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Co-design of technological tools and co-creation of intervention strategies to promote a healthy lifestyle: an Italian case study

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Abstract

Purpose – This paper aims to describe the case study carried out in Italy as part of the HealthyW8 project. In particular, it describes the methodology used in the participatory workshops held in Italy in 2023–2024 and the results obtained.

Design/methodology/approach – Using design thinking and user-centred design methodologies, the workshops aimed to develop intervention strategies and digital tool functionalities suitable for different user needs and local contexts.

Findings – Intervention strategies identified by the Italian stakeholders included the development of tools (e.g. corporate bonuses, reward schemes and applications) that encourage healthy living and physical activity and the creation of educational cartoons that address healthy lifestyles, diets and physical activity. The study underlined the importance of multi-level interventions combining education, public policy and user-centred technological innovations.

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Originality/value – Stakeholders also suggested innovative digital tool functionalities such as the integration with existing shopping list apps to streamline healthy food planning and the connection to real-life community-building events to promote active participation.

Keywords User-centred design, Healthy lifestyle, Obesity prevention, Participatory workshops

Paper type Research paper

1. Introduction

Obesity is a chronic health condition characterized by an excessive accumulation of body fat; it is a significant risk factor for many chronic diseases, including cardiovascular diseases (CVDs), hypertension (Seravalle and Grassi, 2017), type 2 diabetes (T2DM), anxiety, depression and cancer (Abdullah *et al.*, 2010) and is strongly associated with all-cause mortality (Di Angelantonio *et al.*, 2016; Masters *et al.*, 2013; Prospective Studies Collaboration, 2009).

Globally, the prevalence of excessive body weight has been steadily growing for decades in both high- and low-income countries, although at different rates (Williams *et al.*, 2015). The WHO assesses that 2.5 billion (43%) people are above the normal weight range, with 16% falling into the obese category. Since 1990, adult obesity rates have doubled while adolescent obesity rates have quadrupled, which is particularly concerning (Simmonds *et al.*, 2016).

In Italy, obesity is diagnosed according to WHO criteria based on body mass index (BMI); a BMI of 30 or greater is classified as obesity, whereas a BMI in between 25 and 30 is considered overweight. According to this definition, the percentage of Italian people who are classified as overweight is 32%, whereas 10.4% fall into the obese category (Masocco *et al.*, 2023).

Obesity treatment goals must be individualized, addressing underlying causes and supporting and guiding behavioural change while considering pharmacological therapies, psychological support and surgical interventions (Wharton *et al.*, 2020). Weight loss should not be the sole focus of the intervention, as obesity is a chronic heterogeneous disease requiring a multifaceted approach (Burki, 2021; Chianelli *et al.*, 2024; Jia and Liu, 2021). Furthermore, according to the literature review, only a small percentage of individuals characterize as obese successfully lose weight and maintain it over time, while a significant number of individuals, as they age, gain weight (Fildes *et al.*, 2015; Gulliford *et al.*, 2016). Weight gain is associated with various co-morbidities, reinforcing how excessive body weight constitutes a major risk factor (Zheng *et al.*, 2017).

The aforementioned scenario depicting the global trend in weight gain and the higher incidence and prevalence on chronic diseases related to excessive body weight as a consequence are the critical challenges the HealthyW8 project aims to address. The project aims to find new and effective strategies targeted at obesity's prevention through the implementation of a holistic approach, supported by the use of digital tools. To achieve this aim, a consortium of 24 public and private partners from nine European countries was established, involving specialized personnel with complementary skills to overcome the shortcomings of digital interventions, typically ineffective in significantly improving lifestyle (Powell-Wiley *et al.*, 2022; Joseph *et al.*, 2021; Sandborg *et al.*, 2021).

This study aims to present the outcomes of participatory workshops held in Italy between 2023 and 2024 within the framework of the HealthyW8 project. These workshops engaged various stakeholders in co-creating intervention strategies and in co-designing technological tools to favour obesity prevention and healthy ageing.

The remainder of this paper is structured as follows. Section 2 provides an overview of existing studies on participatory approaches, while in Section 3, the participatory

methodology applied during the Italian case study is described in detail. Additionally, Section 4 is mainly focused on the results of the analysis of the Italian participatory workshops, and in Section 5, a discussion is provided. Finally, Section 6 concludes the paper and provides key notes for future developments and directions.

2. Related works

Creating a holistic approach significantly impacting users' lifestyles requires the creation of intervention strategies and tools that properly consider specific contextual factors, address specific context needs and adapt to individual characteristics. Stakeholder interaction is crucial in this process, as it helps refine the designed and implemented intervention tools based on stakeholders' inputs (Vargas *et al.*, 2022; Chudyk *et al.*, 2024). Since the early stages of intervention design, key stakeholders should be engaged for input collection and to support the reaching of desired health outcomes and health issues' resolution improvement (Vargas *et al.*, 2022; Greenhalgh *et al.*, 2016; Ray and Miller, 2017).

Participatory workshops, whether in person or in remote modality, are an effective way to bring together stakeholders and redefine the problem to be solved (van den Akker *et al.*, 2023; D'Andrea and D'Ulizia, 2023; D'Andrea and D'Ulizia, 2024). Specifically, concerning obesity prevention, workshops enable the co-creation and co-design of intervention tools, engaging stakeholders from different backgrounds, identifying specific issues and using a collaborative method for problem solving to target them (Vargas *et al.*, 2022; Ferri *et al.*, 2020; D'Andrea *et al.*, 2015; Israel *et al.*, 2001). In the review provided in Allen *et al.* (2024), the importance of participatory workshops to involve families and schools to promote physical activity and nutrition solutions that take into account local conditions is underlined. While the Implementation Science Team (2021) suggested that co-design and participatory systems modelling are recommended to promote stakeholder ownership and to ensure the sustainability of initiatives. In Portugal, participatory workshops were conducted to identify strengths and barriers for developing apps aimed at promoting healthy lifestyles among adolescents. Physical exercise tips/plans were the most popular feature identified (41.8%), with adolescents citing utility and interest as the primary reasons for continued app use (35.7%) (Frontini *et al.*, 2020).

Focusing on the Italian context, a pilot study on children demonstrates that co-creation in health promotion is feasible, with the advisory committee acting as a central tool for co-governance and co-creation. Stakeholders' involvement enabled the expansion of the number of individuals and institutions actively contributing to the project (Giorgi Rossi *et al.*, 2020).

This paper presents the results of participatory workshops held in Italy, in which different stakeholders were involved in defining intervention strategies supported by technological tools aimed at obesity/overweight prevention through healthy lifestyle recommendations. This case study offers valuable insights into the limited body of literature, particularly in the Italian context, and addresses a significant gap in existing research.

3. Material and methods

The methodological approach implemented within the participatory workshops combines design thinking (DT) (Brown and Wyatt, 2010; Benson and Dresdow, 2014; Altman *et al.*, 2018) and user-centred design (UCD), as described in D'Ulizia *et al.* (2025).

Two rounds of workshops have been defined to collect experiences, motivations and needs regarding intervention strategies and user requirements for the definition of the healthy lifestyle technological tools, as well as to discuss, identify and prioritize intervention strategies and desired tools' functionalities of the HealthyW8 solutions' portfolio.

The first round aimed to gather user requirements, identify essential functionalities for the HealthyW8 portfolio, and engage stakeholders proactively to better understand their experiences, motivations and needs regarding the intervention strategies to be implemented to promote healthy lifestyles. Accordingly, the "understanding" phase of the UCD and the "empathize" and "define" stages of the DT were applied.

The "ideation" and "prototype" stages of the DT, along with UCD's conceptualization stage, were conducted in the second round. Beyond generating ideas for desired functionalities to support the HealthyW8 portfolio, this activity also involved participants in the discussion, identification and prioritization of intervention techniques.

A testing phase will be implemented during the short pilot trials starting from January 2025 to validate the most effective intervention techniques and tool features collected during the short pilot trials.

Note that this paper focuses on the results of the two rounds of participatory workshops, while the results of the testing phase are not within the scope of this work (Figure 1).

In the following sections, the results of the two rounds of participatory workshops that took place in Italy between 2023 and 2024 are described in detail.

4. Results of the analysis of the two rounds of participatory workshops

Overall, 65 people took part in the four workshops (see Figure 2). Specifically, 37 people participated in the first-round workshops (18 in the co-creation workshop and 19 in the co-design workshop), while 28 people participated in the second-round workshops (17 in the co-creation workshop and 11 in the co-design workshop).

Workshop participants were representatives of both end-users targeted by the project (i.e. older adults aged 65+, young adults aged 18–25 and parents of primary schoolchildren) and various stakeholders (e.g. health-care professionals, educators, health-care services, food

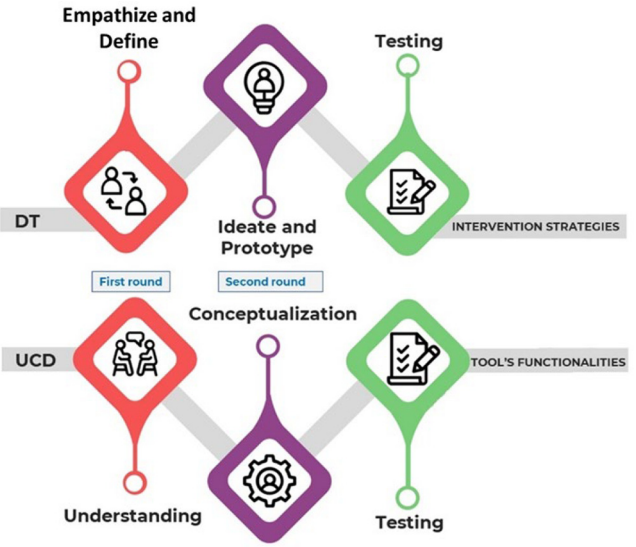

Figure 1. The methodological approach followed within the participatory workshops
Source: Authors' own work

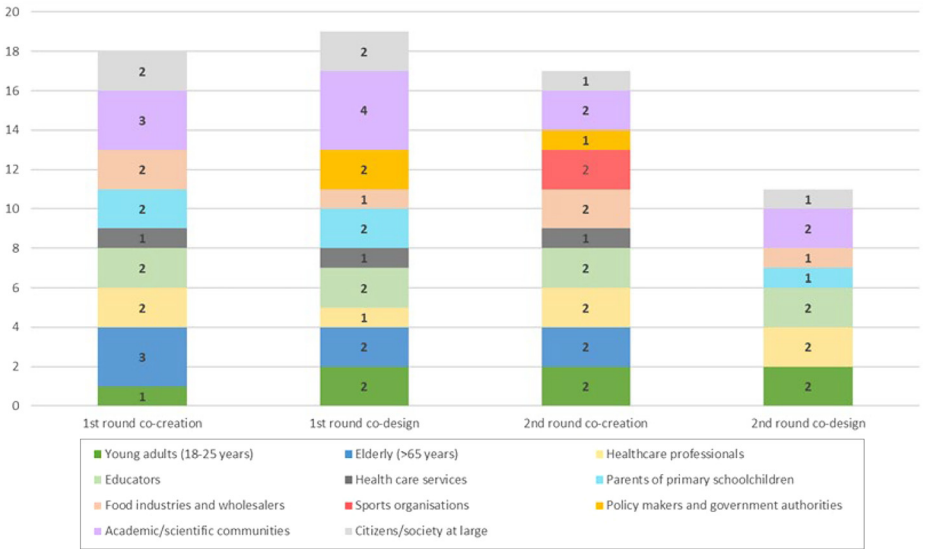

Figure 2. People taking part in the four participatory workshops
Source: Authors' own work

industries and wholesalers, sport organisations, policymakers, academics and civil society). End-users and stakeholders were recruited because of their direct or indirect experience with unhealthy lifestyle behaviours. Participation was voluntary, and informed consent was obtained before taking part in the workshops.

In the following paragraphs, the results of the first-round and second-round workshops will be described separately to support a clearer qualitative analysis.

4.1 Results of first-round workshops

The goal of the first-round workshops was to collect experiences, motivations and needs regarding intervention strategies to promote healthy lifestyles (empathize and define stages) as well as to gather user requirements for identifying functionalities to be configured in the digital tools of the HealthyW8 portfolio (understanding stage). Figure 3 shows the stages implemented during the first-round workshops, highlighted in red.

4.1.1 First workshop on co-creation of intervention strategies

During the first co-creation workshop, three questions were submitted to the various stakeholders. Specifically, participants were asked to write about:

(1) experiences related to eating habits and behaviours for a healthy lifestyle;
(2) difficulties in adopting healthy eating habits and behaviours; and
(3) needs to overcome these difficulties.

Many participants stated that they tried to adopt a healthy lifestyle, albeit with an awareness of the various obstacles along the way; health professionals in particular brought up the challenges in those who have eating disorders. In fact, while some individuals displayed adequate

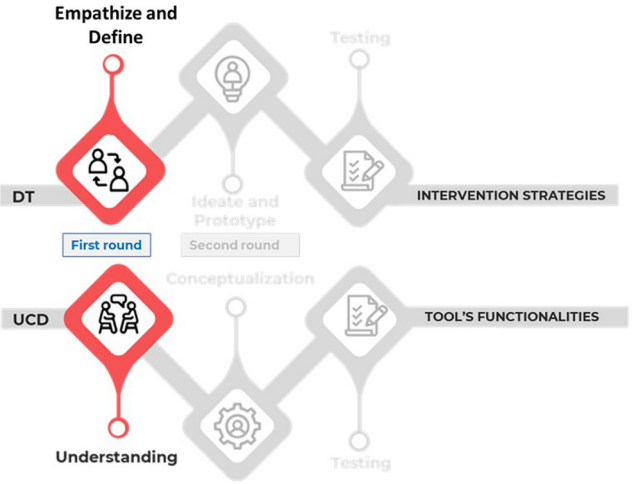

Figure 3. The stages of the first round of participatory workshops
Source: Authors' own work

knowledge in terms of theoretical knowledge about healthy diets, this was often insufficient for maintaining lifestyle changes. On the other hand, according to health-care experts who are in the nutrition field, there are many patients who are completely unaware of what a healthy diet entails. The importance of the synergy between a balanced diet (the Mediterranean one in general, and a more *ad hoc* one for patients with specific problems) and regular physical activity was also highlighted as an important element to take into account. For children, unhealthy eating behaviours were common – skipping, being very selective with food and not eating the right quantities. In spite of guidance from parents and teachers, these habits are present. The parents' influence on children's eating styles is also highlighted, alongside the selectivity typical of the youngest, although dependent on individual characteristics. Finally, in line with the previous point, it appears that Italy is commonly associated with the Mediterranean diet, considered among the best diets for promoting a healthy lifestyle. Nevertheless, Italy is facing increasing levels of obesity, especially among young people, and is characterized by a pronounced North-South difference concerning the levels of obesity.

On the second point, concerning the difficulties faced in adopting healthy eating habits, the participants highlighted various key challenges. Among these were the lack of information and clear guidelines, in particular concerning educational resources for younger individuals. This was associated with high levels of stress, leading to an increase in junk food consumption as well as resistance to making lifestyle changes. Stressful periods, combined with a sedentary lifestyle and restrictions related to individual health conditions, are major obstacles to adopting healthy eating habits and behaviours. On the patient side, health-care professionals noted that it is particularly complex to address and overcome dysfunctional eating behaviours, as they are often ingrained. Some patients believe they have theoretical knowledge concerning behavioural patterns, but their knowledge is often influenced by distorted media interpretations. Furthermore, concerning specifically children, the difficulties arise from their attitude in approaching new (especially healthy) foods and the potential negative influence of parents on their diet. Finally, teachers highlighted several additional barriers to health promotion, including the lack of attention to primary prevention

and physical activity. Young people are often exposed to an "obesogenic environment", characterized by an abundance of fast food, while options for healthy eating are scarce and often more expensive.

Regarding the last point and with particular attention to the identification of the needs that are relevant to support the adoption of healthy eating habits and behaviours, the most relevant ones were: reducing the price of healthy food/taxing junk food and drinks; disseminating information on the risks of sedentariness and unhealthy eating practices; promoting regular physical activity as one of the key aspects emphasized by almost all participants; and providing structured and multidisciplinary support, especially for those individuals with obesity, alongside effective nutritional education for families. Furthermore, with a specific reference to children, a collaboration between school and family and an integration with nutrition education into school curricula. This should be presented playfully and engagingly, promoting the adoption of a healthier lifestyle and behavioural change.

In addition to this, health professionals should adopt a less rigid approach (mainly regarding the prescription of diets) and provide training and informational sessions not only for children but also for their parents.

Afterwards, participants were divided into four groups and asked to discuss:

- existing intervention strategies, identified from literature [1], contributing more effectively to healthy lifestyle's promotion;
- additional intervention strategies within their knowledge; and
- innovative solutions to enhance the effectiveness of existing intervention strategies aimed at promoting a healthy lifestyle.

Regarding the first discussion point, the list of the existing intervention strategies analysed during the group discussion is presented below. They have been adapted from those proposed by the Centers for Disease, Control and Prevention (CDC)[1] (Source: Authors' own work).

Intervention strategies

(1) *Area 1) Strategies at political/governance level:*

- Studying what works in communities to make it easier for people to be more physically active and have a healthier diet.
- Measuring trends in obesity and related risk factors.
- Developing and promoting guidelines on dietary patterns and amounts of physical activity people need for good health.
- Helping families with lower incomes get affordable, nutritious foods.
- Supporting children and families who are at higher risk for obesity through services at Qualified Health Centers.
- Funding programmes and providing training and resources for initiatives that promote healthy eating, food and nutrition security and physical activity.

(2) *Area 2) Strategies at social level:*

- Making it easier to choose healthy food options where people live, work, learn and play.
- Making healthy foods more available by connecting local producers with retailers and organizations such as childcare, schools, hospitals and food hubs.
- Promoting nutrition standards in early care and education settings, food pantries and faith-based organizations.

- Partnering with business and civic leaders to plan and carry out local, culturally tailored interventions to address poor nutrition, physical inactivity and tobacco.
- Designing communities that connect sidewalks, bicycle routes and public transportation with homes, early care and education settings, schools, parks and workplaces.

(3) *Area 3) Strategies at health-care level:*

- Measure patients' weight, height and body mass index, and counsel them on keeping a healthy weight and its role in disease prevention.
- Screen children and adults for overweight and obesity and refer patients with obesity to intensive programmes, including family healthy weight programmes and the Diabetes Prevention Program.
- Counsel patients about nutrition, physical activity and optimal sleep.
- Use respectful and non-stigmatizing, person-first language with all individuals in weight-related discussions.
- Connect patients and families with community services to help them have easier access to healthy food and ways to be active.
- Discuss the use of medications and other treatments for excess weight.
- Seek out continuing medical education on the latest on obesity science.

(4) *Area 4) Strategies at the individual level:*

- Eat a healthy diet by following dietary guidelines.
- Get the amount of physical activity recommended by professionals.
- Get enough sleep.
- Manage stress.
- Talk to their health-care providers about available obesity prevention and treatment options to help reduce potential health risks.

Figure 4 illustrates which strategies participants mostly focused on, with the highest scores emphasizing areas such as "funding programs and training and resources for initiatives promoting healthy eating, food and nutrition security, and physical activity" and "making it easier to choose healthy food options where people live, work, learn, and play".

For the second discussion point, participants suggested additional intervention strategies that were not on the original list. These strategies included increasing the number of health institutions accredited by the National Institute for Obesity Care (INCO), educating the public about obesity as a medical condition and promoting a culture of work–life balance. Training educators on healthy eating was also highlighted as a key component in building a healthier society.

Strategies involving playful and formative activities, emotional education, a multidisciplinary approach and improved access to nutritious and sustainable food were considered crucial. Further suggestions and strategies emphasized promoting active lifestyles and supporting mental health. Examples included financial incentives for biking to work, creating workplace gyms for lunch break activities, encouraging walking groups and setting screen time limits. Providing psychological support and education on eating habits and food relationships was seen as fundamental for fostering a comprehensive understanding of health.

Figure 4. Intervention strategies selected by participants along with their corresponding score
Source: Authors' own work

About the third discussion point, several intervention strategies were proposed to enhance current efforts in promoting healthy lifestyles. These approaches, aimed at creating more comprehensive and community-based health initiatives, focused on public awareness, education, accessibility and technological integration. Innovative suggestions included home visits for individuals with severe obesity and connecting remote areas to expert support systems. While the benefits of telemedicine were acknowledged, it was recommended that its use be limited to preserve personalized care and that GPs receive specialized training. The potential use of artificial intelligence (AI) to analyze medical records and provide risk indicators was also suggested.

Participants also recommended encouraging healthy lifestyles by improving public mobility and access to sustainable transportation, simplifying interventions and leveraging digital technologies (e.g. corporate wellness bonuses, apps and cashback programmes). Additional ideas included creating and increasing learning opportunities. Suggestions ranged from organizing more active school holidays to offering more health-related university courses and supporting voluntary groups promoting physical activity. Two other intervention

strategies that were proposed regarded the idea of assessing the psychological aspects influencing food choices and introducing weight-based taxes.

Encouraging regular exercise among employees and students was seen as a way to promote healthy behaviours, while training health professionals in the use of inclusive language was considered essential to prevent stigmatisation.

To better engage younger audiences, participants recommended implementing school-based projects focused on healthy eating and physical activity. They also emphasized the importance of educating parents – particularly first-time parents – on healthy lifestyle habits. Additionally, the creation of educational cartoons that explain obesity and its effects using child-friendly language was proposed as an effective tool.

Technological solutions were also discussed, including the development of a government-sponsored app that could serve as a reliable source of information on both mental and physical health – seen as a crucial element in the fight against obesity. This app could offer features such as alternative portion size options (e.g. by volume), age-specific meal plans and cost estimates for recipes. Furthermore, it could provide users with personalized feedback on their eating habits, suggesting tailored adjustments based on their current dietary intake – for example, recommending lighter meals after reaching the recommended limit for red meat.

Finally, participants were asked to vote on the two most relevant innovative intervention strategies that emerged during the previous discussion, as included in Table 1.

Different intervention strategies have been developed to prevent and manage obesity and to promote healthy lifestyles. Table 1 shows how many votes each strategy received. The development of educational cartoons emphasizing healthy lifestyles and obesity awareness received four votes, while three votes were given to the training of general practitioners (GPs) in the management of obesity and lifestyle choices.

The most strongly supported strategy, with five votes, was the development of tools such as apps, cashback schemes and company bonuses to encourage physical activity and healthy lifestyles. On top of this, the assessment of the psychological aspects that contribute to poor eating habits, creating a comprehensive government-backed app providing trustworthy health information and rewarding those who exercise regularly raised attention, receiving two votes each.

4.1.2 First workshop on co-design of tools' functionalities

During the first co-design workshop, participants were asked to describe:

- experience in using digital tools (mobile app, web app, recommender system, etc.) supporting healthy lifestyle behaviours (app for physical activity, healthy food, dietary and weight management, etc.);
- the difficulties of using these digital tools to maintain a healthy lifestyle; and
- the benefits of using these digital tools to maintain a healthy lifestyle.

Some participants shared positive feedback, noting that they found tools such as activity and calorie trackers helped manage their health – especially for individuals living with obesity. However, concerns were raised regarding the lack of personalisation, the accuracy of data and the potential for certain applications to promote unhealthy behaviours (e.g. eating disorders). As a more constructive alternative to standard digital tools, the educational game Kaledo [2] was proposed for its effectiveness. Participants identified several challenges, including misuse, disinformation, low user engagement and barriers such as digital illiteracy – particularly among younger and older populations. Recommendations for improvement emphasized the importance of scientifically validated material, personalized support, elements such as

Table 1. New intervention strategies suggested during the group discussion with their corresponding votes

Suggested intervention strategies	Received votes
Sensitizing the public to recognize obesity as a pathology	0
Accrediting more health-care facilities to the National Institute for Obesity Care (INCO)	0
Training teachers on healthy eating habits	0
Institutional efforts to promote a better work–life balance and respect for leisure time	0
Incorporating playful and formative activities	0
Emphasizing emotional education	0
Adopting a multidisciplinary approach	0
Ensuring greater accessibility to healthy and sustainable food	0
Offering financial incentives to those who commute by bike	0
Creating work-based gyms to encourage physical activity during lunch breaks	0
Limiting screen time	0
Promoting biking or walking to school/work	0
Forming walking groups for collective activity	0
Providing psychological support	0
Educating people on eating behaviours and the relationship with food	0
Conducting home visits for severely obese individuals	1
Enhancing connections with remote areas and promoting collaboration among professionals	0
Reduce or limit the use of telemedicine	0
Educating general practitioners (GPs) about lifestyle and obesity management	3
Create predictive risk indicators using AI and medical records	0
Improving access to sustainable transport and public mobility	0
Systematizing and focusing interventions for greater impact	0
Developing tools (e.g. corporate bonuses, reward schemes and applications) that encourage healthy living and physical activity	5
Increasing the amount of activity during school holidays and reducing the amount of time spent in the classroom	1
Increasing the number of health-promoting university courses (e.g. courses in subjects such as sports science)	1
Support voluntary organisations (e.g. the Scouts) that promote healthy lifestyles	0
Introduce weight-based proportional taxes	1
Assessing the psychological aspects, in addition to weight, that influence unhealthy food choices	2
Teaching health professionals to speak in a non-stigmatizing, inclusive way	0
Rewarding students, classes and workers who regularly practice physical activity	2
Developing school projects focused on physical activity, healthy eating and engaging children	1
Organizing teaching sessions for parents, especially new ones	1
Creating educational cartoons that address healthy lifestyles, diets and physical activity while explaining the concept of obesity and its consequences	4
Designing an innovative, government-backed app as a reliable source of information on physical and mental health, aimed at preventing obesity	2
Organize training workshops in schools to teach families and parents about healthy eating	2
Strengthening obesity centres	2

Source(s): Authors' own work

gamification, expert advice and community support to increase user engagement. Older adults were reported to often struggle with digital tools because of cognitive impairment and inexperience, while young people found many apps ineffective, especially those lacking personalized recommendations. Parents expressed concern about their children's lack of interest in health-related apps, while educators and health professionals highlighted the importance of expert advice and usability. In contrast, policymakers and scientists stressed the potential of evidence-based applications to support public health initiatives and promote healthier behaviours on a broader scale.

The following steps in the co-design process involved creating user personas and reviewing app mock-ups to ensure the tools met the diverse needs of different user groups. In spite of interest in digital tools for promoting healthy lifestyles, challenges around accuracy, accessibility and professional guidance persist.

Afterward, videos illustrating the functionalities of the existing digital tools previously developed by the HealthyW8 project's partners, e.g. Gamebus [3] (Van Gorp and Nuijten, 2023) and Nutrida [4] are shown to participants who are invited to discuss in four groups and propose ideas on:

- the functionalities of existing digital tools shown in the videos that are more effective in changing behaviour towards healthier lifestyles; and
- new functionalities of the digital tools to be used for stimulating a healthy lifestyle.

Concerning the functionalities of existing digital tools, participants focused on a variety of topics related to food and meal planning. They mentioned the "search" function for recipes and foods, which allows omitting certain ingredients according to your dietary preferences, such as vegetarianism, food intolerances or religious beliefs. They also explored the ability to create a personalized diet plan. This functionality makes it easy to tailor meals to a person's dietary needs, medical conditions and lifestyle. Additionally, they appreciated the ability to determine the user's degree of daily physical activity, which might affect dietary recommendations and wellness plans.

As part of the second discussion point, to facilitate the process of organizing nutritious meals, participants recommended integrating the Nutrida app with other platforms, such as shopping list applications (like Bring). Reward and incentive systems can inspire users by gamifying their health journey. Furthermore, digital tools should offer tailored support through specialized profiles, creating separate interfaces for specialists, such as trainers and nutritionists, as well as for patients with a specific health plan. In addition, integration with health devices such as iOS apps and Fitbit can enhance comprehensive tracking and provide a more seamless user experience.

According to participants' feedback, it would be crucial to provide consumers with significant incentives motivating them to make long-term lifestyle changes. Leaderboards and user challenges are two examples of features that should emphasize the competitive element to increase engagement. To help users understand the link between diet and health, digital solutions should also help bridge the gap between food choice and quality. Incorporating a cost-benefit analysis specific to certain foods allows promoting sustainability and reducing food waste by facilitating decision-making and zero-kilometre (km 0) production.

Another important improvement to increase users' sense of belonging proposed by participants is to link the app to useful real-world activities. Disclosing details about the developers' experience and the validity of the sources ensures the credibility and reliability of the content. Adding a feature helping small businesses in the area can improve user

connectivity and the local economy. An interactive element would be added by providing access to a group of professionals who can respond to users' questions and offer advice.

Another suggestion that emerged from the discussion refers to the inclusion of child-friendly recipes allowing children to participate in the cooking process. Moreover, adding cost estimates for recipes would also help users budget effectively. Including an emotional component allowing people to consider their feelings following a meal could be another essential component. Indeed, this could help them to make more conscious eating choices in daily life. In addition, a community-based forum where users can share their thoughts on recipes could be beneficial and encourage socializing, particularly among single people. Digital tools offering meal plans tailored to different demographics should be created to accommodate a range of age groups. An average price could be included with each recipe to help users create budget-friendly meal plans. To make meal preparation easier, the app should also suggest different portions based on factors other than weight, such as volume or bowl size. Finally, a feedback system based on user habits that dynamically adjusts dietary suggestions, such as notifying users when they have met their weekly intake of certain food groups, could help maintain balanced nutrition.

Finally, participants were asked to vote on the two most relevant functionalities that emerged from the previous discussion as reported in Table 2.

Table 2 lists suggested features for new tools to promote healthy behaviours and increase user engagement. "Integration with other apps" is the feature most voted for (six votes). "Emotional connection" and "Connection to practical activities" were two other noteworthy recommendations receiving four votes each. While the latter encourages users to consider their emotional states after meals, promoting mindful eating habits, the former places more emphasis on planning community activities connected to the app's digital experience to promote real-life engagement.

Several other proposals received moderate support, such as specialist and patient profiles; substantial lifestyle change incentives; sustainability and waste reduction; and cost estimates for Recipes, each collecting two votes. These would enhance personalized health journeys, provide significant motivations for maintaining lifestyle changes, promote eco-friendly choices and help with budget planning.

4.2 Results of second-round workshops

The goal of the second-round workshops was a critical analysis of the most voted intervention strategies and the design and prototype of the two most voted intervention strategies (ideate and prototype stages). Moreover, the refinement of the personas and the evaluation of mock-ups were also implemented (conceptualization stage). Figure 5 shows the stages implemented during the second-round workshops highlighted in purple.

4.2.1 Second workshop on co-creation of intervention strategies. In the second round of the co-creation of intervention strategies, two main phases were implemented: a critical analysis of the most voted intervention strategies, and the design and prototype of the two most voted intervention strategies.

During the first phase, participants critically analyzed various intervention strategies across four macro-areas: technological tools for promoting healthy lifestyles; educational and training programmes; trustworthy information dissemination; and political/institutional strategies for improving health-care services (see the list provided below). Note that the intervention strategies analysed in this phase are the most voted not only in the first round of the Italian workshop (listed in Table 1) but also in the first round of workshops organized in the different countries involved in the project:

Table 2. New tools' functionalities suggested during the group discussion with their corresponding votes

Suggested new tools' functionalities	Received votes
Integration with other apps: The ability to connect with existing shopping list apps (e.g. Bring) to streamline healthy grocery planning	6
Reward/incentive mechanisms: Implement gamified systems that offer rewards and incentives for healthy lifestyle achievements	0
Create different profiles for patients and professionals (such as trainers or nutritionists) to provide personalized support to people already on a health journey. This is similar to applications for sports activities	2
Device integration: Eenable tracking and feedback by guaranteeing compatibility with other devices, such as Fitbit and iOS health apps	0
Offer significant incentives for lifestyle change to encourage people to start and maintain healthy routines	2
Increase competitiveness: Include elements such as leaderboards and user challenges that encourage competitiveness	1
Food quality: Provide specific information on food quality	0
Cost–benefit analysis: Include cost-effectiveness information about healthy food choices to help users make informed decisions	0
Sustainability and waste reduction: Promote zero-kilometer (km 0) produce and integrate features to fight food waste	2
Connection to practical activities: Facilitate real-life community-building events linked to the app's digital community to promote active participation	4
Credible content sources: Make sure to disclose the experience and dependability of the content creators to maintain transparency and trust	1
Involve local companies: Support the local economy by collaborating with local businesses	0
Expert interaction pool: Provide a network of experts (such as fitness specialists and nutritionists) for interactive advice	2
Kid-friendly recipes: Give kids recipes that encourage them to help out in the kitchen	0
Recipe cost estimation: Provide users an idea of how much each recipe will cost and aid in budgeting	2
Emotional connection: Provide functionalities that invite people to consider their post-meal emotions (e.g. energy levels and satisfaction)	4
Recipe discussion forums: Give users – particularly singles – the opportunity to exchange opinions and personal stories with other people who have tasted the same foods	0
Customisable meal plans: Develop customizable meal plans according to different age groups and needs	0
Average recipe prices: Facilitate financial meal planning by recommending an average cost for each recipe	2
Portion measurement suggestions: Provide different portion measurements (such as volume or bowl size) in addition to weight	0
Habits-based feedback: Provide dynamic feedback that modifies nutritional recommendations based on current consumption patterns. For example, "You've reached your weekly limit of red meat, try pizza"	1

Source(s): Authors' own work

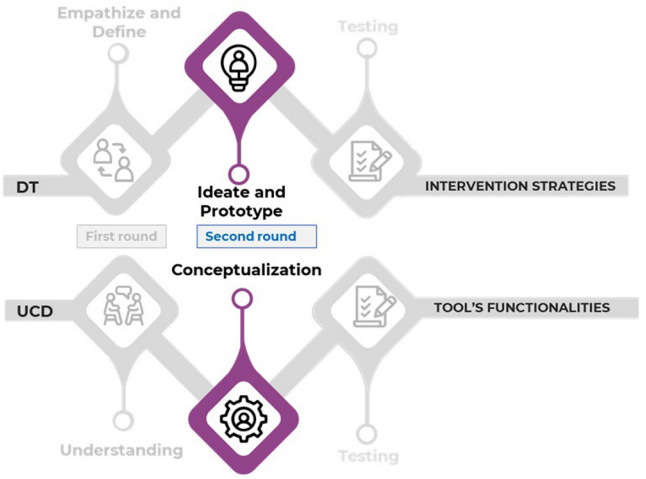

Figure 5. The stages of the second round of participatory workshops
Source: Authors' own work

(1) Macro area A: To develop technological tools/reward programmes for promoting a healthy lifestyle:
   - apps that promote physical activities;
   - cashback and/or corporate bonuses for students/workers who are engaged in physical activity or adopt a healthy lifestyle (e.g. biking to work);
   - information platform for medical information, calories calculation, groups of common interests;
   - automated recommendation systems based on science and taking into account the specifics of the region (promoting healthy local food);
   - tailoring tools/programmes according to the individual and his/her age; and
   - use gamification to target different groups to get more exercise, e.g. Pokémon GO, city walks including storytelling and Wii.

(2) Macro area B: To develop educational and training programmes for promoting a healthy lifestyle:
   - educational activities targeting parents at the school level (daycares, pre-schools, etc.) and nudging to improve eating habits at home;
   - cartoons (using kids' language) explaining what obesity is and its consequences
   - educational programmes at school and kindergarten;
   - emotional education services conducted by trained professionals and addressed to school and work environments for learning how to better manage emotional states such as low self-esteem, stress, guilt, etc.;
   - systematic refresher courses for health-care professional; and
   - regular seminars and campaigns on the "distress" as a major factor for obesity.

(3) Macro area C: To develop tools/initiatives for disseminating trustworthy information on a healthy lifestyle and obesity prevention:

- a verified app endorsed by accredited authorities with a virtual operator to answer questions;
- a national platform (made available by the Ministry of Health), where people can find detailed and trustful information on various health aspects, one of them could be the obesity;
- information and clarification campaigns, sporting events, etc. at national, regional or even company level;
- initiatives for eliminating stereotypes and creating new references on healthy lifestyles (e.g. by promoting influencers beyond social networks, who participate in community networks and offer quality information on healthy eating and lifestyles); and
- Disseminate "healthy lifestyle" interdisciplinary measures across all institutions by including them in daily life/school schedules for all children in all institutions (e.g. it could be exercise, knowledge about diet/food/nutrients/ physically activity/etc., mental health, etc.).

(4) Macro area D: To develop political/institutional strategies for improving health-care and welfare services:

- strengthening of centres for obesity;
- improving conditions for family work–life balance;
- regulating access to sugary foods, reducing attractive marketing and limiting access to certain foods;
- cooperation between organizations that organize after-school activities (e.g. sports, music), schools and municipalities to arrange events, sports tournaments, the possibility to try out new sports and get to know your friend's hobbies/sports/ music instruments. Municipalities should support this with e.g. staff/trainers and facilities; and
- free lunch meals served at all institutions for all children (crèche, kindergarten, primary school, secondary school, high school/youth education) paid by the government. It could also include breakfast for some children.

Participants listed the advantages and disadvantages of each macro area. In Macro A, strategies such as reward schemes and applications encouraging physical activity were seen as helpful for young adults but less effective for individuals with poor self-control or low reading levels. Educational materials and gamification strategies (such as encouraging physical activity through games such as Pokémon GO) were praised for their ability to engage individuals in spite of concerns about addiction and exclusion. In Macro Area B, educational strategies targeting parents were valued for promoting school-family continuity. However, there were challenges in maintaining long-term compliance and the potential for bias, particularly in child-focused programmes. In Macro Area C, concerns were raised about information overload and the lack of tailored solutions, where trusted information dissemination strategies, such as national platforms and verified applications, were seen as valid. Stress and low self-esteem were addressed by emotional education programmes, which were recognized as beneficial but needed careful monitoring to avoid stigmatization.

Attempts to reduce stigma and to promote healthy lifestyles through community leaders or influencers were seen as promising but difficult to scale up. In macro area D, practical

issues such as cost and feasibility in different family circumstances were emphasized, but political and institutional strategies such as strengthening obesity centres and improving work–life balance were also promoted.

Moving to the second phase, participants focused on two strategies that received the most votes: educational activities for parents at the school level to promote healthier eating habits (Macro-area B/strategy a), and emotional education programmes to help manage stress and low self-esteem (Macro-area B/strategy d). In particular, they have been invited to discuss and propose ideas on:

- key stakeholders to be involved for implementing the intervention strategies;
- technological tool(s) that can support the implementation of the intervention strategies; and
- methodologies to personalize the intervention strategies according to the users' characteristics.

For implementing the intervention strategy, different stakeholders should be involved to address various aspects of a healthy lifestyle initiative.

Nutritionists, psychologists, sport trainers and educators are needed to successfully deliver healthy lifestyle interventions. In addition, UX designers, art and music experts and public-speaking specialists who can successfully communicate to engage an audience were recommended. It was also recommended that the family, including parents and grandparents, be involved to create a supportive atmosphere.

In terms of technology, participants suggested the use of shared apps and multimedia, such as films or cartoons, to help parents and children create nutritious menus in a fun way. To make learning about healthy eating more accessible and interesting, they also recommended setting up cooking classes for families. They also highlighted gadgets tracking neurological indices, apps measuring emotions, integrated telemedicine features and an emoji-based application helping users self-assess their moods. Moreover, meal-planning apps offering recipe suggestions and meal substitutions for lower-calorie options and an emotional app connecting users to a specialist for consultations emerged from the discussion. All of these applications should be used in conjunction with structured face-to-face lessons and training, especially for less tech-savvy users.

All participants agreed on the importance of personalized intervention strategies. They suggested conducting interviews and building users' networks, as well as adopting strategies based on factors such as children's age, social and economic status, religion, culture and dietary habits. They also suggested specific strategies for different problems, including physical education or psychological support where appropriate.

4.2.2 Second workshop on co-design of technological tools. During the second co-design workshop, two main phases were implemented: the refinement of the personas and the evaluation of mock-ups.

Personas are fictional characters representing the different end-user types (An *et al.*, 2018; Cooper, 1999) that might use the HealthyW8 tools' portfolio. To ensure that the technological tools are well-suited to the needs of different user groups and to have a better understanding of the main target users and stakeholders interacting with the technological tools, a draft description of several personas has been shown to participants, both for primary end-users (e.g. elderly, young adults and children) and secondary stakeholders (e.g. caregivers, health-care professionals and educators). An example of personas for a primary user is shown in Figure 6.

Through group discussions, these profiles have been refined to include specific behavioural and demographic characteristics to provide more personalized services. These

Stefania

Type of user: Elderly active user who underwent OLT (Primary end-user)

Country: Italy

Age: 69

Family Status: married, living with her husband

Education: High School

Profession: office worker – now retired

Chronic conditions: liver transplant for Cirrhosis (Hepatitis C Virus) 6 years ago, overweight, hypertension (medically treated), dyslipidemia (medically treated)

Disabilities: none

Food Intolerance or allergy: none

Presentation:

Stefania is 69 and had no health problem up to her 40s; since then she got diagnosed with chirrosis (Secondary to an infection) and for more than 20 years she had to struggle with the condition and its consequences, but luckily with the transplant she was finally cured.

Stefania has always been the one cooking at home and she is good at tradition Italian dishes. In her home dinner has always been regarded as a staple family activity in their day-to-day life to get together with her husband and their 2 children. Life changed quite a lot in the past 10 years, first the disease, then the transplant, then retiring and consuming every meal at home.

The quick and light lunches in the work canteen became full meals, just like every dinner.

Both Stefania and her husband have gained a little bit of weight, and her doctors told her that with her medical history she is at a higher risk for complications related to excess weight.

Goals:

1. Altering the weight gain path, and if possible, losing some of it
2. Finding healthy, tasty and quick recipes as a lighter alternative to the recipes she knows and cooks every day.
3. Try to manage her metabolic risk, not increasing the number of medications (or the dosages) she needs to take, and if possible, reducing them.
4. Helping her husband not gain more weight.

Figure 6. An example of personas discussed by participants
Source: Authors' own work

include the user's age group, residence and family context. In addition, the following suggestions emerged from the group discussion: the technological tools need to ask the user to select their occupation and level of education from a drop-down menu; the type of work should be classified as active, semi-sedentary or sedentary to further tailor the recommendations; end users should disclose any medical conditions, not limited to chronic illnesses, as well as any known food intolerances or allergies; and details about their engagement in sports and physical activities, along with how much leisure time they have and the duration of their electronic device usage, should also be collected. To create a personalized shopping list, the technological tools should ask about food preferences and dietary habits, such as the number of meals consumed per day. They should also focus on details of the user's urban environment and access to green spaces and public areas. Participants also highlighted that children's use of technology is an important factor to consider. Children are referred to as supervised users, and it is recommended that technological tools are used under parental supervision. However, to engage younger users, the tools could include a gamified section that children can only access if they adhere to a "correct lifestyle".

To allow participants to contribute to the conceptualization of the most voted functionalities of the technological tools, the mock-up has been used, i.e. a visual representation of a product illustrating the expected appearance and functioning (Interaction Design Foundation – IxDF, 2015). Specifically, the technological partners of the HealthyW8 project prepared some mock-ups illustrating some possible implementations of the most voted functionalities that emerged from the first round (see Table 2). Specifically, the mock-up in Figure 7 conceptualizes the functionality "Integration with Other Apps: The ability to connect with existing shopping list apps (e.g. Bring) to streamline healthy grocery planning", while the mock-up in Figure 8 represents the functionality "Emotional Connection: Integrate features that prompt users to reflect on how they feel after meals (e.g. satisfaction, energy levels)".

Participants were invited to discuss how to improve the mock-ups provided by proposing opinions/suggestions on:

- how to better conceptualize the suggested functionality;
- the coherence and intuitiveness of the flow and sequencing of the frames, and possible improvements;
- the clearness of the textual content of each frame, and possible improvements; and
- the appropriateness of the graphics of each frame, and possible improvements.

The mock-up in Figure 7 addresses integration with shopping list applications such as Bring, highlighting the importance of sourcing price information from impartial entities like the Chamber of Commerce or similar institutions, rather than private food distributors. This approach ensures that ethical food sourcing concerns are addressed. Participants suggested that the mock-up should display price data from these impartial sources in a clear and comparable way to reinforce this feature. Including food options reflecting user values, such as fair trade or organic goods, would further enhance trust. To attract users who place a high value on ethical purchasing practices, the application could emphasize its objective position by adding labels or filters.

Figure 8 shows a mock-up of an emotional evaluation function letting users express how they feel after preparing a recipe. Although the user has more freedom because there is not an automated notice sounding after an hour, it's still entertaining to use emoticons to show satisfaction. To improve this, participants proposed to include in the interface a range of emoticons

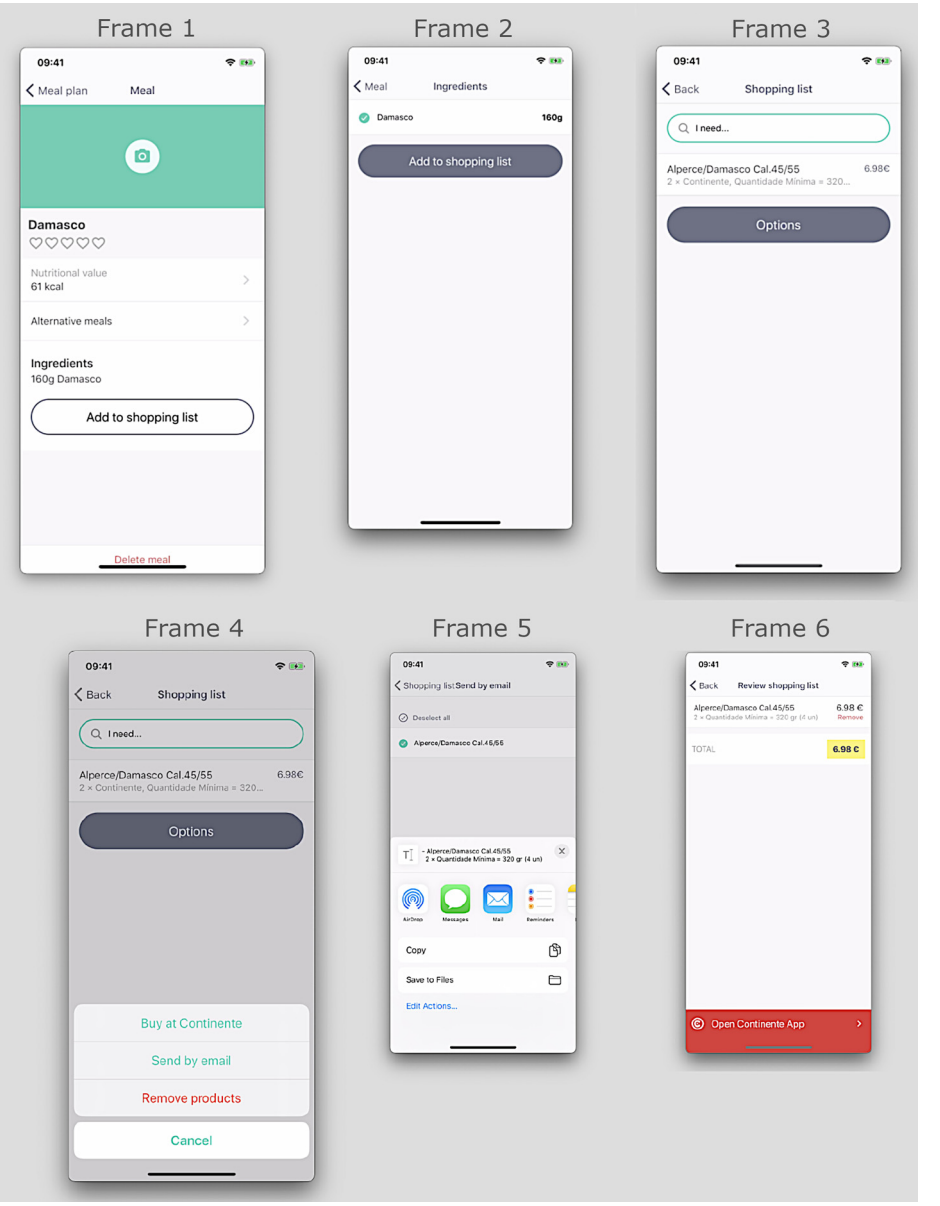

Figure 7. Mock-up of the integration with other apps
Source: Provided by the HealthyW8 consortium

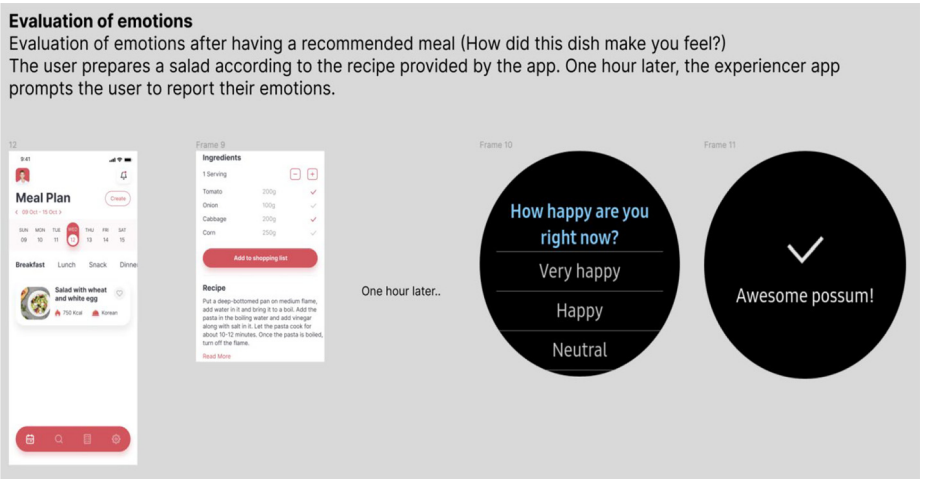

Figure 8. Mock-up of the emotional connection
Source: Provided by the HealthyW8 consortium

representing different levels of enjoyment. Additionally, creating a simple and user-friendly selection process will motivate people engage with this feature and provide insightful comments.

5. Discussion

The Italian case study acknowledges the complex interplay between biological, behavioural and environmental factors that contribute to obesity, in line with the HealthyW8 project's objectives of tackling this disease with innovative, digital and participatory solutions.

As a multilevel strategy for obesity prevention, the participatory approach used in the Italian case study, combining co-creation and co-design techniques, allows for the involvement of a wide range of stakeholders (e.g. parents, health professionals, educators and technology developers) for a thorough and contextualized analysis of the barriers to healthy lifestyles. This process allows for addressing the socio-economic and cultural factors influencing behaviour change. The continued emphasis on the importance of tailored, context-specific intervention strategies was a key outcome of the Italian case study.

The results highlight the barriers identified by different groups of stakeholders, including the cost-effectiveness of nutritious meals, inadequate nutrition education and the impact of parental practices on children's eating habits. These results highlight the need for specific intervention techniques, such as support networks linking families and health professionals and educational initiatives integrated into school curricula. In addition to adhering to UCD principles, this personalisation addresses the shortcomings of one-size-fits-all obesity strategies.

When considering technological advances, functionalities for demonstrating how digital tools can support improvements in healthy lifestyles have been suggested by Italian stakeholders. A variety of user preferences and needs must be satisfied by tools such as gamified physical activity trackers, integrated emotional monitoring systems and meal planning applications.

However, as highlighted above (ref. Section 4), the success of these tools relies heavily on their accessibility, usability and perceived credibility. For instance, while the integration of features such as recipe customization and rewards systems garnered significant interest, participants also

pointed out the necessity of providing evidence-based content and ensuring ethical design to avoid unintended consequences, such as reinforcing disordered eating behaviours.

Moreover, according to the Italian participatory workshops' results, several challenges have been pointed out, hindering the full acceptance of digital health in daily life. Among others, these include a lack of evidence-based standards, privacy concerns, issues with data governance and ethical issues. Additionally, there is a lack of evidence on the effects of digital health strategies on health outcomes, cost-effectiveness and system efficiency (Kaihlanen *et al.*, 2022). The effectiveness of digital health platforms may also be affected by the income and socioeconomic status of users (Bouabida *et al.*, 2022). Certain groups, such as minorities, the elderly and those in low-income or rural areas, may have difficulty understanding and using digital health solutions because of lower health literacy levels. To overcome such barriers, how can we support the positive impact that such technologies can produce on the users? How can we sustain the users' innovation adoption?

To ensure impact on users and concrete use of technology, different intertwined steps can be implemented as reported below:

- *Needs and contexts analysis*: to ensure the digital solution alignment towards stakeholders' expectations and envisioned benefits as well as the context's status in terms of services on stage, technological infrastructures, regulations, etc.
- *Co-design and stakeholders' training*: co-creation of requirements and services' scenarios based on identified needs and local ecosystem determinants. In this phase, stakeholders' training towards the digital tool/service is envisioned to share with them the values of the tool/service and smooth the issue of "misuse of the digital tool".
- *Evaluation and monitoring*: the tool/service is implemented in a specific context. In this phase, a strong evaluation pathway with Key Performance Indicators (KPIs) has to be designed according to identified stakeholders' needs and expected benefits. Continuous monitoring has to be executed to ensure the correct implementation of the digital tool and promptly design corrective actions if required.
- *Evidence-based results analysis and key stakeholders' involvement*: in this phase, according to the generated evidence, identify and involve the relevant needed actors for the service introduction into the daily practice and integration in the health-care paths.

Furthermore, the discussion must address systemic and institutional dimensions that emerged from the analysis of co-created strategies. Policy and governance interventions, such as providing subsidies for nutritious foods and restricting the marketing of unhealthy foods, have been underlined to be essential for long-term behaviour change. However, the success of these interventions depends on local communities, educators and legislators working together. In addition to these systemic changes, public awareness and stigma reduction initiatives (e.g. campaigns with relevant and diverse role models) could help stimulate a culture that prioritizes health and well-being.

The need to involve end-users in the iterative development of technical tools was also highlighted by Italian stakeholders. Mock-ups were improved based on participants' feedback, adding aspects for emotional reflection and integrating apps with e-commerce sites. By allowing users to actively participate in the development of technological functionalities, this iterative approach allows not only to enhance the usefulness and relevance of the tools but also to empower users.

6. Conclusion

The study demonstrated the importance of involving different stakeholders in both the co-creation of intervention strategies and the co-design of digital tools to address the complex

disease of obesity. The participatory approach used in the Italian case study highlighted the contextual and behavioural nuances of lifestyle change and ensured that the proposed solutions were tailored to the specific needs of the target groups. One of the key benefits of the initiative is its comprehensive strategy, which recognizes obesity as a complex disease influenced by societal norms, systemic factors and personal behaviour. The participatory workshops provided important insights into the challenges faced by different demographic groups, such as children with poor eating habits and adults with stress-related eating disorders. To promote long-term behavioural change, the need for multi-level intervention strategies, such as education, technological innovation and legislative support, emerged from the analysis.

Game-based apps, personalized meal planners and emotional monitoring systems are some of the technological solutions put forward by Italian stakeholders as viable means of encouraging healthier lifestyles.

However, their potential depends on their ability to provide evidence-based recommendations, engage users in a meaningful way and remain accessible to a wide range of populations. Ensuring that these tools are intuitive and culturally sensitive will be critical for their successful implementation. Moreover, the challenges related to security and privacy should be addressed, as suggested by the stakeholders. These issues associated with digitization efforts in health care need to be examined, and strategies to mitigate them must be developed, as suggested also in Jawad (2024).

In summary, the Italian workshops identified a range of challenges, needs and experiences with digital health technologies. The results, which included a detailed analysis of various technologies' advantages, disadvantages and potential developments, underlined the urgent need for data-driven, engaging and user-friendly health applications. These insights have been integrated into specific user profiles and the tools' functionalities have been co-designed through mock-up evaluations, laying the groundwork for a more targeted and effective approach to health technology development.

Notes

1. www.cdc.gov/obesity/php/about/obesity-strategies-what-can-be-done.html?CDC_AAref_Val=https://www.cdc.gov/obesity/strategies/what-can-be-done.html, accessed on July 23, 2024
2. www.kaledo.eu/en/home-en/
3. https://blog.gamebus.eu/
4. https://tastingdesign.com/project/nutrida/

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