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FULL-LENGTH REPORT

# Gambling participation among Connecticut adolescents from 2007 to 2019: Potential risk and protective factors

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**ABSTRACT**

*Background and aims:* Gambling in adolescents is a public health concern. This study sought to examine patterns of gambling among Connecticut high-school students using seven representative samples covering a 12-year period. *Methods:* Data were analyzed from $N = 14{,}401$ participants in cross-sectional surveys conducted every two years based on random sampling from schools in the state of Connecticut. Anonymous self-completed questionnaires included socio-demographic data, current substance use, social support, and traumatic experiences at school. Chi-square tests were used to compare socio-demographic characteristics between gambling and non-gambling groups. Logistic regressions were used to assess changes in the prevalence of gambling over time and effects of potential risk factors on the prevalence, adjusted for age, sex, and race. *Results:* Overall, the prevalence of gambling largely decreased from 2007 to 2019, although the pattern was not linear. After steadily declining from 2007 to 2017, 2019 was associated with increased rates of gambling participation. Consistent statistical predictors of gambling were male gender, older age, alcohol and marijuana use, higher levels of traumatic experiences at school, depression, and low levels of social support. *Discussion and conclusion:* Among adolescents, older males may be particularly vulnerable to gambling that relates importantly to substance use, trauma, affective concerns, and poor support. Although gambling participation appears to have declined, the recent increase in 2019 that coincides with increased sports gambling advertisements, media coverage and availability warrants further study. Our findings suggest the importance of developing school-based social support programs that may help reduce adolescent gambling.

**KEYWORDS**

gambling, adolescents, substance use, risk behaviors

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## INTRODUCTION

Gambling among adolescents is a public health concern. Despite legal age restrictions, adolescents participate in multiple types of gambling, including lotteries (Zhai et al., 2021),

internet-based (Potenza et al., 2011; Richard, Ivoska, & Derevensky, 2022), casino-based (Farhat et al., 2021), sports (Giralt et al., 2018), and poker (Dussault et al., 2020). Older national estimates suggest that approximately two-thirds (68%) of adolescents report past-year gambling in the U.S. (Welte, Barnes, Tidwell, & Hoffman, 2008), with 0.2%–12.3% of youth meeting criteria for problematic gambling internationally (Calado, Alexandre, & Griffiths, 2017). These estimates are typically higher than those in adults (0.5%–7.6%) (Derevensky, Marchica, Gilbeau, & Richard, 2022). Problem gambling in adolescents has been associated with a wide range of negative outcomes in the interpersonal, familial, psychological, and legal domains. A general vulnerability of adolescents as a group might be partially explained by the fact that the brain is still maturing during adolescence and young people are not always able to assess the risk level of such activities as gambling (Hardoon & Derevensky, 2002; Volberg, Gupta, Griffiths, Olason, & Delfabbro, 2010). Limited life experience may make adolescents susceptible to peer pressure (Zhai et al., 2017), marketing campaigns (Derevensky, Sklar, Gupta, & Messerlian, 2010; Kristiansen & Severin-Nielsen, 2022), and gambling advertisements more so than adults (Clemens, Hanewinkel, & Morgenstern, 2017). Thus, adolescent may have the highest number of unique risk factors (Sharman, Butler, & Roberts, 2019).

Gambling frequently begins at an early age, often with parents, siblings, or other relatives, and friends. Adolescents may engage in gambling on an occasional basis, wagering with their classmates, purchasing instant lottery tickets, or placing sports bets. During adolescence, experimentation in new activities with peers and friends typically becomes more common, normalizing future potentially problematic excessive gambling activity (Rahman et al., 2012). For some adolescents, gambling progresses from a fun and social activity to a habit that becomes excessive and out of control (Derevensky, 2012). Although gambling can significantly impact adolescents' lives, it is often unnoticed by teachers and parents until it has reached problematic proportions (Roberts, Murphy, McNally, Derevensky, & Sharman, 2022).

A growing body of research suggests that specifically male adolescents exposed to gambling at an earlier age are more at risk for developing gambling problems in the future (Shead, Derevensky, & Gupta, 2010). Adult gambling habits often arise from patterns developed during childhood and adolescence (Dowling et al., 2017). Male gender has been consistently found as a main sociodemographic factor associated with risk-taking and novelty-seeking behavior. Other potential risk factors include poor family cohesion and support (Dickson, Derevensky, & Gupta, 2008), engagement in delinquent behaviors such as alcohol, drug, tobacco use (Richard, Potenza, Ivoska, & Derevensky, 2019; Yip et al., 2011), psychological vulnerabilities, such as a history of trauma and social distress (Felsher, Derevensky, & Gupta, 2010; Jaisoorya et al., 2017; Oksanen, Sirola, Savolainen, & Kaakinen, 2019), low self-esteem (Abdi, Ruiter, & Adal, 2015; Delfabbro, Lahn, & Grabosky, 2006), and mental health problems such as depression and anxiety (Allami, Vitaro, Brendgen, Carbonneau, & Tremblay, 2018; Cosenza, Ciccarelli, & Nigro, 2019; Estevez, Herrero-Fernández, Sarabia, & Jauregui, 2015; Potenza et al., 2011; Yip et al., 2011). Personality characteristics and maladaptive coping strategies may be involved in the development of gambling disorder (GD) in adolescents as well (Pace, D'Urso, Ruggieri, Schimmenti, & Passanisi, 2021).

With technological advances, adolescents may be exposed to many new risks including remote forms of gambling via smartphones and the internet, or by playing videogames (King, Delfabbro, Kaptsis, & Zwaans, 2014), which often include gambling-like elements like loot crates (Kristiansen & Severin, 2020) and thus may make adolescents become familiar with the variety of platforms used in online gambling (Griffiths & Parke, 2010). Internet gambling has transformed the traditional gambling environment, offering convenient, instant, and constant access to novel and interactive forms of gambling (Gainsbury, Russell, Wood, Hing, & Blaszczynski, 2015). A recent systematic review of online gambling found that between 0.77% and 57.5% of adolescents present some degree of problematic online gambling behavior and 0.89%–1% of adolescents exhibited online GD (Montiel, Ortega-Barón, Basterra-González, González-Cabrera, & Machimbarrena, 2021).

Within the current changing gambling environment (e.g., recent legalization of sports gambling and promotion through various media), it is important to understand the degree to which adolescents are involved in gambling activities across multiple years and to identify associated potential risk factors, as these may help shape specific prevention and intervention efforts targeting this vulnerable population. Although gambling has been associated with substance use and other concerns among youth (Yip et al., 2011), with recent legislative changes regarding to retail sports and online betting being legalized in many U.S. jurisdictions, including Connecticut (Holden, Edelman, & Miller, 2022), gambling among adolescents warrants specific attention in current contexts. Some of these changes have been preceded by similar gambling-like activities. For example, prior to the legalization of sports gambling in Connecticut in 2021, daily fantasy sports were legalized earlier in 2017. Although not legally considered gambling, the legalization of daily fantasy sports and its heavy promotion through various media may have potentially influenced sports-related gambling behaviors, especially among adolescents males who may closely follow sports.

The aim of this exploratory study was to evaluate patterns of past-year gambling involvement among Connecticut adolescents, explore demographic characteristics associated with gambling participation, and identify potential risk and protective factors (e.g., age, sex, race, current alcohol, marijuana and tobacco use, depression, social support, traumatic experiences at school) related to adolescent gambling for the period of time from 2007 to 2019.

# METHODS

## Participants

The current analyses included data from the 2007 ($n$ = 1,966), 2009 ($n$ = 2,285), 2011 ($n$ = 1,920), 2013 ($n$ = 2,226), 2015 ($n$ = 2,044), 2017 ($n$ = 2,153), 2019 ($n$ = 1,807) administrations of the Youth Risk Behavior Survey (YRBS) of Connecticut high-school students, a cross-sectional, school-based survey conducted biennially since 1991, with gambling question introduced in 2007. High schools in Connecticut were selected using a random start with a probability proportional to enrollment sizes in grades 9 to 12. Permission was obtained at different levels of administration as required by each school. First, superintendents were informed that a school in their district was selected to participate. After approval from superintendents, administrators in each school were contacted for permission. Teachers of selected classrooms and students were given opportunities to decline participation. Classes were selected to participate by a systematic equal probability sampling procedure. Survey data underwent quality-control procedures, were weighted, and received post-stratification adjustment in order to be representative of high-school students in Connecticut. Surveys were administered at each school in a single day. Answers were anonymous and confidential, and students were reminded that participation was voluntary. The survey was self-administered and took one class period (approximately 45 min) to complete. Detailed descriptions of data collection procedures in the YRBS can be found elsewhere (http://www.cdc.gov/yrbss).

## Measures

***Socio-demographics characteristics*** included age (dichotomous: younger than 16 vs. 16 or older), sex (male vs. female), and race (White vs. non-White).

***Gambling*** was assessed with the question, "During the past 12 months, how many times did you gamble for money or possessions? (Include buying lottery tickets, betting money on sports teams, or playing card games for money.)". This question remained the same from 2007 to 2017 whereas in 2019, the question was modified to "During the past 12 months, how many times have you gambled on a sports team, gambled when playing cards or a dice game, played one of your state's lottery games, gambled on the Internet, or bet on a game of personal skill such as pool or a video game?" If respondents gambled one or more times during the past 12 months, they were classified as gambling; otherwise, they were classified as not gambling.

***Current marijuana use*** was assessed using single survey item, "Have you used marijuana one or more times past 30 days" and coded dichotomously yes/no, with a "no" response defined as "never" response.

***Current alcohol use*** was assessed with the question, "In the last 30 days have you had one or more alcohol drinks" and coded dichotomously yes/no, with a "no" response defined as a "never" response.

***Current tobacco smoking*** was assessed with the question, "During the past 30 days, on how many days did you smoke cigarettes" and coded dichotomously yes/no.

***Social support variables*** included family support and teacher support. Family support was measured by the question, "Do you agree that your family loves you and gives you help and support when you need it?" Teacher support was measured by the question, "Is there at least one teacher or other adult at school that you can talk if you have a concern?" Adolescents who responded affirmatively to either of these two questions, were classified as feeling as if they had social support.

***Traumatic experiences at school*** were assessed with the question, "Were you threatened or injured with a weapon on school property?" Affirmative responses were counted as having experienced trauma on school property.

***Depression/dysphoria*** symptoms was assessed with the question, "In the last 12 months, did you feel sad or hopeless almost every day for more than 2 weeks?" (yes/no).

All measures were present in all years of the YRBS.

## Statistical analyses

Data from the 2007, 2009, 2011, 2013, 2015, 2017, and 2019 of the YRBS were included in analyses. Data from the 2017 survey were described in a prior publication (Zhai, Duenas, Wampler, & Potenza, 2020). The numbers of participating schools are listed with the age range and sex composition being largely similar across the years.

2007: 46 of the 59 sampled eligible schools participated; 12–18 years old; 50% (weighted) male.

2009: 48 of the 63 sampled eligible schools participated; 12–18 years old; 50% (weighted) male.

2011: 44 of the 55 sampled eligible schools participated; 12–18 years old; 50% (weighted) male.

2013: 46 of the 54 sampled eligible schools participated; 12–18 years old; 50% (weighted) male.

2015: 41 of the 50 sampled eligible schools participated; 12–18 years old; 50% (weighted) male.

2017: 38 of the 50 sampled eligible schools participated; 12–18 years old; 51% (weighted) male.

2019: 33 of the 50 sampled eligible schools participated; 12–18 years old; 51% (weighted) male.

Analyses proceeded in several steps. First, weighted prevalence was reported by year of survey to examine patterns over time in gambling participation among adolescents. Second, differences in socio-demographic characteristics between groups (gambling vs. non-gambling) by year were assessed using $\chi^2$ tests. Third, binary logistic regression analyses were employed to assess patterns in the prevalence of gambling from 2007 to 2019 and to model associations of potential risk and protective factors with gambling. The two-level gambling variable (i.e., gambling vs. no-gambling) was the dependent variable of interest. Time was the main predictor of interest, entered in the model as a categorical predictor. Variables considered to be potential risk/protective factors related to gambling level were included as independent variables. The model controlled for age, sex, and race. Adjusted odds ratios (AORs) with 95%

confidence intervals (CIs) were calculated to explain significant effects in the model. Fourth, to determine the relative contribution of each variable to explained variance in the model, multivariable logistic regression analyses were supplemented with relative importance analyses. These analyses partition explained variance among multiple predictors to better understand the role played by each predictor in a regression equation while accounting for intercorrelations among independent variables (Tonidandel & LeBreton, 2011) and thus quantify the relative importance of these variables in predicting outcomes. In other words, variable importance quantifies the relative contribution or impact of individual variables in a predictive model or statistical analysis. It is a measure that helps determine which variables are most influential in explaining the target variable's variability or predicting its values. To make statistically valid inferences from the sample to the study population, we analyzed the data using the provided sampling weights which account for the survey design. Statistical significance was evaluated at the 0.05 level. All analyses were performed using SAS 9.4 statistical software (SAS Institute Inc., Cary, North Carolina, U.S.).

### Ethics

Passive consent procedures, in which parents were given the opportunity to deny permission for their children to participate in the survey, were used to obtain parental permission for most schools. Active consent, in which parents affirmed and authorized permission, was obtained when required. No identifying personal information was collected, and school and classroom codes were removed from the final dataset. All procedures were performed in accordance with the 1964 Helsinki Declaration and its amendments.

## RESULTS

Data on 15,765 individuals were available. Less than 10% had missing data on the gambling question ($n$ = 1,364, 8.6%) and were excluded from analysis. Thus, the total analytic sample consisted of 14,401 individuals. There were 7,062 (50.1%) males, and 8,493 (65.1%) respondents identified as White.

The gambling participation pattern is shown in Fig. 1. The graph shows a significant declining prevalence from 2007 to 2017, with a numerically higher rate of gambling in 2019 compared to several prior survey years.

Appendix Table A1 demonstrated a statistically significant decline in gambling participation from 2007 to 2009 and from 2011 to 2013, with a statistically significant increase from 2017 to 2019.

In each biennial survey, gambling participation was associated with being male; in 2013, 2015, and 2019, it was additionally associated with older age (16+ years). In 2007 and 2009, White adolescents were more likely to report gambling activities, with no differences in the years that followed (Table 1).


*Fig. 1.* Prevalence of gambling participation by the survey year

Figure 2 shows sex-related differences in gambling participation by year. The graph shows that males were significantly more likely than females to report gambling in each survey year.

Table 2 presents potential risk factors associated with gambling participation. The strongest statistical predictors of gambling in 2007–2019 were male sex (AOR = 4; 95% CL 3.6–4.5) and current alcohol use (AOR = 2; 95% CL 1.8–2.4). Additionally, older adolescents had significantly higher odds to report past-year gambling compared to younger adolescents. Similarly, marijuana use in the past month, depression/dysphoric feelings and having been threatened or injured with a weapon on school property were also associated with significantly higher odds of gambling ($1.1 \leq \text{AOR} \leq 1.9$). Less social support was also associated with increased odds of past-year gambling (AOR = 0.79; 95% CL 0.7–0.9). Variable importance analysis showed that male sex and current alcohol use were the most important statistical predictors of adolescent gambling (Fig. 3).

## DISCUSSION

The results of our study show a significant declining prevalence of gambling participation from 2007 to 2017 but a subsequent increase in 2019. There may be several reasons for this pattern. In 2019, the survey gambling question was modified to capture information about current participation in online (internet) gambling. Consequently, one of the explanations of the increased frequency of gambling participation might be that the survey questionnaire in the last year captured more instances of gambling. Another possible explanation is the ease of access to gambling opportunities in more recent years. Due to recent changes in legislation and the introduction of gambling-like features in video games (e.g., loot boxes (Griffiths, 2018; Wardle & Zendle, 2021), use of skins betting in video gaming) alongside increased technological advances, online gambling has become increasingly popular, especially among adolescents (Gómez, Feijóo, Braña, Varela, & Rial, 2020; Hollén, Dörner, Griffiths, & Emond, 2020; Molinaro et al., 2018). The availability of gambling internet sites and gambling apps on smartphones presents adolescents with numerous

*Table 1.* Gambling by sociodemographic group and survey year

| | 2007 (*N* = 1,966) | | 2009 (*N* = 2,285) | | 2011 (*N* = 1,920) | | 2013 (*N* = 2,226) | | 2015 (*N* = 2,044) | | 2017 (*N* = 2,153) | | 2019 (*N* = 1,807) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Gambling* (*n* = 624; 31.97%*) | | *Gambling* (*n* = 581; 26.58%*) | | *Gambling* (*n* = 455; 25.17%*) | | *Gambling* (*n* = 464; 21.10%*) | | *Gambling* (*n* = 426; 21.42%*) | | *Gambling* (*n* = 388; *n* = 18.60%*) | | *Gambling* (*n* = 453; 25.41%*) | |
| Variable | *n* | %* | *n* | %* | *n* | %* | *n* | %* | *n* | %* | *n* | %* | *n* | %* |
| ***Age, years*** | | *p* = 0.09 | | *p* = 0.67 | | *p* = 0.17 | | *p* = 0.0005 | | *p* = 0.25 | | *p* = 0.0003 | | *p* = 0.004 |
| >16 | 441 | 30.39 | 394 | 26.13 | 279 | 23.80 | 263 | **18.45** | 270 | 20.33 | 218 | **15.90** | 248 | **22.36** |
| 16+ | 231 | 34.62 | 187 | 27.29 | 174 | 27.32 | 200 | **25.18** | 156 | 23.31 | 167 | **22.90** | 203 | **30.22** |
| ***Sex*** | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 | | *p* ≤ 0.0001 |
| Female | 175 | **18.66** | 158 | **13.65** | 114 | **11.78** | 114 | **10.71** | 126 | **11.87** | 108 | **9.95** | 147 | **16.22** |
| Male | 465 | **45.21** | 421 | **39.16** | 337 | **38.18** | 347 | **31.33** | 295 | **30.83** | 275 | **26.98** | 303 | **34.62** |
| ***Race*** | | *p* = 0.001 | | *p* = 0.01 | | *p* = 0.34 | | *p* = 0.33 | | *p* = 0.67 | | *p* = 0.70 | | *p* = 0.57 |
| Non-White | 179 | **27.16** | 208 | **22.76** | 160 | 26.55 | 143 | 19.27 | 165 | 21.97 | 187 | 18.79 | 231 | 26.56 |
| White | 452 | **34.13** | 360 | **28.12** | 281 | 24.07 | 296 | 21.38 | 252 | 21.03 | 188 | 18.07 | 220 | 24.78 |

*Weighted percent.
In the body of the table, significantly different percentages (at 0.05 level) by sociodemographic group are denoted in bold.

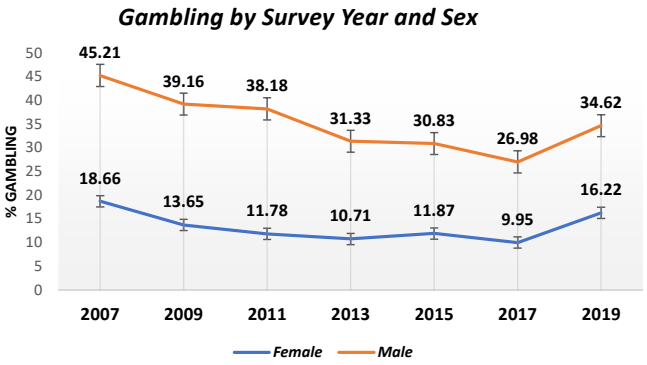


*Fig. 2.* Gambling participation by the survey year, stratified by sex

*Table 2.* Results from multivariable logistic regression model predicting gambling behavior (yes/no)

| | | | | AOR | | |
|---|---|---|---|---|---|---|
| Variable | Estimate | SE | *p* | Point Estimate | 95% Confidence Limits | |
| Year (2009 vs. 2007) | −0.32 | 0.08 | 0.0004 | **0.73** | **0.62** | **0.86** |
| Year (2011 vs. 2007) | −0.44 | 0.10 | 0.0002 | **0.64** | **0.52** | **0.79** |
| Year (2013 vs. 2007) | −0.66 | 0.08 | <0.0001 | **0.52** | **0.44** | **0.61** |
| Year (2015 vs. 2007) | −0.49 | 0.10 | <0.0001 | **0.61** | **0.50** | **0.74** |
| Year (2017 vs. 2007) | −0.62 | 0.10 | <0.0001 | **0.54** | **0.43** | **0.67** |
| Year (2019 vs. 2007) | −0.21 | 0.08 | 0.02 | **0.81** | **0.68** | **0.96** |
| Age (16+ years vs. <16 years) | 0.11 | 0.04 | 0.01 | **1.12** | **1.02** | **1.22** |
| Sex (male vs. female) | 1.39 | 0.06 | <0.0001 | **4.00** | **3.55** | **4.50** |
| Race (White vs. non-White) | 0.11 | 0.06 | 0.07 | 1.12 | 0.99 | 1.27 |
| Current alcohol use (yes vs. no) | 0.74 | 0.07 | <0.0001 | **2.11** | **1.83** | **2.42** |
| Current marijuana use (yes vs. no) | 0.34 | 0.07 | <0.0001 | **1.41** | **1.22** | **1.64** |
| Current tobacco use (yes vs. no) | 0.16 | 0.08 | 0.07 | 1.17 | 0.99 | 1.40 |
| Depression/ dysphoria (yes vs. no) | 0.17 | 0.07 | 0.02 | **1.19** | **1.03** | **1.36** |
| Social support (yes vs. no) | −0.23 | 0.08 | 0.01 | **0.79** | **0.67** | **0.93** |
| Traumatic experiences at school | 0.62 | 0.11 | <0.0001 | **1.86** | **1.48** | **2.35** |

*Bolded are significant adjusted odds ratios at 0.05 level.
AOR = adjusted odds ratio.
SE = standard error.

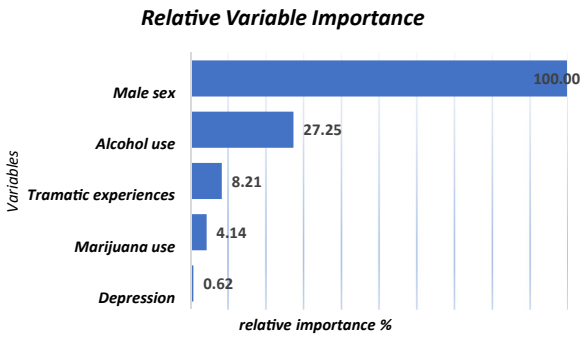


*Fig. 3.* Relative variable importance analysis

opportunities to gamble online. Given the unique characteristics of the internet (availability, accessibility, affordability, anonymity, and convenience), online gambling may show some unique features with respect to other forms of adolescent risk-taking behaviors that are often associated with strong peer pressure or influences. The isolative characteristics of the internet may contribute to the link between problematic internet use, depression, and substance use specifically in adolescents (Potenza et al., 2011). Studies also suggest that online gambling may be more addictive than offline gambling (Chóliz, Marcos, & Lázaro-Mateo, 2021). Another change warrant mentioning is the legalization of daily fantasy sports in Connecticut in 2017, and following legalization there was considerable advertising including during sports events. The extent to which these may have influenced sports wagering among youth warrants consideration.

With regards to potential socio-demographic risk factors and in line with the previous findings from the YRBS and other Connecticut data (Zhai et al., 2020; Zhai et al., 2017), the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) (Loo, Kraus, & Potenza, 2019) and other studies (Riley, Oster, Rahamathulla, & Lawn, 2021), adolescent male gender was significantly associated with gambling participation in each year of the survey and, in fact, was the strongest statistical predictor of past-year gambling involvement. This might be explained by adolescent boys being more likely to engage in risk-taking behaviors in general (Ajisuksmo, 2021), and these behaviors often occur in social settings involving peers. At the same time, adolescent boys are more susceptible to deviant peer pressure for risk-taking behaviors, sometimes to seek alignment with a masculine ideal or appear more mature among peers (McCoy, Dimler, Samuels, & Natsuaki, 2019). Also, boys may be more influenced by marketing campaigns and pay more attention to gambling advertisements than girls (Kristiansen & Severin-Nielsen, 2022). For those adolescents with adequate family support, exposure to gambling advertisements did not promote encouraging attitudes towards gambling and gambling participation (Parrado-González & León-Jariego, 2020). In fact, one cross-sectional study of Finnish adolescents found that social support from parents and school personnel was associated with decreased gambling activity among boys and girls (Räsänen, Lintonen, Tolvanen, & Konu, 2016). Among boys, social support from friends was associated with increased gambling, which suggests that friends often play a significant role in male gambling activity (Räsänen et al., 2016). Social support plays an important role in shaping adolescent behavior toward gambling, as social support can be used as a buffer during periods of stress and traumatic events. Specifically, individuals who receive higher levels of social support perceive stressful situations as less threatening, less traumatic, and more controllable (Evans, Steel, & DiLillo, 2013; Pakenham, Smith, & Rattan, 2007). However, some studies have found that social support is a more silent buffer in females (Szkody & McKinney, 2020). Future studies should investigate relationships between gender and social support and how it is related to gambling.

Corroborating other findings (Zhai et al., 2020), stressful and traumatic events like being threatened or injured with a weapon on school property statistically predicted gambling participation. Childhood trauma and life stressors have been linked to GD (Horak, Eagle, Stein, & Lochner, 2021), with stressful life events often moderating the relationship between childhood trauma and GD. While some people may use gambling as a coping mechanism to avoid negative mood states or regulate unpleasant emotions (Barrault, Mathieu, Brunault, & Varescon, 2019; Weatherly & Miller, 2013), gambling for escape and excitement may in turn either mediate or moderate the relationship between major depression and problematic gambling behavior (Vaughan & Flack, 2022). Further investigation of current life stressors as probable moderating link between childhood trauma and GD may provide a deeper understanding of these complex associations. Collectively, the findings suggest that substance use, trauma exposure, consequent psychiatric difficulties as depression and poor social support from parents and teachers may increase interest in gambling participation and thereby increase risk for developing GD in the future in adolescents.

Gambling participation was further associated with alcohol and marijuana use. Specifically, current alcohol use was the second most robustly associated factor with gambling. The co-occurrence of alcohol and other substances (like marijuana) with gambling are well-documented in other studies of adolescents (Buja et al., 2020; Peters et al., 2015; Richard et al., 2019), as alcohol, drug use, and other risk-behaviors tend to cluster together, particularly during adolescence when significant physical and psychological development occurs (Assanangkornchai, Li, McNeil, & Saingam, 2018).

The gambling environment has been changing, overlapping with other popular adolescent activities such as video games, with elements of gambling (e.g., loot crates or loot boxes) incorporated into them. These features may make gambling more accessible and socially acceptable among young people. These broader opportunities to gamble may facilitate more habitual patterns of gambling that can have negative life consequences, including development of GD, and this possibility should be investigated in

future studies. The serious nature of gambling problems among adolescents is particularly alarming considering that gambling is perceived to be a highly acceptable activity and common form of entertainment, with little recognition of the potential harm for adolescents. New forms of gambling and significant expansion in the range of gambling activities supported by digital technologies may be a particular risk for adolescents due to the potential of early age of onset of gambling involvement and development of positive attitude towards gambling. Further, adolescent gambling clusters with other risk behaviors including alcohol and drug use. Therefore, intervention programs concerning adolescent gambling should take into consideration other risk-taking behaviors (alcohol, drug use). Social support from parents and school personnel should be considered protective resources that can play a crucial role in decreasing adolescent gambling.

Several strengths and limitations of the study are noteworthy. The YRBS is a large epidemiological study involving self-report measures. First, gambling was assessed with only one question, and types and problematic severity of gambling could not be investigated given that multiple forms of gambling were embedded in one question annually. Additionally, the gambling question was modified in the 2019 survey. Thus, the potential impact of temporal contexts cannot be disentangled from the change in the question assessing gambling. Second, self-reported data are subject to biases, such as reliability on memory, social desirability, and honesty of responses. Given the illegal nature of several variables (e.g., gambling among participants younger than 18 years, use of illicit substances or licit substances for adults like alcohol), it is possible that participants may not have reported engagement in certain behaviors, leading to overly conservative prevalence estimates. Conversely, bravado-type responses may have led to over-estimations. Third, the cross-sectional design of this survey study precludes analyses or statements about potential directionality or causality. Moreover, the survey is descriptive and not designed to explain reasons behind observed patterns over time. Fourth, although this is a representative sample, the survey was conducted in select school districts in one state; thus, the extent to which current findings generalize to populations outside the state of Connecticut is unclear. Fifth, there are other potential risk and protective factors including several individual, social, and familial domains, which were not measured in this study. Specific risk factors may differ for individuals as gambling problems likely have multiple etiological determinants. Sixth, only certain forms of gambling were mentioned in the surveys, and it is possible that specific forms of gambling were not reported by respondents. Seventh, the study was exploratory and thus used a relatively liberal threshold for determining statistical significance.

Overall, results suggest that gambling is a relatively common activity among Connecticut adolescents. Further, our study identified several risk and protective factors that may have important roles in influencing youth involvement in gambling, a risk factor for gambling disorder. Prevention and intervention efforts should be focused on multiple-behavior interventions (e.g., drug and alcohol use) specifically among boys and adolescent with mental health vulnerabilities. Early life stressors, specifically adverse childhood experiences and trauma screening and assessment, are also warranted. Adequate social support may act as a protective factor against gambling and problem gambling. Hence, strengthening adolescents' social support from school and parents may be beneficial. Social support may be a crucial component of intervention strategies for adolescent problem gambling. Strong familial relationships, positive role models, and open communication between adolescents, parents, and teachers may reduce the likelihood of involvement in risky behaviors such as gambling. Given that adolescents may be increasingly exposed to various gambling opportunities online and offline, especially in the context of legalized sports gambling, it is important to identify individuals at risk, monitor the consequences of gambling involvement, and refer individuals for help when needed. This may be particularly relevant in Connecticut and other states where sports gambling has been recently legalized.

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*Authors' contribution:* Drs. EAS, RG, and MNP conceptualize the study, design, and conduct analyses and wrote the original draft of the manuscript. Dr. ZWZ was involved in review & editing of the manuscript. All authors provided critical feedback with respect to the content of the manuscript. They also had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analyses.

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## APPENDIX

*Table A1.* Unadjusted odds ratios by survey year

| | 2009 vs 2007 | | | 2011 vs 2009 | | | 2013 vs 2011 | | | 2015 vs 2013 | | | 2017 vs 2015 | | | 2019 vs 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CL | | OR | 95% CL | | OR | 95% CL | | OR | 95% CL | | OR | 95% CL | | OR | 95% CL | |
| Gambling | **0.77** | **0.67** | **0.89** | 0.93 | 0.76 | 1.14 | **0.80** | **0.65** | **0.97** | 1.02 | 0.87 | 1.20 | 0.83 | 0.67 | 1.04 | **1.50** | **1.16** | **1.94** |

Bolded are significant findings.