

# Gaming and gambling behaviours among Italian adolescents: a cross-sectional study



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## Summary

**Background** As the boundaries between gaming and gambling increasingly blur, emerging evidence suggests that gaming might act as a gateway to gambling. In this context, we examined the prevalence of these behaviours and their relationship with each other in a nationally representative sample of Italian adolescents.

**Methods** In this cross-sectional study, we used data from 11965 students aged 15–19 years (mean age 16.9 years, SD 1.4; 50.6% male, 49.4% female) who participated in the 2023 ESPAD Italia cross-sectional survey between April 15 and May 31, 2023. Anonymous in-class questionnaires were administered to students on paper or online. Participants reported their sex (current legal), year of birth, geographical area, and perceived socioeconomic status. Information on gaming was derived from self-reported measures, including the Screening Test for Problematic Gaming (STPG). Gambling data included self-reported participation and patterns of engagement (assessed using the South Oaks Gambling Screen–Revised for Adolescents; SOGS-RA). Post-stratification weighting based on geographical area, age, and sex was applied in accordance with the target population's distribution. We estimated adjusted odds ratios (aORs) and 95% CIs for gambling participation, any-risk gambling (SOGS-RA  $\geq 2$ ), and problem gambling (SOGS-RA  $\geq 4$ ) in relation to gaming behaviours using logistic regression models, adjusting for age, sex, geographical area, and perceived economic status.

**Findings** Recent (past 12 months) gaming was reported by 67.2% (n=6621) of participants (85.2% of male participants [n=4181]; 49.2% of female participants [n=2440]). Among them, 33.0% (n=1937) had spent money on gaming in the previous year, and 24.0% (n=1511) scored high on the STPG. Lifetime gambling was reported by 58.7% (n=5955) of participants (65.8% of male participants [n=3311]; 51.6% of female participants [n=2644]; 57.2% [n=3653] of minor participants [younger than 18 years]), while recent (past 12 months) gambling was reported by 53.0% (n=5422; 60.0% of male participants [n=3055]; 45.9% of female participants [n=2367]; 51.5% of minor participants [n=3310]). Among recent gamblers, 20.4% [n=798] met criteria for any-risk gambling. Recent gaming was associated with lifetime gambling (aOR 1.74, 95% CI 1.57–1.93), recent gambling (1.65, 1.49–1.83), and any-risk gambling (1.33, 1.08–1.62). With increasing in-game spending and loot box engagement, these associations seemed to strengthen. An average monthly spending of more than €50 on in-game purchases (1.64, 1.10–2.44) and more than €5 on loot boxes (4.76, 2.55–8.88) over the past 12 months was associated with problem gambling.

**Interpretation** Like gaming, gambling is widespread among Italian adolescents, including minors. Findings indicate a convergence between these behaviours and suggest that gaming monetisation systems might engage psychological vulnerabilities similar to those involved in gambling, or even—although causal inferences cannot be drawn due to the limitations of the cross-sectional design—promote gambling participation and escalation.

**Funding** Department for Anti-Drug Policies, Presidency of the Italian Council of Ministers (Italy); Italian Ministry of University and Research; General Directorate for Welfare of the Lombardy Region; and Local Health Protection Agency of Pavia.

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## Introduction

Gaming, which refers to playing video games on electronic devices, and gambling, defined as wagering money or valuables on events with uncertain outcomes, are globally popular activities. Despite their differences, they share the potential to cause harm and addiction, with effects that extend beyond the individual, burdening families and communities.<sup>1–3</sup> These risks underscore the need for public health action, with

particular attention to adolescents, who are disproportionately susceptible due to developmental and social factors.<sup>3–5</sup>

According to recent data, over 80% of students aged 15–16 years across 37 European countries engaged in gaming in the past year, and 85% of those aged 13–17 years in the USA identify as gamers.<sup>6,7</sup> At the same time, a non-negligible proportion of adolescents engage in gambling despite legal age restrictions. A 2024 global

Lancet Public Health 2025

Published Online  
December 11, 2025  
[https://doi.org/10.1016/S2468-2667\(25\)00274-9](https://doi.org/10.1016/S2468-2667(25)00274-9)

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### Research in context

#### Evidence before this study

Gaming and gambling are widely prevalent activities among adolescents that might be associated with harm and the risk of addiction. It has been suggested that the boundaries between the two are becoming increasingly blurred, with gaming potentially acting as a gateway to gambling. Before conducting this study, we searched PubMed for articles on gambling and gaming published between Jan 1, 2000, and Dec 31, 2024, using combinations of the terms “gambling” and either “gaming” or “loot box” in the title or abstract. The search identified 780 articles. Most studies relied on non-representative or convenience samples and focused on specific subpopulations or isolated gaming features, such as loot boxes, often without adequate adjustment for potential confounders. Only a small proportion of the literature focused specifically on adolescents, and the extent to which engagement in gaming and gambling co-varies was rarely examined. In general, a concerning overlap between certain gaming and gambling behaviours has been observed, particularly when gaming involves monetary spending and interaction with chance-based reward systems such as loot boxes. Among the most notable longitudinal contributions, a study conducted in 2021–22 on a representative sample of Swedish adults found that in-game spending was associated with increases in at-risk gambling over time, while two studies on convenience samples of Spanish (2020–21) and Italian (2020) adolescents observed that engagement with loot boxes might foster involvement in gambling and the development of problem gambling behaviours. However, recent large-scale, nationally representative data on adolescents are lacking.

#### Added value of this study

This study represents, to the best of our knowledge, the most extensive investigation to date into the relationship between gaming and gambling behaviours among adolescents, using a nationally representative sample of over 12 000 Italian students aged 15–19 years. It provides detailed prevalence estimates for both gaming and gambling, including among minors, and examines the associations between different facets of gaming, including time and financial investment, potential symptoms of problematic use, and loot box engagement, and gambling outcomes, specifically participation and at-risk or problem gambling. A key strength of the study lies in its adjustment for relevant sociodemographic variables and the inclusion of stratified analyses to elucidate differential patterns.

#### Implications of all the available evidence

Both gaming and gambling are widespread among Italian adolescents, despite gambling being prohibited for minors. Gaming in the previous year shows a modest association with lifetime, recent, and any-risk gambling, which becomes more pronounced among individuals with higher in-game spending and greater involvement in loot boxes. These findings reinforce growing concerns about the convergence of gaming and gambling and its potential implications for adolescent health. A precautionary public health approach is warranted, including clearer regulation of in-game monetisation systems, stricter enforcement of age restrictions on gambling participation, and educational strategies targeting young people and families.

meta-analysis reported a past-year gambling prevalence of 18% among individuals younger than 18 years.<sup>8</sup>

In the past decades, gaming and gambling have progressively evolved from distinct activities into an increasingly unified ecosystem. The “gamification” of gambling began with the introduction of video game-like elements into slot machines to attract and retain users, and it has since become well established, especially in online settings.<sup>3,9</sup> Recently, gaming itself has undergone a process of so-called gamblification, involving the incorporation of gambling-related affordances and cultural cues within gameplay to sustain player engagement, a trajectory that the *Lancet Public Health* Commission on Gambling interprets as part of a wider commercial development through which gambling is embedded into other consumer sectors, especially those targeting younger audiences.<sup>3,10</sup> Beyond video games that include features resembling or directly replicating casino games such as slot machines or roulette, this concept can be extended to several chance-based reward systems now common in gaming.<sup>1,10</sup> Loot boxes—virtual packages typically obtainable through purchase and offering random bonuses—are among the most frequently

criticised elements for representing a disguised form of gambling.<sup>9</sup> Qualitative evidence indicates that gamers themselves might perceive specific video game features as gambling.<sup>11</sup>

According to some researchers, the progressive convergence of gaming and gambling might not only enhance their appeal and addictiveness but also render gaming—typically more accessible and earlier in onset than gambling—a potential gateway to gambling.<sup>9,12</sup> Studies have found a direct association between these activities, with a particularly evident link when players engage with video games incorporating gambling-like features (such as loot boxes or simulated casino games), or when they spend money through in-game purchases.<sup>9,12</sup> Some degree of overlap between harmful gaming and gambling behaviours has also been observed.<sup>12</sup> However, available evidence mostly relies on non-representative samples, which either include adults or consist of narrowly defined populations (eg, video game players or individuals with gambling problems), and seldom examine whether one activity covaries with the other.<sup>12</sup> Furthermore, previous studies frequently neglected to account for potential confounding variables such as age,

sex, gender, or socioeconomic status,<sup>12,13</sup> often prioritising specific gaming features (eg, loot boxes) over the broader relationship between gaming and gambling.<sup>12</sup> These limitations hinder the availability of comprehensive, generalisable data on adolescents' behaviour.

Since 1995, the European School Survey Project on Alcohol and Other Drugs (ESPAD) has been collecting harmonised, nationally representative data on health-related behaviours among European high school students, providing a valuable framework for monitoring trends and facilitating cross-national comparisons.<sup>14</sup> Leveraging data from the 2023 ESPAD Italia survey, the present study provides up-to-date epidemiological insights on gaming and gambling among adolescents in Italy, examining their association through covariate-adjusted and stratified analyses.

## Methods

### Study design and participants

Data were drawn from the 2023 wave of the ESPAD Italia study, a nationally representative cross-sectional survey conducted annually since 1995 on the Italian adolescent student population. The study complies with European and national ethical guidelines and received ethical approval (number 0027159/2019) from the Ethics and Research Integrity Committee of the Italian National Research Council.

A representative sample of high school students aged 15–19 years was obtained through multistage stratified random sampling, using geographical area and school type as stratification variables, with classes as the final sampling unit. Within each school, one or more classes from the first to fifth grade were selected. Passive parental consent was used, with information letters provided to schools, parents or guardians, teachers, and students outlining the study's aims, administration procedures, privacy and anonymity safeguards, and dissemination plans. Participation was voluntary, with students free to withdraw at any time. In 2023, 85% of invited schools (146) accepted to participate. The anonymised survey was completed by students in class. Presence in class on the day of data collection served as the inclusion criterion, whereas the only exclusion criterion was the inability to complete the questionnaire independently, for instance, due to specific support needs. Among the eligible population, the participation rate was 99%. Geographical area, age, and sex-based post-stratification weighting was applied in accordance with the target population's distribution. A total of 12 225 students aged 15–19 years (mean age 16.9 years; SD 1.4) took part in the survey.

### Data collection and variables of interest

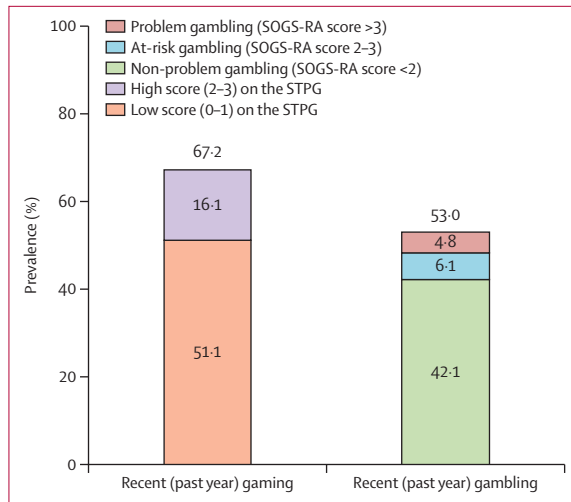
Data were collected between April 15 and May 31, 2023, using anonymous in-class questionnaires, on paper or online via mobile devices. Participants reported their sex (current legal) and year of birth. Participants aged

15–17 years were classified as minors. Regions of residence were grouped into northern, central, southern, and island areas. Participants rated their perceived familial economic wellbeing compared with other Italian families on a 7-point Likert scale (from 1 for “very much above” to 7 for “very much below”). Responses were grouped into three categories (1–2 for “above the average”, 3–5 for “average”, and 6–7 for “below the average”). Gaming in the past 12 months was defined as “recent”, consistent with the definition of “recent use” adopted by the European Union Drugs Agency (EUDA, formerly EMCDDA) in its survey methodology.<sup>15</sup> Respondents reporting recent gaming were asked further questions on gaming behaviours. The questionnaire assessed gaming time on typical school days, gaming time on typical non-school days, and the average monthly amount of money spent on gaming through online payments in the previous 12 months. Further details on question formulation and answer coding are provided in the appendix (pp 14–15). The perception of potentially concerning gaming behaviours was assessed using the Italian version of the 3-item Screening Test for Problematic Gaming (STPG), which showed good psychometric properties (Cronbach's  $\alpha=0.769$ ).<sup>16</sup> Scores of 0 or 1 were considered indicative of a low score, while scores of 2 or 3 were considered indicative of a high score.<sup>16</sup> For loot boxes, the questionnaire assessed the average monthly expenditure during the previous 12 months and evaluated potential symptoms of excessive use, as detailed in the appendix (pp 14–15). The questionnaire also collected data on lifetime gambling experience. Gambling was described as a game of chance where it is possible to win or lose money, with examples provided. Participants who reported gambling in the past 12 months were classified as recent gamblers. At-risk and problem gambling behaviours were assessed using the Italian version of the 12-item South Oaks Gambling Screen–Revised for Adolescents (SOGS-RA; Cronbach's  $\alpha=0.780$ ). In line with common practice in the literature, non-problem gambling, at-risk gambling, and problem gambling were defined on the basis of the sum scores from the 12 items, each scored dichotomously (0 or 1). Non-problem gambling was defined as a sum score between 0 and 1, at-risk gambling as a sum score between 2 and 3, and problem gambling as a sum score of 4 or higher.<sup>17</sup> We considered a score of 2 or higher as indicative of any-risk gambling.

### Statistical analysis

After excluding questionnaires with missing information on sex (2.1%), the dataset included 11 965 participants, for whom the prevalence of gaming and gambling behaviours was calculated. The mean age of the sample was 16.9 years (SD 1.4), and the median age was 17 years (IQR 16–18). In the ESPAD Italia survey, some items are hierarchically dependent on others (eg, participants should report their online in-game purchases only if they indicate having

See Online for appendix



**Figure:** Prevalence of gaming and gambling behaviours among 11 965 Italian students aged 15–19 years, Italy, 2023  
 SOGS-RA=South Oaks Gambling Screen Revised for Adolescents.  
 STPG=Screening Test for Problematic Gaming.

played video games in the previous 12 months). In paper-and-pencil questionnaires, participants might provide contradictory responses or complete lower-level items without answering the corresponding higher-level questions. Therefore, students were classified as lifetime and recent gamblers if they either answered affirmatively to the corresponding questions or responded to the questionnaire items asking about gambling formats used in the past 12 months. Likewise, they were classified as recent gamers if they either answered affirmatively to the recent gaming question or responded to items asking about types of video games used in the past 12 months. To estimate the prevalence of behaviours assessed by lower-level items, which might include missing values, we used two approaches. First, we presented conventional descriptive statistics, reporting counts and weighted percentages calculated over the number of valid respondents for each variable (ie, excluding item-specific missing responses). Second, in line with the methodology applied in the ESPAD Italia reports, we re-weighted lower-level behaviours to the total sample by multiplying the weighted proportion (excluding missing values) of respondents who answered the higher-level item by the proportion reporting the subordinate behaviour among those respondents.

After excluding participants with missing data on sex and on both lifetime and recent gambling, 10 521 participants (87.9% weighted) were included in the association analysis. These participants had a mean age of 16.9 years (SD 1.4) and a median age of 17 years (IQR 16–18). For each study outcome (ie, lifetime gambling, recent gambling, any-risk gambling, and problem gambling), we conducted a series of weighted logistic regression models in which each gaming-related measure was considered separately as the main exposure,

adjusting for age, sex, geographical area, and perceived economic status. This approach was chosen to prevent multicollinearity issues, as the gaming measures were moderately correlated (appendix pp 2–3). Additionally, we tested selected interaction terms between gaming-related measures (ie, school-day gaming time with gaming expenditure, non-school-day gaming time with gaming expenditure, and loot box expenditure with loot box symptoms), and conducted stratified analyses by sex, age group, and socioeconomic status (appendix p 4). Heterogeneity across strata was tested by comparing the likelihood ratio test of models with and without interaction terms between the exposure and stratification variables; problem gambling estimates were excluded from this testing owing to limited case numbers. *p* values lower than 0.05 were considered significant. All analyses were done using SAS version 9.4, and figures were produced using R version 4.1.1.

#### Role of the funding source

The funders of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

#### Results

Of the 11 965 participants included in the dataset (50.6% male, 49.4% female), 67.2% (*n*=6621) were classified as recent gamers (85.2% of male participants [*n*=4181]; 49.2% of female participants [*n*=2440]; figure). Of these, 33.0% (*n*=1937) had spent money on in-game online purchases (21.3% of the whole sample; ESPAD-method prevalence estimate 22.2%), while 24.0% (*n*=1511) reported a high score on the STPG (15.9% in the whole sample; ESPAD prevalence estimate 16.1%; table 1). The prevalence of lifetime gambling was 58.7% (*n*=5955; 65.8% in male participants [*n*=3311]; 51.6% in female participants [*n*=2644]; 57.2% in those younger than 18 years [*n*=3653]), while recent gambling was reported by 53.0% of participants (*n*=5422; 60.0% of male participants [*n*=3055]; 45.9% of female participants [*n*=2367]; 51.5% of those younger than 18 years [*n*=3310]). The age of those who reported recent gambling ranged from 15 to 19 years (mean age 16.9 years, SD 1.4; median age 17 years, IQR 16–18), indicating an age distribution similar to that of the whole sample. Among those who gambled in the past 12 months, 11.4% (*n*=466) reported at-risk gambling (5.6% of the whole sample, ESPAD prevalence estimate 6.1%), and 9.0% (*n*=332; 4.4% of the whole sample, ESPAD prevalence estimate 4.8%) reported problem gambling, corresponding to 20.4% reporting any-risk gambling (*n*=798; 10.0% of the whole sample, ESPAD prevalence estimate 10.9%). The figure shows the prevalences of recent gaming and gambling as bar charts, with each bar subdivided to display the corresponding STPG and SOGS-RA score distributions, calculated using the procedure adopted in the ESPAD report.

The distribution of the variables related to sample characteristics and gaming behaviours in the subgroup included in the association analysis was very similar to that observed in the total sample (table 1).

Participants reporting recent gaming had higher odds of lifetime gambling (adjusted odds ratio [aOR] 1.74, 95% CI 1.57–1.93), recent gambling (1.65, 1.49–1.83), and any-risk gambling (1.33, 1.08–1.62) than did those who did not report recent gaming (table 2). Our estimates did not provide evidence of a direct association between recent gaming and problem gambling. Nonetheless, the proportion of participants reporting problem gambling was numerically higher among recent gamers than among non-recent gamers (4.2% vs 2.0%).

Compared with non-recent gamers, participants who reported gaming for less than 60 min on typical school days had higher odds of lifetime gambling, recent gambling, and any-risk gambling (table 2). Those gaming for 60 min or more had comparable odds to those gaming for less than 60 min. A similar pattern was seen for those who reported gaming on non-school days. Compared with non-recent gamers, those playing for less than 60 min had higher odds of lifetime gambling, recent gambling, and any-risk gambling. Participants gaming for 60 min or more showed similar odds to those gaming for less than 60 min. Although no significant association with problem gambling emerged across either school or non-school days, the proportion of participants reporting problem gambling seemed to be higher with longer gaming time.

In relation to non-recent gamers and exclusively offline gamers, online gamers who reported an average monthly spending of up to €10 on gaming through online payments in the past 12 months had higher odds of lifetime gambling and recent gambling, but not of any-risk or problem gambling (table 2). Spending between €11 and €50 was associated with increased odds of lifetime gambling, recent gambling, and any-risk gambling, while the association with problem gambling was not significant. With expenditures over €50, odds further increased for lifetime gambling, recent gambling, any-risk gambling, and problem gambling.

Participants with either low or high scores on the STPG reported lifetime gambling more frequently than non-recent gamers, recent gambling, and any-risk gambling (table 2). Although the proportion of participants reporting problem gambling seemed to increase with STPG scores, no significant associations were observed.

Compared with participants who neither gamed nor found any loot boxes in the past year, those who reported an average monthly spending of up to €5 on loot boxes during the previous 12 months had higher odds of lifetime gambling and recent gambling but did not significantly differ in the odds of any-risk and problem gambling (table 2). When spending exceeded €5, the direct associations with lifetime gambling and recent gambling became more evident, and a strong direct

	Total sample (n=11 965)	Subsample in association analysis (n=10 521)
<b>Sex</b>		
Male	5991 (50.6%)	5224 (50.2%)
Female	5974 (49.4%)	5297 (49.8%)
<b>Legal age</b>		
No	7653 (61.7%)	6653 (60.8%)
Yes	4312 (38.3%)	3868 (39.2%)
<b>Geographical area</b>		
Northwestern Italy	2907 (24.9%)	2548 (24.9%)
Northeastern Italy	1254 (18.8%)	1105 (19.1%)
Central Italy	5423 (20.5%)	4786 (20.3%)
Southern Italy	1534 (25.1%)	1343 (24.9%)
Great Italian islands	847 (10.8%)	739 (10.8%)
<b>Perceived family economic wellbeing</b>		
Above the average	2412 (28.9%)	2404 (28.9%)
Average	5092 (61.1%)	5085 (61.1%)
Below the average	858 (10.1%)	854 (10.1%)
<b>Recent gaming (past 12 months)*</b>		
No	3225 (32.8%)	3213 (32.8%)
Yes	6621 (67.2%)	6608 (67.2%)
<b>In-game online purchases in the past 12 months*</b>		
No	7156 (78.7%)	7133 (78.6%)
Yes	1937 (21.3%)	1936 (21.4%)
<b>Gaming time on a typical school day (in the past 30 days)*</b>		
No recent gaming	4933 (52.4%)	4917 (52.4%)
<60 min	2461 (25.9%)	2459 (25.9%)
≥60 min	2076 (21.7%)	2070 (21.7%)
<b>Gaming time on a typical non-school day (in the past 30 days)*</b>		
No recent gaming	4529 (49.8%)	4518 (49.8%)
<60 min	1883 (20.9%)	1878 (20.9%)
≥60 min	2748 (29.3%)	2741 (29.3%)
<b>STPG score*</b>		
No recent gaming	3225 (33.9%)	3213 (33.8%)
Low (0–1)	4780 (50.3%)	4772 (50.3%)
High (2–3)	1511 (15.9%)	1509 (15.9%)
<b>Loot box opening in the past 12 months*</b>		
No recent gaming or no loot boxes found	8352 (92.1%)	8340 (92.1%)
No (found a loot box and did not open it)	88 (0.8%)	87 (0.8%)
Yes	724 (7.1%)	721 (7.1%)
<b>Average monthly spending on loot boxes in the past 12 months*</b>		
No recent gaming or no loot boxes found	8372 (93.3%)	8358 (93.3%)
≤€5	581 (5.7%)	580 (5.7%)
>€5	92 (1.0%)	92 (1.0%)
<b>Potential symptoms of excessive loot box use (0–5)*</b>		
0 or no loot boxes found	8737 (96.5%)	8723 (96.5%)
1–2	226 (2.3%)	224 (2.3%)
3–5	124 (1.2%)	124 (1.2%)

Data are n (%); percentages exclude missing values. STPG=Screening Test for Problematic Gaming. \*The sum does not add up to the total because of some missing values.

**Table 1: Absolute numbers and weighted percentages of demographic, socioeconomic, and selected gaming behaviour variables among the total sample and among the sample included in the association analysis, Italy, 2023**

	Lifetime gambling (yes vs no)		Recent gambling (yes vs no)		Any-risk gambling (yes vs no)		Problem gambling (yes vs no)	
	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Total	5955 (57.4%)		5422 (51.7%)		798 (8.2%)		332 (3.4%)	
<b>Recent gaming</b>								
No	1461 (46.1%)	1.00	1322 (41.1%)	1.00	144 (4.8%)	1.00	59 (2.0%)	1.00
Yes	4078 (62.5%)	1.74 (1.57-1.93)	3724 (56.5%)	1.65 (1.49-1.83)	611 (10.0%)	1.33 (1.08-1.62)	254 (4.2%)	0.92 (0.69-1.22)
<b>Gaming time on a typical school day (in the past 30 days)</b>								
No recent gaming (or no gaming on school days in the past 30 days)	2462 (50.9%)	1.00	2227 (45.3%)	1.00	255 (5.6%)	1.00	99 (2.2%)	1.00
<60 min	1520 (62.4%)	1.49 (1.33-1.67)	1385 (56.4%)	1.46 (1.31-1.63)	225 (9.7%)	1.36 (1.12-1.66)	94 (4.1%)	1.25 (0.94-1.68)
≥60 min	1324 (64.4%)	1.50 (1.32-1.70)	1223 (59.2%)	1.50 (1.32-1.70)	237 (12.3%)	1.39 (1.14-1.71)	96 (5.0%)	1.14 (0.84-1.55)
<b>Gaming time on a typical non-school day (in the past 30 days)</b>								
No recent gaming (or no gaming on non-school days in the past 30 days)	2243 (50.4%)	1.00	2024 (44.8%)	1.00	223 (5.3%)	1.00	87 (2.1%)	1.00
<60 min	1151 (61.8%)	1.59 (1.41-1.79)	1053 (56.1%)	1.53 (1.36-1.72)	160 (9.0%)	1.34 (1.08-1.66)	68 (3.8%)	1.06 (0.77-1.47)
≥60 min	1721 (63.3%)	1.43 (1.27-1.61)	1588 (58.0%)	1.43 (1.27-1.61)	302 (11.7%)	1.34 (1.10-1.64)	117 (4.5%)	1.06 (0.79-1.42)
<b>Average monthly in-game online purchases in the past 12 months</b>								
No recent gaming or exclusively offline gaming	1909 (48.5%)	1.00	1718 (42.9%)	1.00	195 (5.2%)	1.00	80 (2.1%)	1.00
€0-10	2372 (60.7%)	1.59 (1.42-1.76)	2172 (55.1%)	1.55 (1.39-1.71)	320 (8.6%)	1.10 (0.91-1.35)	118 (3.2%)	0.79 (0.59-1.06)
€11-50	422 (69.0%)	2.00 (1.62-2.47)	395 (64.3%)	1.98 (1.62-2.43)	82 (14.4%)	1.58 (1.16-2.14)	36 (6.3%)	1.30 (0.85-2.00)
>€50	355 (69.6%)	2.09 (1.67-2.61)	324 (63.4%)	1.92 (1.55-2.37)	83 (17.2%)	2.09 (1.57-2.78)	41 (8.5%)	1.64 (1.10-2.44)
<b>STPG score</b>								
No recent gaming	1461 (46.1%)	1.00	1322 (41.2%)	1.00	144 (4.8%)	1.00	59 (2.0%)	1.00
Low	2932 (62.1%)	1.77 (1.59-1.97)	2684 (56.3%)	1.68 (1.51-1.87)	408 (9.1%)	1.24 (1.01-1.53)	158 (3.5%)	0.81 (0.60-1.09)
High	937 (63.0%)	1.69 (1.46-1.96)	851 (56.6%)	1.56 (1.35-1.81)	170 (12.4%)	1.67 (1.30-2.14)	79 (5.7%)	1.28 (0.90-1.82)
<b>Average monthly spending on loot boxes in the past 12 months</b>								
No recent gaming or no loot boxes found	4704 (57.1%)	1.00	4272 (51.2%)	1.00	608 (7.8%)	1.00	244 (3.1%)	1.00
€0-5	395 (68.3%)	1.61 (1.30-1.99)	371 (64.0%)	1.62 (1.33-1.99)	61 (11.1%)	1.00 (0.74-1.35)	22 (4.0%)	0.98 (0.63-1.53)
>€5	68 (73.9%)	2.31 (1.34-3.99)	64 (71.1%)	2.07 (1.25-3.44)	22 (26.5%)	3.26 (1.90-5.58)	15 (18.1%)	4.76 (2.55-8.88)
<b>Number of potential symptoms of excessive loot box use (0-5)</b>								
0 (or no loot boxes found)	4929 (57.3%)	1.00	4482 (51.4%)	1.00	638 (7.9%)	1.00	260 (3.2%)	1.00
1-2	157 (70.4%)	1.79 (1.29-2.48)	149 (66.5%)	1.76 (1.29-2.41)	29 (13.5%)	1.47 (0.98-2.20)	8 (3.7%)	1.10 (0.58-2.09)
3-5	89 (71.8%)	1.99 (1.23-3.22)	84 (68.3%)	2.04 (1.29-3.24)	26 (23.0%)	2.46 (1.51-4.00)	12 (10.6%)	1.81 (0.90-3.67)

Data are n (%) or adjusted ORs (95% CI). Percentages are unweighted and represent the proportion of participants reporting the outcome (ie, lifetime gambling, recent gambling, any-risk gambling, and problem gambling) of the total of the participants in each level of the gaming-related variable, using only participants with observed outcome values within each exposure category. ORs estimated by weighted multivariable logistic regression models adjusted for sex, age, geographical area, and economic status. OR=odds ratio. STPG=Screening Test for Problematic Gaming.

**Table 2: Adjusted ORs for lifetime, recent, any-risk, and problem gambling, according to gaming activities among 10 521 students aged 15-19 years, Italy 2023**

association also emerged with any-risk gambling and problem gambling.

In relation to non-recent gamers and those with no potential symptoms of excessive loot box use, individuals with 1-2 symptoms more frequently reported lifetime gambling and recent gambling; the association with any-risk gambling was not significant (table 2). Reporting 3-5 symptoms showed a strong direct association with lifetime gambling, recent gambling, and any-risk gambling, whereas the association with problem gambling was not significant. Nevertheless, the proportion of participants reporting problem gambling was numerically higher among those with 3-5 symptoms of excessive loot box use than among those reporting 1-2 symptoms (10.6% vs 3.7%).

Interaction terms between selected gaming measures showed inconsistent patterns across outcomes and did not meaningfully affect the main findings (appendix p 4). Results from the stratified analyses (appendix pp 5-13) were consistent with those from the main analysis. No significant heterogeneity was observed across strata defined by sex, age, and socioeconomic status, although the impact of increased in-game spending and engagement with loot boxes on gambling involvement and severity seemed more pronounced in younger participants aged 15-17 years.

### Discussion

In this cross-sectional study based on a nationally representative sample of 11 965 Italian students aged

15–19 years, both gaming and gambling were highly prevalent. Overall, 67% reported gaming in the past year, and 24% of them reported a high score on the STPG. More than half of participants (53%) reported recent gambling (including 52% of minors). Among these, 11% engaged in at-risk gambling and 9% in problem gambling according to the SOGS-RA. The results indicate a convergence between gaming and gambling behaviours in this population. The association between gaming and gambling involvement and harm appears particularly strong when gaming entails monetary spending, especially through loot boxes, suggesting that video game monetisation systems might warrant attention either because they might engage psychological vulnerabilities similar to those involved in gambling or because they may promote gambling participation and escalation.

To our knowledge, no recent study has provided such broad age-range gaming data for Italian adolescents. In 2024, ESPAD Europe surveyed 113 882 students aged 15–16 years in 37 European countries, reporting a 12-month gaming prevalence of 73.6% in Italy and an average of 80.4% across the whole sample.<sup>7</sup> Earlier Italian studies on small samples reported variable gaming rates; our estimate falls mid-range.<sup>18,19</sup>

Recent gambling prevalence rates observed in this study exceeded those reported in most prior research. A meta-analysis by Tran and colleagues<sup>8</sup> considering studies published up to 2019 estimated recent gambling prevalence in Italy at 15–42% among adults and 33–45% among individuals younger than 18 years, with the latter group ranking highest in Europe and second worldwide after Israel. The unfavourable leading position of Italy is confirmed by the 2024 European ESPAD survey of students aged 15–16 years, which reported that Italy had the highest 12-month gambling prevalence of all the countries included in the survey (prevalence 44.8%), with rates increasing since 2015 in contrast to a stable European average (22–23%).<sup>7</sup> A worrisome trend also emerged from the ESPAD Italia study on the 15–19-year age group, from which our data are derived, with the prevalence reported here being the highest since data collection began in 2009.<sup>20</sup> Our observations for any-risk and problem gambling fall within the confidence intervals of the estimates reported by the meta-analysis by Tran and colleagues.<sup>8</sup> The high rate of underage gambling supports the view that age-verification systems in Italian land-based venues (based on ID checks) and in online platforms (based on authentication against official registries) remain widely circumventable.<sup>21,22</sup>

Higher in-game spending (particularly on loot boxes), rather than gaming time, seems to drive the association between gaming and gambling involvement and any-risk gambling. This factor also emerges as the most salient in relation to problem gambling, which, by contrast, did not show a clear association with gaming per se (at any frequency) or with the STPG, likely due to the small

number of observations, but possibly also because more intense gaming and gambling patterns might compete with each other. Importantly, all observed associations remain independent of sex, age, and socioeconomic status, although they appear more pronounced among minors.

Even if the co-occurrence of certain gaming and gambling patterns might largely be explained by shared psychological, social, and familial factors,<sup>12</sup> a few longitudinal studies conducted on adults and on non-representative samples of adolescents support the possibility that spending money on gaming (including loot boxes) might increase the risk of harmful gambling.<sup>19,23,24</sup> Concerns that certain gaming experiences, now widespread especially in mobile gaming apps,<sup>9,25,26</sup> might serve as a gateway to gambling or promote its escalation are theoretically plausible. Through the commercial design of digital games, in which spending is increasingly embedded within the experience of play, adolescents could become familiar with a consumption model where money is routinely exchanged for reward and excitement, echoing dynamics that are also present in gambling.<sup>3,5</sup> Explicit references to gambling practices, including those embedded in the design of game mechanics that link spending to progression or advantage, might contribute to its normalisation.<sup>10</sup> Additionally, it has been proposed that repeated spending on chance-based rewards in gaming could condition behavioural patterns reinforced by variable-ratio reward schedules, potentially increasing susceptibility to gambling.<sup>10,25,26</sup>

Nonetheless, reverse causality cannot be ruled out. For instance, a small study on adult participants found that symptoms of problem gambling could increase adult players' susceptibility to overspending on loot boxes.<sup>27</sup> It is also worth noting that studies examining the relationship between gaming and gambling in adults have generally resulted in mixed findings.<sup>28–30</sup>

This study has some limitations and strengths. The cross-sectional design of our study precludes causal inference, and the reliance on self-reported measures makes the findings subject to potential recall bias. Although ESPAD Italia includes only high school students and results might not generalise to non-students, this limitation is mitigated by the fact that, in 2023, 89.7% of Italian residents aged 15–19 years were enrolled in high school, making the survey broadly representative of this age group.<sup>31</sup> Subjective comparison-based measures of family economic status are widely used and generally considered reliable among adolescents, yet they might still be influenced by limited awareness,<sup>32</sup> while the absence of race and ethnicity data prevents assessment of their potential confounding effect. Finally, although the STPG is a validated instrument with robust psychometric properties, it primarily reflects the perception of harmful gaming patterns, rather than their actual presence. Nevertheless, these limitations are balanced by key

strengths. First, to the best of our knowledge, this is the first study to address this issue using a rigorously selected, large, nationally representative sample. Moreover, the analyses were adjusted for major confounding variables, and stratified approaches allowed for a more nuanced understanding of subgroup patterns. Finally, the classroom-based survey design of ESPAD might have reduced social desirability bias, yielding more candid reporting of sensitive behaviours such as gambling compared with household surveys.<sup>33</sup>

Given the widespread prevalence of gaming and gambling among adolescents, raising awareness of their risks is essential. However, as emphasised by the second *Lancet* Commission on Adolescent Health and Wellbeing and consistent with the regulatory perspective advanced by the *Lancet Public Health* Commission on Gambling, it is crucial to address industry strategies that exploit adolescents' vulnerabilities, such as their susceptibility to peer influence and digital marketing.<sup>35</sup> Given the growing evidence of gaming-related harms and its potential gateway role into gambling, rigorous monitoring and a precautionary stance on in-game monetisation systems are warranted.

Italy supports the Pan European Game Information (PEGI) initiative, which provides content descriptors for in-game purchases, loot boxes, and gambling-related elements, based on which recommended age ratings are assigned. However, as in most European countries, these indications are not currently legally binding.<sup>34</sup> Regulatory approaches around the world differ substantially in their scope and effectiveness.<sup>34</sup> For instance, Japan has banned certain chance-based reward mechanisms similar to loot boxes, yet comparable monetisation strategies remain legal. Belgium's ban on loot boxes has been largely unenforced, offering little more than a false sense of security.<sup>35</sup> Meanwhile, China has introduced the world's most stringent restrictions on loot boxes, requiring disclosure of odds, daily purchase limits, and progressively increasing probabilities in the player's favour.<sup>36</sup> Some countries, such as the UK, have instead opted for industry self-regulation.<sup>36</sup> Apparently, softer measures such as labelling, probability disclosure, age ratings, and parental controls can be implemented with relative ease, but their effectiveness depends on industry collaboration, whereas outright bans appear difficult to put into practice and are heavily reliant on international cooperation.<sup>36</sup>

Direct action on gambling is also needed. A comprehensive strategy for Italy might first include stronger controls on underage access to land-based gambling and to gambling apps and other online platforms. Strengthening age-control measures and restricting gambling availability have shown promising results both in local and international contexts, although implementation remains challenging, particularly online.<sup>3,37</sup> The response could also entail tighter rules on product design, higher taxation of gambling operators

(especially those operating online), and the introduction of non-circumventable limits on sponsorships and advertising, with a particular emphasis on curbing online and digital promotional content.<sup>3</sup>

Longitudinal evidence is needed to clarify the pathways from gaming to gambling, alongside advances in understanding psychological mechanisms at play and comparative cross-national evaluations of regulatory impact.<sup>38</sup>

#### Contributors

Conceptualisation: PB, GM, SM, and AO. Data curation: EB, SB, SM, and MS. Formal analysis: PB. Funding acquisition: SM and AO. Investigation: EB, SB, SM, and MS. Methodology: EB, PB, SB, SM, GM, and MS. Project administration: SM and AO. Resources: SM and AO. Supervision: LC, SG, SM, and AO. Visualisation: PB and GM. Writing: GM. Writing—review and editing: PB, EB, SB, LC, SG, SM, AO, MS, and RV. EB, PB, SB, SM, GM, AO, and MS had access to all raw data, which were verified for accuracy and consistency by EB, PB, SB, SM, and MS. SM and AO had final responsibility for the decision to submit the manuscript for publication.

#### Declaration of interests

We declare no competing interests.

#### Data sharing

The study protocol, statistical analysis plan, and informed consent form will be available from the corresponding author by email upon reasonable request at any time after publication. The raw data cannot be shared, as their use is restricted to researchers within the ESPAD project. However, a summary including several descriptive statistics can be found in the ESPAD Italia 2023 report.

#### Acknowledgments

This publication was produced with the contribution of the Italian Ministry of University and Research (MUR) pursuant to Ministerial Decree Number 1396 of Sept 18, 2024 – PRO-BEN 2 Call. The research was carried out within the project “Proben2024\_0000011” (University of Pavia Unique Project Code, CUP: F53C24001800001). The Department for Anti-Drug Policies, Presidency of the Council of Ministers (Italy), supported the ESPAD Italia project. The work of GM was also supported by the General Directorate for Welfare of the Lombardy Region through the Local Health Authority of Pavia.

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