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# Online Gambling and At-Risk Gambling Behaviour in a Cross-Sectional Survey Among 13–19 Year-Old Adolescents in Barcelona

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**Abstract**
Gambling forms part of social and leisure activities for adolescents but is not free of potential harms. Moreover, with the emergence of new technologies, gambling has become increasingly accessible and appealing to this population. The aim of this study was to determine the magnitude of gambling behaviour and its associated factors in adolescents aged 13–19 years in the city of Barcelona in 2021. A cross-sectional study was conducted using data from the 2021 Survey of Risk Factors in Secondary Schools. A bivariate analysis was carried out and multiple logistic regression models were constructed to estimate adjusted odds ratios and their 95% confidence intervals for online, non-online, and at-risk gambling. The prevalence of gambling among adolescents in Barcelona was 18.6% in boys and 6.1% in girls. Gambling was associated with various sociodemographic, health, and lifestyle factors, with differences observed by sex and gambling modality (online vs. non-online). The prevalence of at-risk gambling was 6.2% in boys and 1% in girls. At-risk gambling was associated with male sex, engaging in online gambling, poor mental health, and participating in more than two different types of gambling. The results of this study show that gambling is a widespread activity among adolescents in Barcelona, with significant associated risks. Preventive programmes and regulations are needed to reduce gambling involvement and gambling-related harms.

**Keywords** Gambling · Adolescent · Adolescent health · Online gambling · Gambling-related harm · Mental health

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## Introduction

Gambling is illegal for young minors but remains a popular activity among this demographic as part of their social and leisure pursuits (Calado et al., 2017). Moreover, it is commonly perceived as a socially acceptable and risk-free form of entertainment (Deans et al., 2017). According to the 2019 European School Survey Project on Alcohol and Other Drugs (ESPAD), 22% of 15–16 year-old European students had engaged in gambling at least once within the previous 12 months (ESPAD Group, 2020). The 2021 Survey on Drug Use in Secondary Education in Spain (*Encuesta sobre uso de Drogas en Enseñanzas Secundarias en España*, ESTUDES) revealed that 20.1% of adolescents aged 14–18 years were involved in land-based and/or online gambling, with boys showing a higher prevalence (27.6%) than girls (12.6%). In addition, 9.4% of adolescents exclusively gambled online, and the rates were also higher among boys (15%) than girls (3.8%) (OEDA. Spanish Drug Observatory, 2022).

Participation in gambling can have serious negative consequences that impact the health and wellbeing of individuals, families, and communities (Wardle, 2018). From a public health perspective, gambling-related harms encompass various problems in four domains: financial, educational and developmental, relationships, and health. These difficulties can affect individuals' attitudes and concerns about money, disrupt relationships with family and friends, and influence physical and mental wellbeing (Blake et al., 2019). The terms "at-risk gambling" and "problem gambling" are used to describe gambling-related harms, which manifest as persistent and recurring patterns of gambling behaviour. According to a systematic review (Calado et al., 2017), between 0.2% and 12.3% of young Europeans meet the criteria for problem gambling. Conversely, the 2021 ESTUDES survey conducted in Spain reported rates of 3.4% for at-risk gambling (5% of boys and 1.9% of girls), corresponding to 17.9% of all gamblers (19.1% boys and 15.2% girls) (OEDA. Spanish Drug Observatory, 2022).

Although adolescents tend to engage in gambling less frequently than adults, they are at greater risk of experiencing severe gambling-related harms (Wardle, 2015). This paradoxical trend is highlighted by a study reporting that rates of problem gambling among adolescents were two to four times higher than those in adults (Blinn-Pike et al., 2010). The higher rates of problem gambling may be due to the incomplete development of executive functions, such as planning and impulse control, in the adolescent brain, rendering adolescents more vulnerable to addictive behaviours. Consequently, adolescents are more likely to engage in impulsive and risky behaviours (Gladwin et al., 2011).

Gambling behaviour is influenced not only by individual factors but also by structural and intermediate determinants that play a crucial role in shaping its health impact (Sancho O et al., 2021). In adolescents, gambling and problem gambling have been associated with male gender (Blinn-Pike et al., 2010; Frisone et al., 2020; Pisarska & Ostaszewski, 2020; Raisamo et al., 2020), as well as with disadvantaged socioeconomic status (SES), at both the individual level (Buja et al., 2019; Welte et al., 2008) and the environmental level (Buja et al., 2019; Van der Maas, 2016). Gambling involvement and problem gambling has also been linked to individual factors such as poor mental health (Moodie & Finnigan, 2006; Potenza et al., 2011) and substance use (Carbonneau et al., 2022; Dowling et al., 2017), school-related factors, including poor academic connectedness (Melendez-Torres et al., 2020), social factors such as social exclusion (Dowling et al., 2017; Riley et al., 2021), and family factors, such as parental monitoring, which is a protective factor (Gori et al., 2015; Riley et al., 2021).

Prior research has also shown that the availability of gambling (Calado et al., 2017; King et al., 2010), its accessibility (Kang et al., 2019; Lloret et al., 2018), and gambling advertising (Derevensky et al., 2010; Hing et al., 2014) are strongly associated with increased exposure to gambling and problem gambling. The gambling industry has actively used new technologies that facilitate faster automated machines with sensory elements and immediate rewards (Armstrong et al., 2017). In this context, higher levels of gambling involvement and engaging in more than two forms of gambling have been positively associated with problem gambling (Mazar et al., 2020). It is concerning that the gambling industry and its marketing strategies have targeted the younger population, as early experiences with gambling, at around the age of 10 years, seem to predict gambling problems in the future (Nower et al., 2004).

Emerging technologies and new gambling trends, such as online gambling, have enhanced appeal among youth and can reinforce cognitive biases. These biases represent systematic errors in thinking and decision-making that can lead to irrational behaviour and risky gambling habits (Abbott et al., 2018). The ease of access to online gambling, as well as the comfort and anonymity it provides (Dowling et al., 2017) may have increased the prevalence of gambling in recent years (Botella-Guijarro et al., 2020). In Spain, the online modality has been particularly associated with cases of gambling addiction among individuals under the age of 26 years (Chóliz, 2016). Moreover, involvement in online gambling and problem gambling rates among young people have been further intensified by the recent COVID-19 pandemic (Håkansson, 2020; Jenkinson et al., 2020).

Understanding the characteristics of young gamblers in this new, ever-evolving, and potentially more risky context is crucial to implementing preventive measures and effective policies to tackle gambling and its associated harms. Therefore, the aim of this study was to determine the prevalence of gambling and at-risk gambling, as well as to identify the factors associated with these behaviours, among adolescents in the city of Barcelona in 2021.

## Methods

### Study Design, Population, and Sampling

A cross-sectional study was carried out based on a selection of questions from the 2021 Survey of Risk Factors in the Secondary School (*Factors de Risc en Estudiants de Secundària*, FRESC), conducted in the city of Barcelona, Spain, between February and June 2021. The FRESC survey is conducted every 5 years by the Public Health Agency of Barcelona and is representative of the educational centres in the city. The survey aims to identify the determinants, behaviours and attitudes related to the health of adolescent students in Barcelona, as well as their impact on social inequalities in health (Agència de Salut Pública de Barcelona, 2021).

The study population consisted of boys and girls aged between 13 and 19 years enrolled in educational centres in the city of Barcelona during the 2020–21 academic year. The sample was selected through stratified random sampling, in which the sample unit was the classroom. The classrooms were selected considering the SES of the neighbourhood where the school was located, the school type (public, subsidised, or private), and the district. The sample size was determined to obtain an accuracy of ± 3% for a 95% confidence level and an alpha error of 5% for a proportion of approximately 50% (assumption of maximum

uncertainty), resulting in a sample of 3374 adolescents. We excluded students who did not complete gambling questions (1.2%); therefore, the final sample consisted of 3332 students, 1704 girls and 1628 boys.

## Variables and Measures

Dependent variables were gambling involvement (yes/no), according to responses to the question "Have you gambled for money in the last 12 months?" and at-risk gambling (yes/no), assessed through the responses to the Lie/Bet questionnaire (Johnson et al., 1997). This questionnaire identifies at-risk gambling if one or both questions have an affirmative response: "Have you ever lied to your family and friends about how much you have spent on gambling?" and "Have you ever felt that you needed to gamble for more and more money?".

Independent variables encompassed a range of gambling behaviours and sociodemographic, heath, and lifestyle factors. Gambling behaviour was included in the gambling frequency item (≤ once a week/ > once a week) and the gambling typology item, which was disaggregated as the prevalence of the following gambling types: "Lotteries", "Sports betting", "Slots", "Casino", "Bingo", "Video games", "Stock market" and "Contests". The variable was grouped according to the total number of gambling types (≤ 2 gambling types/ ≥ 3 gambling types). The age of onset (≤ 10 years/ > 10 years) was also included.

Sociodemographic variables included students' age (≤ 18 years/ > 18 years) and individual and environmental SES. Individual SES (advantaged SES/disadvantaged SES) was obtained using the Family Affluence Scale (FAS) (Hartley et al., 2016), based on a set of questions related to the economic possibilities of the pupil's family, dichotomised into disadvantaged SES (FAS 0 to 3) and advantaged SES (FAS 4 to 7). Environmental SES (advantaged SES/disadvantaged SES) was determined based on the neighbourhood where the school was located. This determination was made using the most recent edition of the household disposable income index (Ajuntament de Barcelona, 2019), dichotomised into disadvantaged SES (< 100) and advantaged SES (≥ 100).

The study examined several health and lifestyle variables. These included the following: *allowance* (yes/no); this variable indicated whether the student received money periodically from his or her family. Mental health (good/poor) was assessed using the strengths and difficulties questionnaire (SDQ) (Goodman et al., 2000). The SDQ is a 25-item ordinal scale assessing symptoms, behaviours, and relationships with others. The total score is obtained from the sum of the 25 items and ranges from 0 to 40. The higher the score, the higher the likelihood of mental health problems. Scores from 0–19 indicate good mental health and those from 20–40 indicate poor mental health. Use of legal drugs (yes/no) was determined by whether the student reported smoking ≥ 1 cigarette per month and/or reported consuming alcohol in the last 12 months. Use of illegal drugs (yes/no) was determined by whether the student reported using cannabis in the last 12 months and/or had ever tried other illegal substances during their life. Household cohabitation (> 1 adult/1 adult) examined whether the student lived with only one adult or with more than one adult. Leisure time with friends (a little/a lot) was based on the number of afternoons per week the student reported spending with friends and was categorised as a lot if the student spent three or more afternoons per week with friends. School attachment (good/poor) was based on the student's opinion of their school and was dichotomised into good (the student like the school) and poor (the student did not like the school).

Finally, stratification variables consisted of students' sex (boys/girls) and gambling modality (online/non-online), differentiating between students who gambled online and those who did not gamble online.

### Statistical Analysis

First, we performed a bivariate description of the dependent variables and the remaining variables on gambling behaviour, stratified by sex and gambling modality. We examined whether there were significant differences between the two gambling modalities using a chi-square test. The level of statistical significance was set at $p < 0.05$. In addition, a multivariate analysis was carried out to determine the association between gambling involvement and the remaining independent variables using a multiple logistic regression model stratified by sex and gambling modality. Online and non-online gamblers were compared with non-gamblers and odds ratios (OR) and their 95% confidence intervals (CI) were estimated, adjusted by all variables. Finally, using a sub-sample of gamblers, a multiple logistic regression model was carried out comparing at-risk and non-at-risk gamblers based on the estimation of OR and their 95% CI. This model was not stratified by sex due to the low number of girls in the sample. Significant variables were included, and the analysis was controlled by age and individual SES. For the analysis and processing of the data, we used the statistical programme RStudio version 4.1.1.

### Ethical Considerations

The 2021 FRESC Survey is anonymous and confidential, in compliance with Law 6/2007 of July 17, which regulates the preparation and advertising of surveys and opinion studies in Catalonia. In addition, data confidentiality is guaranteed in accordance with Organic Law 3/2018 on the Protection of Personal Data and the guarantee of digital rights. The FRESC survey is part of the statistical actions of interest of the *Generalitat de Catalunya* and is included in the Annual Statistical Action Programme under registration number: 09-01-03.

## Results

The final sample consisted of 3332 adolescents, 51.1% girls (N = 1704) and 86.2% minors (N = 2873).

Table 1 shows the bivariate analysis of the prevalence of gambling and at-risk gambling in adolescents (N = 3332) stratified by sex and modality. The proportion of boys who gambled was 18.6% and that of girls was 6.1%. Significant differences were observed between gambling modalities in boys, with the prevalence of online gambling being 12.9% and that of non-online gambling being 5.7% ($p < 0.001$). No significant differences were observed between modalities in girls, although the prevalence of non-online gambling (3.3%) was slightly higher than that of online gambling (2.8%). The prevalence of at-risk gambling was 6.2% for boys and 1% for girls. Significant differences were observed between online and non-online modalities in boys ($p < 0.001$), in whom the prevalence of at-risk gambling was 4.9% for the online modality and 1.3% for the non-online modality.

Table 2 shows the results of the bivariate analysis in terms of frequency, typology, age of onset of gambling, and at-risk gambling in the adolescent gambling population (N = 406),

**Table 1** Prevalence of gambling and at-risk gambling in adolescents, according to sex and gambling modality (N = 3332)

| | Boys (N = 1,628) | | | | Girls (N = 1,704) | | | |
|---|---|---|---|---|---|---|---|---|
| | Total N (%) | Online N (%) | Non-online N (%) | *p*-value | Total N (%) | Online N (%) | Non-online N (%) | *p*-value |
| *Prevalence*[a] | | | | | | | | |
| Gambling involvement | 303 (18.6) | 210 (12.9) | 93 (5.7) | **< 0.001** | 103 (6.1) | 47 (2.8) | 56 (3.3) | 0.368 |
| At-risk gambling | 100 (6.2) | 79 (4.9) | 21 (1.3) | **< 0.001** | 17 (1.0) | 8 (0.5) | 9 (0.5) | 0.736 |

[a]Bold values are significant (chi-square test $p < 0.05$)

**Table 2** Frequency, typology, age of onset and prevalence of at-risk gambling in adolescent gambling population, according to sex and gambling modality (N = 406)

| Variables[a] | Boys (N = 303) | | | Girls (N = 103) | | |
|---|---|---|---|---|---|---|
| | Online (N = 210) | Non-online (N = 93) | *p*-value | Online (N = 47) | Non-online (N = 56) | *p*-value |
| | N (%) | N (%) | | N (%) | N (%) | |
| *Gambling frequency* | | | | | | |
| ≤ Once a week | 174 (83.7) | 86 (94.5) | **0.039** | 44 (93.6) | 54 (96.4) | 0.841 |
| > Once a week | 34 (16.3) | 7 (7.7) | | 3 (6.4) | 2 (3.6) | |
| *Gambling types* | | | | | | |
| ≤ 2 gambling types | 132 (63.5) | 70 (76.9) | **0.022** | 34 (72.3) | 44 (78.6) | 0.496 |
| ≥ 3 gambling types | 76 (36.5) | 21 (23.1) | | 13 (27.7) | 12 (21.4) | |
| *Prevalence of gambling types* | | | | | | |
| Lotteries | 49 (23.6) | 20 (22.7) | 0.877 | 8 (17.0) | 9 (16.7) | 0.962 |
| Sports betting | 86 (41.3) | 10 (12.3) | **< 0.001** | 9 (19.1) | 3 (5.6) | **0.035** |
| Slots | 40 (19.2) | 14 (16.5) | 0.580 | 9 (19.1) | 8 (14.5) | 0.534 |
| Casino | 46 (22.1) | 18 (20.9) | 0.823 | 8 (17.0) | 9 (17.6) | 0.935 |
| Bingo | 36 (17.3) | 13 (14.8) | 0.592 | 9 (19.1) | 18 (34.6) | 0.084 |
| Video games | 138 (66.3) | 11 (15.1) | **< 0.001** | 31 (66.0) | 0 (0) | - |
| Stock market | 69 (33.2) | 2 (2.5) | **< 0.001** | 12 (25.5) | 2 (3.6) | **0.001** |
| Contests | 38 (18.3) | 4 (4.7) | **0.002** | 6 (12.8) | 6 (11.1) | 0.798 |
| *Age of onset* | | | | | | |
| > 10 years | 184 (88.5) | 80 (87.9) | 0.873 | 41 (87.2) | 45 (80.4) | 0.349 |
| ≤ 10 years | 26 (12.5) | 12 (13.2) | | 6 (12.8) | 11 (19.6) | |
| *Prevalence* | | | | | | |
| At-risk gambling | 79 (37.6) | 21 (22.6) | **0.012** | 8 (17.2) | 9 (16.1) | 0.897 |

[a]Bold values are significant (chi-square test $p < 0.05$)

stratified by sex and modality. Among gamblers, there was a higher frequency and greater number of gambling types in the online modality than in the non-online modality in both boys and girls but these differences were statistically significant only in boys. The preferred gambling type for online gamblers was gambling-like features within video games, with 66.3% of boys and 66% of girls involved. The second preferred online gambling type was sports betting among boys (41.3%), and playing the stock market among girls (25.5%). Among non-online gamblers, girls played bingo (34.6%) and casinos (17.6%), while boys played mostly in lotteries (22.7%) and casinos (20.9%). Age of onset was before the age of 10 between 12 and 19% of the respondents, with no significant differences between modalities. The proportion of gamblers engaging in at-risk gambling was 33.2% among boys and 16.5% among girls. Significant differences between modalities were observed only in boys, with the prevalence of at-risk gambling being higher among online gamblers (38%) than among non-online gamblers (23.1%) ($p = 0.012$).

Table 3 shows the association between gambling and socioeconomic and health variables stratified by modality for boys and girls. Compared with boys who did not gamble, boys who engaged in online gambling were more likely to be of legal age [OR: 2.33 (1.57–3.45)], have disadvantaged SES [OR: 1.63 (1.15–2.30)], study in a school located in a disadvantaged SES neighbourhood [OR: 1.77 (1.38–2.46)], receive an allowance [OR: 1.40 (1.02–1.93)], have poor mental health [OR: 1.76 (1.14–2.68)], use legal drugs [OR: 1.49 (1.06–2.11)] and illegal drugs [OR: 1.76 (1.19–2.58)], live with only one adult [OR: 1.48 (1.04–2.09)], spend a large amount of leisure time with friends [OR: 1.46 (1.06–2.02)] and have poor school attachment [OR: 1.47 (1.03–2.09)]. Compared with boys who were not gamblers, boys engaged in non-online gambling were more likely to receive an allowance [OR: 1.77 (1.12–2.82)], use legal drugs [OR: 2.09 (1.24–3.59)] and illegal drugs [OR: 3.01 (1.81–4.98)], and spend a large amount of leisure time with friends [OR: 1.86 (1.16–3.04)].

Compared with girls who did not gamble, those who were online gamblers were more likely to be of legal age [OR: 2.55 (1.24–5.03)], receive an allowance [OR: 2.37 (1.22–4.91)], study in a school located in a disadvantaged SES neighbourhood [OR: 1.93 (1.00–3.94)], and have poor school attachment [OR: 2.11 (1.10–3.94)]. Compared with girls who did not gamble, those who were non-online gamblers were more likely to use legal [OR: 2.97 (1.49–6.32)] and illegal drugs [OR: 1.97 (1.03–3.68)].

Table 4 shows the association between at-risk gambling and the socioeconomic, health and behavioural variables studied in the sub-sample of gamblers (N = 406). The variables most strongly associated with at-risk gambling were sex, mental health, gambling modality, and the variety of gambling types. Thus, male sex [OR: 2.50 (1.37–4.82)], having poor mental health [OR: 2.05 (1.15–3.67)], gambling online [OR: 2.06 (1.08–4.08)] and involvement in more than two different gambling types [OR: 5.98 (2.45–14.91)] were associated with at-risk gambling, adjusted by age and individual SES.

## Discussion

The prevalence of gambling among adolescents in Barcelona was 18.6% in boys and 6.1% in girls. In both sexes, gambling was associated with the use of legal and illegal drugs and with receiving money from parents. Gambling was also associated with other sociodemographic, health, and lifestyle factors, with differences observed between sexes and depending on whether the gambling modality was online or non-online. The prevalence of at-risk

**Table 3** Multivariate analysis: logistic regression models. Adjusted odds ratios of gambling and associated factors between gamblers and non-gamblers, stratified by sex and gambling modality (N = 3332)

| Variables[a] | Boys (1.628) | | | | | Girls (1.704) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Non-gamblers (N = 1325) | Online gamblers (N = 210) | Non-online gamblers (N = 93) | Adjusted model[b] (Reference: Non-gamblers) | | Non-gamblers (N = 1601) | Online gamblers (N = 47) | Non-online gamblers (N = 56) | Adjusted model[b] (Reference: Non-gamblers) | |
| | | | | Online gamblers | Non-online gamblers | | | | Online gamblers | Non-online gamblers |
| | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) |
| *Age* | | | | | | | | | | |
| < 18 years (reference) | 1180 (89.1) | 155 (73.8) | 76 (81.7) | 1 | 1 | 1384 (86.4) | 33 (70.2) | 45 (80.4) | 1 | 1 |
| ≥ 18 years | 145 (10.9) | 55 (26.2) | 17 (18.3) | **2.33 (1.57–3.45)** | 1.22 (0.64–2.21) | 217 (13.6) | 14 (29.8) | 11 (19.6) | **2.55 (1.24–5.03)** | 0.95 (0.44–1.89) |
| *Individual SES* | | | | | | | | | | |
| Advantaged (reference) | 1008 (76.1) | 141 (67.1) | 70 (75.3) | 1 | 1 | 1236 (77.2) | 32 (68.1) | 40 (71.4) | 1 | 1 |
| Disadvantaged | 317 (23.9) | 69 (32.9) | 23 (24.7) | **1.63 (1.15–2.30)** | 0.85 (0.49–1.43) | 365 (22.8) | 15 (31.9) | 16 (28.6) | 1.46 (0.73–2.81) | 1.38 (0.71–2.59) |
| *SES of school neighbourhood* | | | | | | | | | | |
| Advantaged (reference) | 615 (46.4) | 69 (32.9) | 40 (43.0) | 1 | 1 | 716 (44.7) | 13 (27.7) | 20 (35.7) | 1 | 1 |
| Disadvantaged | 710 (53.6) | 141 (67.1) | 53 (57.0) | **1.77 (1.38–2.46)** | 1.26 (0.80–1.99) | 885 (55.3) | 34 (72.3) | 36 (64.3) | **1.93 (1.00–3.94)** | 1.60 (0.90–2.92) |
| *Allowance* | | | | | | | | | | |
| No (reference) | 747 (56.4) | 91 (43.3) | 36 (38.7) | 1 | 1 | 755 (47.2) | 12 (25.5) | 22 (39.3) | 1 | 1 |
| Yes | 578 (43.6) | 119 (56.7) | 57 (61.3) | **1.40 (1.02–1.93)** | **1.77 (1.12–2.82)** | 846 (52.8) | 35 (74.5) | 34 (60.7) | **2.37 (1.22–4.91)** | 1.10 (0.62–1.98) |

**Table 3** (continued)

| Variables[a] | Boys (1.628) | | | | | Girls (1.704) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Non-gamblers (N = 1325) | Online gamblers (N = 210) | Non-online gamblers (N = 93) | Adjusted model[b] (Reference: Non-gamblers) | | Non-gamblers (N = 1601) | Online gamblers (N = 47) | Non-online gamblers (N = 56) | Adjusted model[b] (Reference: Non-gamblers) | |
| | | | | Online gamblers | Non-online gamblers | | | | Online gamblers | Non-online gamblers |
| | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) |
| *Mental health* | | | | | | | | | | |
| Good (reference) | 1187 (89.6) | 172 (81.9) | 83 (89.2) | 1 | 1 | 1289 (80.5) | 35 (74.5) | 40 (71.6) | 1 | 1 |
| Poor | 138 (10.4) | 38 (18.1) | 10 (10.8) | **1.76 (1.14–2.68)** | 0.93 (0.43–1.83) | 312 (19.5) | 12 (25.5) | 16 (28.6) | 1.03 (0.49–2.01) | 1.41 (0.73–2.62) |
| *Legal drug use* | | | | | | | | | | |
| No (reference) | 749 (56.6) | 77 (37.2) | 25 (27.5) | 1 | 1 | 756 (47.2) | 23 (48.9) | 11 (19.6) | 1 | 1 |
| Yes | 575 (43.4) | 130 (62.8) | 66 (72.5) | **1.49 (1.06–2.11)** | **2.09 (1.24–3.59)** | 845 (52.8) | 24 (51.1) | 45 (80.4) | 0.55 (0.27–1.08) | **2.97 (1.49–6.32)** |
| *Illegal drug use* | | | | | | | | | | |
| No (reference) | 1161 (87.8) | 147 (71.0) | 54 (60.0) | 1 | 1 | 1376 (86.1) | 35 (74.5) | 37 (67.3) | 1 | 1 |
| Yes | 162 (12.2) | 60 (29.0) | 36 (40.0) | **1.76 (1.19–2.58)** | **3.01 (1.81–4.98)** | 222 (13.9) | 12 (25.5) | 18 (32.7) | 1.69 (0.74–3.73) | **1.97 (1.03–3.68)** |
| *Household cohabitation* | | | | | | | | | | |
| > 1 adult (reference) | 1087 (82.0) | 151 (71.9) | 78 (83.9) | 1 | 1 | 1328 (82.9) | 36 (76.6) | 45 (80.4) | 1 | 1 |
| 1 adult | 238 (18.0) | 59 (28.1) | 15 (16.1) | **1.48 (1.04–2.09)** | 0.76 (0.40–1.33) | 173 (17.1) | 11 (23.4) | 11 (19.6) | 1.22 (0.57–2.39) | 1.00 (0.47–1.96) |
| *Leisure time with friends* | | | | | | | | | | |

**Table 3** (continued)

| Variables[a] | Boys (1.628) | | | | | Girls (1.704) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Non-gamblers (N = 1325) | Online gamblers (N = 210) | Non-online gamblers (N = 93) | Adjusted model[b] (Reference: Non-gamblers) | | Non-gamblers (N = 1601) | Online gamblers (N = 47) | Non-online gamblers (N = 56) | Adjusted model[b] (Reference: Non-gamblers) | |
| | | | | Online gamblers | Non-online gamblers | | | | Online gamblers | Non-online gamblers |
| | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) | N (%) | N (%) | N (%) | $OR_{Multi}$ (95%CI) | $OR_{Multi}$ (95%CI) |
| A little (reference) | 654 (49.4) | 77 (36.7) | 27 (29.0) | 1 | 1 | 927 (57.9) | 21 (44.7) | 27 (48.2) | 1 | 1 |
| A lot | 671 (50.6) | 133 (63.3) | 66 (71.0) | **1.46 (1.06–2.02)** | **1.86 (1.16–3.04)** | 674 (42.1) | 26 (55.3) | 29 (51.8) | 1.65 (0.89–3.08) | 1.11 (0.63–1.96) |
| *School attachment* | | | | | | | | | | |
| Good (reference) | 1061 (80.1) | 152 (72.4) | 65 (69.9) | 1 | 1 | 1259 (78.6) | 29 (61.7) | 44 (78.6) | 1 | 1 |
| Poor | 264 (19.9) | 58 (27.6) | 28 (30.1) | **1.47 (1.03–2.09)** | 1.45 (0.87–2.36) | 342 (21.4) | 18 (38.3) | 12 (21.4) | **2.11 (1.10–3.94)** | 0.80 (0.39–1,52) |

[a]Bold values are significant (chi-square test $p < 0.05$)

[b]95%CI: 95% confidence interval; Multivariate Odds Ratio, adjusted for all variables. OR calculated from the reference group "non-gamblers"

**Table 4** Multivariate analysis: logistic regression models. Association between at-risk gambling with socio-economic, health and behavioural variables of gambling (N = 406)

| *Variables*[a] | At-risk gamblers (N = 117) | Non-at-risk gamblers (N = 285) | Adjusted model[b] (Reference: Non-at-risk gamblers) At-risk gambling |
|---|---|---|---|
| | N (%) | N (%) | $OR_{Multi}$ (95%CI) |
| *Sex* | | | |
| Girls (reference) | 17 (14.5) | 86 (30.2) | 1 |
| Boys | 100 (85.5) | 199 (69.8%) | **2.50 (1.37–4.82)** |
| *Mental health* | | | |
| Good (reference) | 87 (74.4) | 240 (84.2) | 1 |
| Poor | 30 (25.6) | 45 (15.8) | **2.05 (1.15–3.67)** |
| *Online gambling* | | | |
| No (reference) | 30 (25.6) | 117 (41.1) | 1 |
| Yes | 87 (74.4) | 168 (58.9) | **2.06 (1.08–4.08)** |
| *Gambling types* | | | |
| ≤ 2 gambling type (reference) | 58 (49.6) | 222 (77.9) | 1 |
| ≥ 3 gambling types | 59 (50.4) | 63 (22.1) | **5.98 (2.45–14.91)** |

[a]Bold values are significant (chi-square test $p < 0.05$)

[b]95%CI: 95% confidence interval; Multivariate Odds Ratio, adjusted by age and individual socioeconomic status. OR calculated from the reference group "non-at-risk gamblers"

gambling was 6.2% in boys and 1% in girls, corresponding to 33.2% of boys who gambled and 16.5% of girls who gambled. At-risk gambling was associated with male sex, online gambling, poor mental health, and engaging in more than two types of gambling.

The prevalence of gambling in Barcelona is considerably lower than those published in the neighbouring environment. The 2021 ESTUDES survey reported that the prevalence of gambling in Spain was 27.6% in boys and 12.6% in girls (OEDA. Spanish Drug Observatory, 2022), while the ESPAD survey reported that the prevalence of gambling in Europe was 29% in boys and 15% in girls (ESPAD Group, 2020). These differences could be related to the regulations in Catalonia governing gambling in Barcelona, such as Decree 240/2004, which limits the number of gambling establishments, thus controlling the proliferation of these premises (Clotas et al., 2020). However, the significance of our results should not be underestimated, since most individuals in our sample were minors, and gambling is illegal in this age group.

The results of our study regarding sex revealed a higher prevalence of gambling in boys than in girls, which is in accordance with those of other studies (Blinn-Pike et al., 2010; Frisone et al., 2020; Pearce et al., 2008; Pisarska & Ostaszewski, 2020). This result suggests that gambling remains a highly male-dominated phenomenon in adolescence. However, this dynamic may change, as gambling is on the rise, is socially accepted, and is less stigmatised by women (McCarthy et al., 2019). Although the prevalence of gambling in girls was low, gambling behaviours should be monitored and findings should be disaggregated by sex and with a gender perspective (Macía et al., 2022).

It is noteworthy that, in the case of boys, the prevalence of online gambling was more than twice that of non-online gambling, suggesting that online gambling may be on the increase due to its allure, the ease of bypassing age restrictions, and anonymity

(Dowling et al., 2017; Lloret et al., 2018). Similarly, we found that people who gamble online did so more frequently and were involved in more gambling types than those who engage in non-online gambling, both in boys and girls. This result could be explained by the increased availability, accessibility, and greater exposure to online gambling advertising (Derevensky et al., 2010; Kang et al., 2019). In addition, the FRESC survey was conducted in the context of the COVID-19 pandemic, which could have boosted online gambling to the detriment of non-online gambling, as concluded by previous studies (Håkansson, 2020; Jenkinson et al., 2020). A particularly concerning finding was that approximately 66% of online gamblers participated in gambling-like features within video games, such as loot boxes. The intersection between gaming and gambling has been little studied among young people (Wardle & Zendle, 2021), but some studies highlight the hazardousness of these forms of hybrid-gambling products, which can also be a gateway to conventional gambling (Spicer et al., 2022). To avoid future problems, the lack of regulations in this area has created a gap that should be addressed as soon as possible (Wardle & Zendle, 2021).

Compared with the prevalences found in our study, those of at-risk gambling in Spain as a whole is slightly higher in boys and lower in girls (OEDA. Spanish Drug Observatory, 2022). Therefore, the results of our study suggest that boys in Barcelona gamble less than Spanish boys, but also that those who do so are at greater risk of experiencing problem gambling. Indeed, almost one out of three boys in Barcelona who gamble were at risk of engaging in problem gambling and the proportion was much higher in online gamblers (37.6%) than in non-online gamblers (22.6%), with significant differences (0.012). Among girls, no differences were observed between modalities, and they had a lower prevalence of at-risk gambling than boys, which is consistent with the existing literature (Elton-Marshall et al., 2016; Frisone et al., 2020; Pisarska & Ostaszewski, 2020).

Multivariate analysis showed that, in almost all the subgroups studied, receiving money periodically from parents was associated with gambling. Similarly, a clear relationship was observed between gambling and drug use, both legal and illegal. On the one hand, empirical research on youth has identified a relationship between gambling behaviour and the use of legal drugs, such as alcohol and tobacco, and illegal drugs, such as cannabis (Calado et al., 2017; Carbonneau et al., 2022; Dowling et al., 2017; Riley et al., 2021). On the other hand, previous research has shown that higher weekly income among adolescents is associated with an increased risk of gambling, drinking alcohol, and smoking (Buja et al., 2019). Additionally, a study by Darling et al., (2006) also found that greater availability of money was linked to a higher likelihood of gambling and alcohol consumption, highlighting the close relationship between drug use, the availability of money, and gambling. These findings are consistent with the notion that young people with more money are more likely to gamble as they have the means to do so.

Regardless of financial means, we also observed that SES influenced online gambling behaviour, especially among boys. Disadvantaged SES was associated with the online modality, both individually and at the level of the school's neighbourhood. Given that disadvantaged SES neighbourhoods tend to have more land-based opportunities, and therefore, a greater availability of non-online gambling (Van der Maas, 2016; Welte et al., 2006), we expected to find an association between non-online gambling and disadvantaged neighbourhoods. However, this result could be explained by the regulations implemented in Barcelona governing gambling halls (Clotas et al., 2020). The impact of disadvantaged SES on online gambling exclusively can be explained by the role of online advertising on the most vulnerable people. Hing et al., (2014) showed that online advertising played a significant role in turning non-gamblers into gamblers, and it can be expected that youth from

disadvantaged SES will be more vulnerable to advertising, as people with low SES spend more time watching screen-based entertainment (Stamatakis et al., 2009).

In both boys and girls, being of legal age was significantly associated with online gambling but not with non-online gambling. Indeed, an inverse relationship could be expected, as age restrictions are more difficult to overcome for minors in the non-online modality. These results suggest that land-based gambling, such as casinos, is more enticing to young people when it is illegal than when it is legal. This could be related to the impulsiveness and sensation seeking of younger adolescents, and these two factors are closely linked to gambling in youth (Botella-Guijarro et al., 2020; Frisone et al., 2020; Pisarska & Ostaszewski, 2020). Likewise, gambling onset is also related to more social behaviour, termed recreational gambling (Gambling Research Exchange Ontario, 2017), in which the reward sought is to have fun and share the experience with friends. Such social gambling could be more related to the land-based modality, which has been reported to be the first gambling experience (Montes & Weatherly, 2017). In our study, recreational gambling also seemed to have an influence since, among boys, spending a large amount of leisure time with friends outside school was associated with greater engagement with gambling. Similar results were reported by Räsänen et al., (2016), who found that, among boys, higher social support from friends was associated with increased gambling involvement. Therefore, it seems evident that gambling is part of the leisure activities and social relations of these young boys.

Although recreational gambling can start as a social behaviour, persistent gambling involvement can lead to more individual and solitary behaviour, which is usually related to online gambling, and could explain why poor school attachment in both boys and girls has been associated only with the online modality. Because online gambling is carried out alone, it could lead to social isolation and, in turn, lower school attachment and impaired school performance, as previously reported (Melendez-Torres et al., 2020). Likewise, the addictive nature of online gambling could reduce the time spent in schoolwork, which could impair academic results and lead to greater disaffection with school (Dowling et al., 2017).

In line with the previously discussed findings, a correlation was established between online gambling in boys and living with only one adult, as well as with poor mental health outcomes. Living with only one adult could be related to less family supervision, whereas family monitoring has been associated as a protective factor against gambling involvement (Gori et al., 2015; Riley et al., 2021). Online gambling also reduces the possibility of parental control (Lloret et al., 2018), which might explain why this relationship was only found in this modality. In addition, the solitariness of online gambling could lead to greater social isolation and loneliness in the family environment, which could also negatively impact adolescent's mental health. Previous studies have demonstrated a relationship between poor mental health and gambling (Moodie & Finnigan, 2006; Potenza et al., 2011). Nevertheless, during adolescence, this correlation may not always be apparent, as these problems may not have fully developed and could potentially be both a cause and a result of gambling involvement (Moodie & Finnigan, 2006). Our study revealed that poor mental health was only associated with boys who engaged in online gambling, highlighting the vulnerability of this particular subgroup.

Mental health has not only been associated with increased gambling involvement but has also been found to increase gambling-related harms. Our study showed that at-risk gamblers were twice as likely to have impaired mental than non-at-risk gamblers. Potenza et al., (2011) reported that dysphoria/depression was 1.97 times more likely in at-risk online gamblers than in low-risk gamblers. Similarly, Moodie & Finnigan et al. (2006)

concluded that depression was significantly more prevalent in problem gamblers than in non-problem gamblers.

Furthermore, online gambling has also been associated with greater harms, as problem gambling is more likely in online than in land-based gamblers (Calado et al., 2017; Elton-Marshall et al., 2016). This finding emphases the addictive nature of the online modality on youth, in line with the study carried out by Potenza et al., (2011), in which problem gamblers were more often online than non-online gamblers. Therefore, the online modality is clearly related to heightened harm because it is associated with a higher risk of problem gambling and poor mental health. The results of our study show that further investigation is required into the connection between online gambling and mental health, particularly concerning the gambling-related harms affecting the adolescent population.

In this study, male sex increased the probability of engaging in at-risk gambling, the likelihood being 2.5 times higher than in boys than in girls. These results are consistent with those reported in the literature (Bozzato et al., 2020; Calado et al., 2017; Pisarska & Ostaszewski, 2020), indicating that males not only gamble more but are also at greater risk than females. Additionally, problem gamblers engaged in more different types of gambling than non-problem gamblers, in line with the thesis of Mazar et al., (2020) that being involved in more than two forms of gambling increases the chances of problem gambling.

This study has some limitations. First, the study data were obtained from a self-administered survey, which could have underestimated adolescent gambling behaviour. However, this reporting bias was reduced by the fact that this study was not a specific gambling survey but formed part of a general survey on health and risk factors. In addition, the survey was anonymous and confidential. Second, the screening method used for at-risk gambling could have yielded false positives and negatives. Nevertheless, the questionnaire has good psychometric properties (sensitivity: 99%; specificity: 91%) and has been validated in an adolescent population (Götestam et al., 2004). Third, we relied exclusively on quantitative data, which limited the interpretation of the results. Nevertheless, this study used a large representative sample. Fourth, a portion of the sample was in non-compulsory education. Therefore, this subgroup is representative of schooled youth but not of the entire adolescent population. To address this limitation, future studies are planned using population-based surveys in this specific subgroup. Finally, the cross-sectional nature of the study allowed associations to be identified but limited the possibility of determining possible causal relationships between gambling and the variables examined.

This study also has notable strengths. First, as previously mentioned, we used a large sample from a representative health survey conducted across educational centres in the city, which increased the statistical power of the study and its results. Second, the study design allowed us to estimate prevalence rates, which will be useful for better planning of social and health resources. Third, we were able to compare a large number of variables associated with various health problems simultaneously, leading to a comprehensive understanding of gambling behaviour and its determinants. Furthermore, by stratifying the analysis by sex and gambling modality, we were able to study four population subgroups with different gambling behaviours separately. Finally, this study is the first to shed light on the relationship between adolescent gambling and sociodemographic, health and lifestyle factors in the city of Barcelona.

This study provides valuable insights into the state of gambling in the city of Barcelona, significantly expanding our knowledge of this pervasive issue among young individuals and its potential detrimental effects in both the short and long term. The results show that regulation seems to have had a positive effect on reducing the prevalence of gambling in Barcelona compared with its neighbouring environment and highlight the association

between the availability of money and access to gambling, which should be considered in recommendations and preventive programmes.

Furthermore, the results reveal a close association between at-risk gambling and mental health, especially in the case of online gambling. Online gambling is the most prevalent and high-risk gambling modality and is associated with a multitude of gambling-related harms, especially in adolescent boys. Consequently, from a public health perspective, there is an urgent need to regulate online gambling and implement interventions to reduce the health inequalities associated with gambling and gambling-related harm. This growing problem should be addressed as soon as possible to mitigate its impact and ensure the well-being of affected individuals.

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**Data Availability** The data that support the findings of this study are available from the Agència de Salut Pública de Barcelona. Restrictions apply to the availability of these data, which were used under license for this study. Data are available on request from the corresponding author with the permission of the Agència de Salut Pública de Barcelona.

## Declarations

**Competing interests** The authors declare that they have no conflict of interest.

**Informed Consent** All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

**Confirmation Statement** The authors declare that this manuscript has not been published or accepted at another journal and it is not under consideration for publication elsewhere or in any other language.

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