of anxiety, sleep and parent chief complaint. pK data was collected using a sparse sampling method. Biomarkers in the AKT-ERK pathway, as well imaging markers were explored.

Results:

83 participants were randomized across 3 sites. Tideglusib was well tolerated with no related serious adverse events reported. One participant was discontinued due to elevated liver enzymes. Final efficacy data as well as pharmacokinetics, pharmacodynamics and biomarkers predicting response will be presented.

Conclusions: Tideglusib, a GsK-3β inhibitor, was well tolerated in adolescents with ASD. Efficacy and biomarker data will also be presented

Oral Session - 15B
International and Cross-Cultural Perspectives
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2:40 PM - 3:30 PM - Arcadis Zaal

2:40 **197.001** Universal Developmental Surveillance for Autism in Infants, Toddlers and Preschoolers: The Social Attention and Communication Study-Revised (SACS-R) and SACS-Preschool

J. Barbaro, *C. Dissanayake and N. Sadka, Olga Tennison Autism Research Centre, La Trobe University, Melbourne, Australia*

Background: Barbaro and Dissanayake (2010) utilised developmental surveillance for the early identification of autism within the Social Attention and Communication Study (SACS), where Maternal and Child Health (MCH) nurses were trained to monitor children for autism during routine, community-based health-checks between 12-24 months. The SACS had a positive predictive value (PPV) of 81%, and estimated sensitivity and specificity of 83.8% and 99.8%, respectively. However, all 20,770 children monitored were not followed-up at a later age to identify any false-negatives.

Objectives: The objectives of the current study were to: 1) improve the SACS' psychometric properties through use of the SACS-Revised (SACS-R) at children's routine, community-based health-checks from 12-24 months; 2) follow-up all children monitored with the SACS-R at 3.5 years to confirm diagnoses and identify false-negatives; and 3) investigate the psychometric properties of the newly added SACS-Preschool (SACS-PR) check at 3.5 years.

Methods: The SACS-R and SACS-PR contain brief checklists of key social-communication markers of autism at 12-, 18-, 24-, and 42-months-of-age, with 200 MCH nurses trained to utilise these checklists during their routine consultations. A total of 13,838 children were monitored on the SACS-R between 12- to 24-months, with all children identified at 'high likelihood' for autism referred for a developmental assessment with the SACS team. Children were assessed by the team every 6 months until 2 years, with gold-standard assessment tools (ADOS-Toddler, Mullen Scales of Early Learning, ADI-R). All children returned at 42 months to confirm diagnoses.

All children monitored by the MCH nurses between 12-24 months were also monitored with the SACS-PR at their 42-month consultation, with all children identified at 'high likelihood' for autism referred to the SACS team for an assessment. Furthermore, children identified as 'low likelihood' who had *any* developmental concerns, including autism, or had a community-based diagnosis of autism, were also referred for assessment with the SACS team to determine/confirm diagnoses.

Results: The nurses identified 323 children at 'high likelihood' for autism (2.3% referral rate) between 12- to 24-months using the SACS-R. Of these, 234 children have been assessed, with 192 children meeting criteria for ASD (82.4% PPV); the remaining children had developmental and/or language delays. Thus, no "true" false positives (typically developing children) were identified using the SACS-R. 72% of 12-month-olds, 82% of 18-month-olds, and 85% of 24-month-olds met criteria for autism, confirmed at 42-months-of-age. Sensitivity and specificity of the SACS-R was 72.3% and 99.6%, respectively, and Negative Predictive Value (NPV) was 97.7%. Nurses are currently monitoring children at their 42-month-check with the SACS-PR; thus, psychometric properties of the SACS-PR will be presented at the conference. Prevalence rates of autism found in the sample so far is 2.7%.

Conclusions: Developmental surveillance using the SACS-R continues to be the most effective method for the early identification of autism available. Its PPV is higher than the original SACS, with excellent NPV, specificity and sensitivity. These data confirm that developmental surveillance using the SACS-R is the most effective way to identify infants and toddlers with autism, with follow-ups using the SACS-PR useful in identifying 'false negatives'.

2:52 **197.002** Pilot Randomised Controlled Trial of the Who Caregiver Skills Training in Public Child Neuropsychiatry Services in Italy

E. Salomone[1,2]*, M. Settanni*[1]*, F. Ferrara*[1]*, A. Salandin*[1]*, T. WHO CST Team*[2]*, T. CST Italy Team*[1] *and C. Servili*[2]*, (1)Department of Psychology, University of Turin, Turin, Italy, (2)Department of Mental Health and Substance Abuse, World Health Organization, Geneva, Switzerland*

Background: Access to publicly-available, evidence-based early intervention for ASD is very limited even in high-income European countries, including Italy. The WHO Caregiver Skills Training (CST) program is evidence-based and meets affordability and feasibility criteria for implementation in public health settings. Following a formative adaptation process and pre-pilot implementation showing good acceptability and appropriateness to the local context, a pilot randomized controlled trial (RCT) of the WHO CST was conducted in rural and low-resourced urban areas in Northern Italy.

Objectives: to examine acceptability and feasibility of community-implemented CST; to pilot RCT processes.

Methods: The study is a two-arm pilot RCT of CST against enhanced treatment as usual (eTAU: one psychoeducation session in addition to TAU). Research assessments are at baseline, 3-month endpoint, and 9-month follow-up. Families were recruited in two waves through public Child Neuropsychiatry Services. Inclusion criteria were: clinical diagnosis of ASD; age 2-5 years; caregiver with sufficient level of Italian language to benefit from the intervention. Following baseline ascertainment (assessments of child autism severity and cognitive ability), participants were randomly assigned to either CST or eTAU on a 1:1 allocation ratio using stratified randomisation by age and autism severity. The CST program was delivered per manual by 6 pairs of local clinicians, who met CST fidelity criteria; CST group size varied from 5 to 8 families. Participation in the program was open to 1-2 caregivers per family; data were collected on the target caregiver/child dyad. Feedback forms and focus groups were used to record the facilitator and caregivers' experience. Main outcomes reported will be caregiver/child interaction data, caregiver self-efficacy, wellbeing, stress and mental health, child language and adaptive behaviour. Analysis will be by intention-to-treat.

Results: A total of 88 caregiver/child dyads were referred to the study; two did not meet the age criterion. The remaining 86 caregiver/child dyads were enrolled and completed baseline assessments. Sample ethnicity was representative of the Regional population; 16% (n=14) were non-Italian. The randomisation was acceptable to families and effective; children in the two groups (CST, n=43 and TAU, n=43) did not differ by age, autism severity or cognitive ability (ps ranged .786-.802). At the time of submission, CST attendance, endpoint and follow-up data were available only for Wave 1 participants (n=44: CST, n=22 and TAU, n=22). In the CST group, 82% of the target caregivers completed at least 75% of the program and 87% reported adherence to home practice. One caregiver/child dyad dropped-out from the CST program; none dropped-out from the study. All data were complete and research assessments were acceptable. Blinding was maintained. Program materials and contents were considered acceptable by caregivers. Facilitators suggested further adaptation of materials to strengthen psychoeducation messages on caregiver wellbeing and stigma reduction.

Conclusions: Preliminary data indicate that the RCT processes were successful; study retention was high in both groups; CST implementation in community setting (attendance rate; feasibility; acceptability) was satisfactory, suggesting that a full study can proceed. Final results, including treatment effects, will be available for presentation.

3:04 **197.003** Effects of Dual-Language Exposure on Language and Executive Function in Children with ASD and ADHD

A. B. Ratto[1]*, L. Anthony*[2]*, M. D. Powers*[3]*, A. Verbalis*[1]*, S. Seese*[1] *and L. Kenworthy*[1]*, (1)Children's National Health System, Washington, DC, (2)University of Colorado, Denver, Aurora, CO, (3)Children's National Health System, Rockville, MD*

Background: Dual-language exposure (DLE) has been linked to advantages in executive functioning (EF), particularly in cognitive flexibility, and reduced single-language vocabulary. However, there has been limited research on the effects of DLE on EF and language skills in clinical populations. Prior research indicates possible detrimental effects of DLE on EF and language skills in adults with ADHD, while DLE has not been shown to significantly impact EF or language skills in children with ASD.

Objectives:To investigate the effects of dual-language exposure on executive functioning and vocabulary in children with ASD and ADHD

Methods: Participants were drawn from a sample of 136 children (ages 8-11 years) from Title I schools, enrolled in a clinical trial of two EF interventions. All children met criteria for ADHD or ASD. Household income differed significantly by language exposure ($t(110)=5.51$, $p<.0001$). Using the case control matching application of SPSS 24, a final sample of 64 children (n=32 DLE) was created, matched on household income (within $5000). There were no significant differences in age, gender, diagnosis, or full-scale IQ on the Wechsler Abbreviated Scales of Intelligence-II (WASI-II) (Table 1). Parent education was significantly lower among DLE children ($t(60)=3.127$, $p=.003$), and thus was controlled for in all subsequent analyses. Vocabulary and EF were assessed using selected subtests of the WASI-II, the Verbal Fluency subtest of the Delis-Kaplan Executive Function System (D-KEFS), the Behavior Rating Inventory of Executive Functioning (BRIEF), and the Flexibility Interference Scale (FIS), a parent rating scale of daily difficulties due to cognitive rigidity.

Results:Hierarchical regression analyses were used to assess differences in EF and language skills by DLE, after controlling for both parent education and child diagnosis, in separate steps. Parent education significantly predicted language skills (WASI-II Vocabulary, F=12.393, p=.001; D-KEFS Category Fluency F=7.328, p=.009), and child diagnosis was associated with language skills at a level approaching significance; however, after controlling for parent education and diagnosis, DLE had no significant effect on language skills (Table 2). After controlling for parent education and diagnosis, DLE was associated with higher EF, including significantly less parent-reported interference from cognitive rigidity on the FIS (F=7.412, p=.009), as well as fewer difficulties with transitions and tolerating change on the BRIEF: Shift subscale (F=3.495, p=.067) and better flexible problem-solving on the WASI-II: Block Design (F=3.668, p=.060), at a level approaching significance (Table 2). After controlling for multiple comparisons, the effects of DLE on the BRIEF: Shift and WASI-II: Block Design were not significant. DLE was not significantly associated with behavioral regulation skills (BRIEF), metacognitive skills (BRIEF), or verbal switching skills (DKEFS; Table 2).

Conclusions: Although concerns about detrimental effects of DLE on language skills are common, the present study adds to prior findings indicating that DLE does not negatively impact language skills in children with neurodevelopmental disorders. Findings also indicate that DLE may have beneficial effects for EF skills in this population, consistent with findings in typically-developing samples. Overall, this study brings into question “common wisdom” that parents of children with neurodevelopmental disorders should limit their children’s exposure to other languages.

3:16 **197.004** Identifying Cultural Differences and Commonalities in Autistic Traits across India, Japan and the UK Using the Autism-Spectrum Quotient (AQ)

S. Carruthers[1], *E. Kinnaird*[2], *A. Rudra*[3], *P. Smith*[4], *C. Allison*[5], *B. Auyeung*[6], *B. Chakrabarti*[7], *A. Wakabayashi*[8], *S. Baron-Cohen*[5], *I. Bakolis*[2] *and R. A. Hoekstra*[9], *(1)King's College London, London, United Kingdom of Great Britain and Northern Ireland, (2)King's College London, London, United Kingdom, (3)Psychology, Ben Gurion University of the Negev, Beer Sheva, Israel, (4)University of Cambridge, Cambridge, United Kingdom, (5)Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge, United Kingdom, (6)University of Edinburgh, Edinburgh, United Kingdom, (7)Centre for Autism, School of Psychology & Clinical Language Sciences, University of Reading, Reading, United Kingdom, (8)Chiba University, Chiba, Japan, (9)Department of Psychology, King's College London, London, United Kingdom*

Background: There is a global need for brief open-source screening instruments that can identify “red flags” for autism spectrum disorder (ASD) and support frontline professionals in their referral decision-making (Durkin et al., 2015). Though generally believed to be a universal disorder, there may be subtle differences in identification or reporting of ASD symptoms across cultures. In order to assess the potential for any measure to be adapted for cross-cultural screening use, it is important to understand the relative performance of such measures in different cultures.

Objectives: Our study aimed to identify and compare the items on the Autism-Spectrum Quotient (AQ)-Child (Auyeung et al., 2008) most predictive of an ASD diagnosis among children aged 4-9 years across different samples from India, Japan and the UK.

Methods: Parent-reported AQ-Child data were collected from 73 children with a formal ASD diagnosis and 81 neurotypical children from India (previously reported in Rudra et al., 2014); 116 ASD and 190 neurotypical children from Japan (data not previously reported), and 488 ASD and 532 neurotypical children from the UK (some data previously reported in Allison et al., 2012). None of the children included had a reported diagnosis of intellectual disability. Participants from each country were randomly allocated to derivation and validation samples. For each item, Discrimination Indices (DI) and Positive Predictive Values (PPV) were calculated using the derivation and validation samples respectively. Items surpassing a discrimination index (DI) threshold of 0.5 and a positive predictive value (PPV) of 0.7 within each country were considered highly discriminative for that culture. Such items were compared across cultures. The psychometric validity of the “red flag items” was assessed using Receiving Operating Curves (ROC curves), discriminant analysis, Cronbach’s alpha and Pearson’s correlation coefficient.

Results: 16 items in the Indian sample, 15 items in the Japanese sample and 28 items in the UK sample demonstrated excellent predictive ability of an ASD diagnosis. Five items surpassed the high discrimination threshold ($DI \geq 0.5$, $PPV \geq 0.7$) in all three samples. One item (‘When s/he talks, it isn’t always easy for others to get a word in edgeways’) was highly discriminative in Japan but poorly discriminative ($DI<0.3$) in the UK and India, and a further item (S/he enjoys doing things spontaneously) had excellent discrimination properties in the UK but poorly discriminated in the Indian and Japanese samples. Two additional items were highly discriminative in two cultures but poor in the third.

Conclusions: In a cross-cultural study of children with intelligence in the normal range, there was cross-cultural overlap in the items most predictive of an autism diagnosis, supporting the notion of global universality in autistic traits and the possibility of adapting an existing tool for cross-cultural screening. Subtle cultural differences were suggested in four items, which may be related to contrasting sociocultural values and attitudes such as social conformity and uncertainty avoidance (Hofstede, 2001). These findings can inform the development of a brief “red flag” global screening tool for ASD.