

# Problem Gambling Among Ontario Students: Associations with Substance Abuse, Mental Health Problems, Suicide Attempts, and Delinquent Behaviours

Steven Cook · Nigel E. Turner · Bruce Ballon · Angela Paglia-Boak ·  
Robert Murray · Edward M. Adlaf · Gabriela Ilie · Wendy den Dunnen ·  
Robert E. Mann

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**Abstract** This paper describes gambling problems among Ontario students in 2009 and examines the relationship between gambling problems and substance use problems, mental health problem indicators, and delinquent behaviors. Data were derived from the Ontario Student Drug Use and Health Survey of Ontario students in grades 7–12. Gambling

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S. Cook  
Department of Sociology, University of Toronto, Toronto, ON, Canada  
e-mail: steven.cook10@me.com

N. E. Turner (✉) · B. Ballon · A. Paglia-Boak · R. Murray · E. M. Adlaf · R. E. Mann  
Centre for Addiction and Mental Health, 33 Russell Street, Rm. T524, Toronto, ON M5S 2S1, Canada  
e-mail: Nigel\_Turner@camh.net; nigel.turner@camh.ca

B. Ballon  
e-mail: Bruce.Ballon@camh.ca

A. Paglia-Boak  
e-mail: Angela.Boak@camh.ca

R. Murray  
e-mail: Robert.Murray@camh.ca

E. M. Adlaf  
e-mail: eadlaf@sympatico.ca

R. E. Mann  
e-mail: Robert.Mann@camh.ca

N. E. Turner · E. M. Adlaf · R. E. Mann  
Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada

B. Ballon  
Department of Psychiatry, University of Toronto, Toronto, ON, Canada

G. Ilie  
St. Michael's Hospital, Toronto, ON, Canada

W. den Dunnen  
Department of Psychology, University of Ottawa, Ottawa, ON, Canada

problems were measured as 2 or more of 6 indicators of problem gambling. In total 2.8 % of the students surveyed endorsed two or more of the problem gambling items. The odds of problem gamblers reporting mental distress was 4.2 times higher than the rest of the sample and the odds of problem gamblers reporting a suicide attempt were 17.8 times greater than the rest of the sample. In addition compared to the rest of the students, delinquent behaviors were also more common among problem gamblers, including theft ( $OR = 14.5$ ), selling marijuana ( $OR = 19.6$ ), gang fights ( $OR = 11.3$ ) and carrying a handgun ( $OR = 11.2$ ). In a multivariate analysis, substance-use problems, mental health problems, and the participation in a variety of delinquent behaviors remained significantly associated with youth problem gambling behavior. Students who report problem gambling behaviors show increased substance abuse, mental health, and delinquency/criminal problems that are similar to those seen among adult problem gamblers. The association between these problems suggests that these problems could be addressed in a unified manner.

**Keywords** Problem gambling · Adolescents · Comorbidity · Substance use · Depression · Suicide

## Introduction

Gambling is common in Ontario among all age groups (Adlaf and Ialomiteanu 2000; McCreedy et al. 2008; Paglia-Boak et al. 2010), and the rate of gambling participation appears to be quite high among Ontario's adolescents (Adlaf and Ialomiteanu 2000; Derevensky et al. 2003; Turner et al. 2008a, b). The frequency of adolescent gambling behavior, combined with an increase in gambling availability in the past two decades has sparked concerns about youth gambling, and about problems that gambling may be creating among young people (Gupta and Derevensky 1998a, b; Welte et al. 2008, 2009). Studies of adolescent problem gambling have reported prevalence rates ranging from 2 % (Martin et al. 2009) to as high as 7.4 % (Derevensky et al. 2003; Shaffer and Hall 1996), and according to some studies, rates of problem gambling among youth are higher than those reported by adults (Gupta and Derevensky 1998b; Jacobs 2000; National Research Council 1999; Shaffer and Hall 1996). Better understanding adolescent problem gambling behavior is therefore important because, while adolescent gambling does not necessarily lead to adult gambling (Vitaro et al. 2004), the trajectories of many adult problem gamblers can be traced back to adolescent gambling behavior. For example, Turner et al. (2006) found that roughly 75 % of the pathological gamblers reported having started gambling by the age of 18, necessitating a better understanding of adolescent gambling behavior.

Several studies have examined adolescent problem gambling in Ontario. Govoni et al. (1996) estimated that 8.1 % of their sample of Windsor adolescents were problem gamblers, and a further 9.4 % were at risk gamblers, based on the adolescent version of the South Oaks Gambling Screen (SOGS-RA). Gupta and Derevensky (1997) estimated that 4.9 % of their Southern Ontario sample were probable pathological gamblers, and an additional 8.0 % were at risk gamblers, based on the DSM-IV-Multiple Response-Juvenile (DSM-IV-MR-J) scale. They also observed that problem gambling rates were higher among males than females, and increased with grade. Adlaf and Ialomiteanu (2000), using the 12-item SOGS-RA, found that 7.5 % of Ontario students in grades 7 through 13 met the

criteria for at-risk gambling and 5.8 % met the criteria for problem gambling. Recent studies however have found a somewhat lower rate of 2.0 (Martin et al. 2009) and 2.8 (Brunelle et al. 2012), but these rates are nonetheless higher than the rates found for adults. Consistent with previous results, they also found that more males than females reported at-risk and problem gambling (Gupta and Derevensky 1997).

Adolescent problem gambling has been associated with a wide range of comorbid conditions, which have been well-documented in the peer reviewed literature (e.g., Barnes et al. 2005; Gupta and Derevensky 1998a, b; Magoon et al. 2005; Turner et al. 2008a, 2011; Tozzi et al. 2013; Walther et al. 2012; Cheung 2012; Cheung and Cheung 2008). In general, the extant research literature has revealed that problem gambling is correlated with other addictive behaviors (Jacobs 2000), with adolescent problem gamblers appearing to be more likely to use alcohol and other substances and to experience problems with these substances than are other youth (Gupta and Derevensky 1998a, b; Kusyszyn 1972; Lesieur and Klein 1987; Winters and Anderson 2000). Turner et al. (2011), for example, observed that clusters of young gamblers could be identified, and that while heavy gamblers and drug-takers formed separate clusters, there were substantial numbers of problem gamblers in both clusters suggesting a significant overlap in gambling and drug-use behaviors. The comorbidity between problem gambling and substance use has led some researchers to conclude that problem gambling is best understood from a broader ‘addiction behaviors spectrum’ (Jacobs 2000; Molde et al. 2009), making problem gambling and other addictive behaviors part of the same underlying construct.

Other researchers have expanded the link between drug use, alcohol use, and problem gambling to include delinquent behavior (e.g., Barnes et al. 2005; Derevensky and Gupta 2000; Yeoman and Griffiths 1996). This perspective takes into account the elevated rates of gambling problems are elevated among incarcerated adolescents (Westphal et al. 1998) and amongst adults offenders (see Abbott et al. 2005; Turner et al. 2009). In addition, adolescent problem gamblers report higher rates of delinquent behaviors, such as stealing money (Derevensky and Gupta 2000; Yeoman and Griffiths 1996). Using data from a prospective longitudinal study from Montreal, Wanner et al. (2006) demonstrate that the co-occurrence of early alcohol use, gambling behavior and marijuana use are predictive of Moffitt’s (2003) ‘life-course persistent’ group of adult offenders. These findings suggest that the early onset of addictive behaviors, including problematic gambling, are important for understanding the trajectories of antisocial behavior throughout the life-course.

In addition to examining the association between problem gambling behavior, delinquency, and substance use, researchers have also revealed that adolescent problem gamblers are more likely to experience psychological distress, anxiety, and depression (Derevensky and Gupta 2004; Gupta and Derevensky 1998a) and may be at increased risk for suicidal behavior (Derevensky and Gupta 2004; Kaminer et al. 2002; Nower et al. 2004) relative to adolescents without problem gambling behavior. However, despite the importance of these comorbid internalizing behaviors for understanding adolescent problem gambling, few studies have attempted to link these internalizing behaviors with other comorbid externalizing behaviors. In one exception, from an ‘addictive behaviors spectrum’ (Jacobs 2000) perspective, depression is believed to be related to problem gambling behavior because it reduces the stress and alcohol-related problems related to substance abuse (Jacobs 2000; Molde et al. 2009). Gambling behavior, in other words, provides a temporary reprieve from the stresses associated with substance abuse.

## The Current Study

While problem gambling in adolescence has been linked with other problematic behaviors, including substance use, delinquency, depression, and suicidality, more research is warranted. First, much of the existing research has been based on samples derived from clinical populations, while much less research has examined comorbid problems among general and representative populations of adolescent problems (for exceptions, see Molde et al. 2009, Cheung 2012 etc.). The first aim of our study was to determine the distribution of problem gambling behaviors in a representative and population-based sample of adolescent students from grades 7 to 12 in Ontario, Canada.

The second aim of our study was to examine a broader and more integrated series of comorbid risk factors that are associated with adolescent problem gambling including substance use, elevated psychological distress, suicidality, and delinquency. While separate theoretical frameworks have been advanced for understanding the associations between problem gambling behavior and substance use (Jacobs 2000; Molde et al. 2009), and have included the importance of delinquent behavior (Wanner et al. 2006), few studies have examined the contribution of these risk factors in conjunction with internalizing characteristics, such as depression and suicidality. Because these variables are interrelated, we will examine the relationship using multivariate logistic regression to determine which variables are most strongly associated with problem gambling. The consideration of these interrelated risks, from a broader theoretical framework, suggests that adolescent problem gambling may be part of an overall pattern of risk taking (Jessor 1991). In an effort to assess the relative contribution of each of these comorbid risk factors, a multivariate statistical analysis was conducted to isolate which predictors are most strongly associated with adolescent problem gambling, controlling for the effects of the other risk factors.

## Method

### Survey and Participants

The data for this study were derived from a large sample ( $N = 4851$ ) of the 2009 cycle of the Ontario Student Drug Use and Health Survey (OSDUHS), a cross-sectional survey of Ontario students enrolled in grades 7 through 12. The 2009 OSDUHS employed a stratified (region and school type), two-stage (school, class) cluster sample design. In elementary/middle schools, two classes were randomly selected—one 7th grade and one 8th grade class. In secondary schools, four classes were randomly selected, one in each grade from 9 to 12. Surveys were administered between November 2008 and June 2009. Of the 181 schools, 573 classes were selected across 47 school boards. Thirteen percent (13 %) were lost due to absenteeism, and 22 % were lost due to either unreturned consent forms or parents' refusal, and the final student participation rate was 65 %. A series of exclusionary criteria were also applied in order to enhance data quality and to minimize respondent bias. The survey was completed by 4980, however students were excluded if they (1) did not report a valid age; (2) did not report a valid sex; (3) reported the use of a fictitious drug; (4) reported using 10 or more of 13 illicit drugs (excluding cannabis) 40 or more times during the past year (“faking bad”); or (4) did not respond to half or more of the core substance use questions. In total 129 cases (2.6 %) were excluded for the above stated reasons, resulting in a final sample of 4851.

Post hoc analyses revealed no significance between-class differences between classes with a high response rate (above 70 %) and low response rate (below 70 %) for substance abuse, delinquency, mental health problems, or demographic factors, indicating that a non-response bias was unlikely.

All participants provided informed consent; students less than 18 years of age required signed parental consent and older students were appropriately briefed. To promote anonymity and privacy, self-report questionnaires were administered by the Institute for Social Research, York University, on a classroom basis. The mean age of these participants was 14.6 years, 47 % were males and 53 % were females.

## Measures

### Problem Gambling

Due to space limitations in the survey, the OSDUHS uses a list of 6 gambling symptoms that were taken from South Oaks Gambling Screen Revised for Adolescents (SOGSRA) (Winters et al. 1993). The items were selected to maximize the content and variance of the full SOGS-RA with a minimum of items (Adlaf and Paglia-Boak 2003). Six items were selected from the 12-item scale based on maximizing the correlation between the short scale and the full scale, and the resulting scale had a reliability coefficient ( $\alpha$ ) of 0.71. Receiver Operating Curve analysis was used to examine the concordance of thresholds on the short instrument with determination of problem gambling by the full SOGSRA. The area under the curve (AUC) value was 0.80, and according to Akobeng (2007) AUC values of 0.7–0.9 reflect a test of moderate accuracy. A cut-off of 2 on the short instrument provided the best correspondence with a cut-off of 4 on the full SOGS-RA. People who endorsed two or more items on the short scale had an average of 4.6 (SD = 2.7) on the full SOGS-RA. The rate for problem gambling for the full SOGS-RA was 3.1 %, whereas the short SOGS-RA with a cut off of 2 indicated a rate of problem gambling of 4.4 %; thus this short measure may be overly inclusive. The observed 42 % higher rate for a cut off of 2 will be used to adjust the observed rate of problem gambling in the current study. For the purpose of this analysis, any student who answered positively to two or more of the individual gambling indicators was classed as having a gambling problem. It is important to note that this measure is used as an indicator of problem gambling broadly defined, rather than as a measure of a clinically significant gambling pathology. The odds ratios reported below will be a comparison of those who score two or more on the indicators of problem gambling as noted above, compared to the rest of the student population.

### Substance Use Problems

The OSDUHS includes the Alcohol Use Disorders Identification Test (AUDIT), which was developed by the World Health Organization (Saunders et al. 1993). This instrument is designed to detect problem drinkers at the less severe end of the spectrum of alcohol problems, and has been used in several previous studies (e.g., Adlaf and Ialomiteanu 2000; Turner et al. 2011). The AUDIT assesses hazardous and harmful drinking. Hazardous drinking refers to an established pattern of drinking that increases the likelihood of future medical and physical problems (e.g., accidents), whereas harmful drinking refers to a pattern of drinking that is already causing damage to one's health (e.g., alcohol-related

injuries). Those with a score of 8 or more (out of 40) are considered to be drinking at a hazardous level. The reliability coefficient ( $\alpha$ ) for these items is 0.87.

The Severity of Dependence Scale (SDS) for cannabis use (Martin et al. 2006) is also included, and is designed to gauge cannabis dependence experienced by students. The SDS is a valid and reliable 5-item scale used to screen for dependence in adolescent populations. Each item was scored on a 4-point scale and scores were summed. A total score of 4 or more (out of 15) indicates cannabis dependence. The reliability coefficient ( $\alpha$ ) for these 5 items is 0.77.

### Elevated Psychological Distress

The OSDUHS includes the 12 item version of the General Health Questionnaire (GHQ-12) (Goldberg et al. 1997; Goldberg and William 1988), a screening instrument used to detect current psychological distress. The GHQ-12 uses 12 items to assess depressed mood, anxiety, and problems with social functioning. A score of 3 or more on the GHQ-12 is considered as reflecting someone experiencing elevated psychological distress. The reliability coefficient ( $\alpha$ ) for these 12 items is 0.87.

To measure suicide ideation and attempts the students were asked: “In the last 12 months, did you ever seriously consider attempting suicide?” and “In the last 12 months, did you ever actually attempt suicide?” Response options to both questions were yes or no.

### Delinquent Behaviors

The OSDUHS contains questions about engaging in violent and non-violent delinquent behaviors during the past year. For non-violent delinquent acts, students were asked: “How often (if ever) in the last 12 months have you (1) Taken a car without permission; (2) Banged up or damaged something on purpose (vandalism); (3) Sold marijuana or hashish; (4) Taken things worth \$50 or less; (5) Taken things worth more than \$50; Broken into a locked building (excluding home); (6) Sold drugs other than marijuana or hashish; (7) Ran away from home; (8) Set something on fire that you weren’t supposed to.” For violent delinquent acts, students were asked: “How often (if ever) in the last 12 months have you: (1) Beat up or hurt anyone (excluding sibling fights); (2) Taken part in gang fights; (3) Carried a weapon (e.g., gun or knife); (4) Carried a handgun.” The non-violent and violent delinquent behaviors were first considered separately in the bivariate analyses to examine the relationship of each delinquent behavior to problem gambling separately. Next, in order to estimate the number of types of delinquent behavior the students participated in during the past year, the items were then aggregated, with students who reported participating in three or more delinquent behaviors during the past year considered to have participated in a variety of delinquent behaviors.

### Analysis

In order to ensure that the sample was reflective of the population of Ontario students, post stratification weights were calculated for the sex-by-grade distributions within each regional stratum separately to restore each region’s structure to the population structure. Because our design employs complex sampling methods and unequal probabilities of selection, all 2009 confidence intervals (CI) were corrected for characteristics of the

sampling design (i.e., stratification, clustering and weighting) using Stata 11.0 Taylor series survey routines (StataCorp 2009). The analysis was based on a design with 19 strata (region \* school type), 181 primary sampling units (schools). For both the bivariate and multivariate analyses, the odds ratios were calculated using binary logistic regression models correcting for the survey design, and controlling for the significance of grade and sex. The data were analyzed using STATA, version 13.1.

## Results

### Gambling Problems

Overall, 2.8 % (95 % CI 2.0–3.9 %) of students responded positively to two or more of the individual gambling questions, indicating a gambling problem. This percentage represents about 29,000 Ontario students. Problem gamblers were significantly more often male than female (4.3 vs. 1.2 %, respectively). No significant differences were found across grade or between regions of Ontario (Northern, Western, Eastern, and Toronto), indicating a consistent prevalence of problem gambling for adolescents in the province. As noted above, this short version of the SOGS-RA likely over estimates the prevalence by about 42 % so it is estimated that the full SOGS-RA would yield a prevalence of 2.0 %.

### Bivariate Associations

The percentages of problem gamblers (e.g., endorsed 2 or more of the problem gambling items) and the rest of the student population reporting substance use problems, internalizing problems, and delinquent behaviors can be found in Table 1. Overall, 21 % (95 % CI 18.8–22.9 %) of students in grades 7–12 report drinking at a hazardous level as assessed by the AUDIT, representing approximately 211,000 students across Ontario. The percentage of problem gamblers, who report hazardous drinking, is close to half, compared to only 1/5 the rest of the student population. After controlling for the effects of sex and grade, the odds of problem gamblers reporting hazardous drinking behavior was 3 times greater than for the rest of the students.

About 3 % (95 % CI 2.2–3.7 %) of students report cannabis dependence. Across Ontario this represents approximately 31,000 students in grades 7–12. Among problem gambling adolescents higher rates of cannabis dependence are seen, with about one quarter of problem gamblers falling in this category compared to about 2 % of the rest of the student population. After controlling for the effects of sex and grade, the odds of problem gamblers report cannabis dependence is 11 times greater than the other students.

Elevated psychological distress is reported by just over 30 % (95 % CI 29.1–32.9 %) of students, representing about 327,000 Ontario students. Just over 60 % of problem gamblers report elevated psychological distress, while about 30 % of the remaining students fall in this category. After controlling for the effects of sex and grade, the odds of problem gamblers reporting elevated psychological distress was 4 times greater than the other students.

Almost 10 % (95 % CI 8.3–10.8 %) of students reported that they had seriously considered suicide in the past year. This percentage represents about 99,000 Ontario students. About 2.8 % (95 % CI 2.2–3.5 %) of students report attempted suicide in the past year, representing about 29,000 Ontario students. The rates of suicide ideation and suicide attempts over the past year are significantly higher among problem gamblers. After

**Table 1** Percentage of problem gamblers (2 or more of the problem gambling symptoms) and the rest of the student population reporting substance use problems, internalizing problems, non-violent criminal behavior and violent criminal behavior, 2009 OSDUHS

Indicator	Problem gamblers (%)	Other students (%)	OR	95 % CI
<i>Substance use</i>				
Hazardous drinking	48.0	20.0	3.0	1.0–9.3
Cannabis dependence	24.0	2.3	11.0	5.3–22.6
<i>Internalizing behavior</i>				
Elevated psychological distress	61.0	30.2	4.2	2.4–7.6
Suicide ideation	26.1	9.0	4.0	1.9–8.2
Suicide attempt	25.3	2.2	17.8	6.5–44.7
<i>Non-violent crime</i>				
Theft under \$50	51.4	13.4	5.5	3.1–9.8
Theft over \$50	44.5	4.3	14.5	7.9–26.6
Vandalism	53.7	12.7	6.8	3.9–11.9
Break and enter	24.7	4.0	6.1	3.4–11.0
Take car without consent	41.7	29.4	8.2	3.9–17.2
Sell marijuana or hashish	31.1	5.9	5.3	2.9–9.5
Sell drugs other than marijuana	29.2	1.5	19.6	10.4–36.9
Ran away from home	42.7	7.9	9.3	4.9–17.2
Fire setting	41.8	14.1	3.4	1.9–6.2
<i>Violent crime</i>				
Assault	47.4	9.0	7.5	3.5–16.3
Gang fight	23.8	2.3	11.3	5.0–25.2
Carry weapon	31.8	6.8	4.8	2.4–9.6
Carry handgun	14.4	1.1	11.2	3.8–33.0

Problem gambler was defined as endorsing 2 or more of the problem gambling symptoms. Odds ratios were all calculated in a logistic regression model controlling for the effect of age and sex. All odds ratios are significant  $p < 0.01$

controlling for the effects of sex and grade, the odds of problem gamblers reporting having seriously considered committing suicide was 4 times that of the rest of the students and the odds of reporting suicide attempts was 18 times greater than the rest of the student population.

Problem gamblers are much greater odds than the rest of the student population to report nonviolent delinquent behaviors. After controlling for the effects of sex and grade, the odds of them reporting these behaviors compared to the rest of the student population range from 3.4, for fire setting, to 19.6 for selling drugs other than marijuana.

Young problem gamblers have much greater odds to report violent delinquent behaviors (see Table 1). After controlling for the effects of sex and age, the odds of problem gamblers reporting violent delinquent behaviors ranged from 4.8 for carrying a weapon to 11.3 for participating in a gang fight.

We also calculated an overall delinquency measure. Any individual who endorsed 3 or more of any of the nonviolent or violent delinquency items was classed as delinquent. The odds of problem gamblers being in this category were 12.5 (95 % CI 6.1–24.7) times those of students who were not problem gamblers, controlling for the effect of sex and age.



**Table 2** Weighted Multivariate logistic regression predicting problem gambling behavior (2 or more of the gambling problem symptoms) and the rest of the student population, 2009 OSDUHS

	Model 1: substance use	Model 2: internalizing problems	Model 3: delinquency	Model 4: multivariate model
Sex	3.32***	5.10***	2.56**	4.14***
Age	1.17	1.17*	1.21	1.12
Hazardous drinking	1.97			1.22
Cannabis dependency	8.75***			3.43**
Suicide attempt		13.5***		6.46**
Psychological distress		3.47***		2.75***
Delinquency			11.35***	5.86***

*n.s.* not statistically significant; \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$

### Multivariate Analysis

The bivariate analyses showed significant associations between problem gambling and a large number of substance and mental health problems. However, substance and mental health measures and problem behaviors often show associations with each other (e.g., Turner et al. 2011; Turner et al. 2012; Donovan and Jessor 1985), and it is possible that problem gambling may show stronger associations with a subset of the comorbidities examined here, which could reflect the most important relationships and possibly the more likely causal pathways. We therefore conducted a multivariate analysis using binary logistic regression to identify the comorbidities most strongly associated with adolescent problem gambling (as indicated by a score of 2+ on the SOGSRA-SA). The multivariate context enables the estimation of independent associations of substance use behavior, mental health variables, and delinquency (endorsed 3 or more of the delinquency items) on the odds of youth problem gambling.

Table 2 presents the multivariate analysis of the variables associated with youthful problem gambling. The results reveal that males were more than 4 times more likely than females to report problem gambling after controlling for differences in substance use, internalizing behavior, and delinquency ( $p < 0.001$ ). In addition, the multivariate results showed that problem gambling was significantly associated with the measures of internalizing behavior, as elevated psychological distress ( $OR = 2.75$ ,  $p < 0.001$ ), and suicide attempts ( $OR = 7.05$ ,  $p < 0.001$ ) were significantly higher among youthful problem gamblers. Delinquency also had a net multivariate influence on problem gambling, as youth who reported participating in three or more types of delinquency over the past 12 months were 5.9 more likely to meet the criteria for problem gambling than less delinquent youth ( $p < 0.001$ ). Interestingly, while cannabis dependency had a strong multivariate impact on adolescent problem gambling behavior ( $OR = 3.4$ ;  $p < 0.001$ ), hazardous drinking as measured by the AUDIT did not reach significance in when controlling for cannabis dependency, or in the multivariate analysis, suggesting that hazardous drinking did not have a net influence on problem gambling. The correlation matrix (Table 3) reveals a moderate correlation of .24 between the hazardous drinking measure and cannabis dependence, suggesting that the lack of significance is not due to problems with multicollinearity.

**Table 3** Correlation matrix of independent and dependent variables, 2009 OSDUHS

	Problem gambling	Hazardous drinking	Cannabis dependence	Suicide attempt	Psychological distress
Hazardous drinking	.124				
Cannabis dependence	.177	.243			
Suicide attempt	.132	.084	.078		
Psychological distress	.095	.121	.112	.168	
Delinquency	.242	.325	.245	.156	.138

All correlations are significant at the .001 level

## Discussion

The first aim of this study was to estimate the distribution of youth problem gambling behaviors in a representative and population-based sample of adolescent students. Based on the endorsement of 2 or more symptoms among Ontario students in grades 7–12, we estimated 2.8 % of Ontario students had a probable gambling behavior problem, with a 95 % confidence interval ranging from 2.2 to 3.5 %. As noted above, this short version of the SOGS-RA likely over estimates the prevalence by about 42 %, so it is estimated that the full SOGS-RA would yield a prevalence of 2.0 %. This figure is lower than has been found in most previous studies of problem gambling (Gupta and Derevensky 1998a, b; Jacobs 2000; National Research Council 1999; Shaffer and Hall 1996; Turner et al. 2011; Welte et al. 2008, 2009). However, these results are similar to recent results reported by Martin et al. (2009) who reported that of the youths surveyed, 4.1 % were considered at-risk gamblers, while another 2 % were probable pathological gamblers. In another relatively recent study, Brunelle, et al. (2012) reported a rate of 2.8 % probable pathological gamblers, but a much higher rate amongst internet gamblers. Consistent with the existing research (Gupta and Derevensky 1997), we also found that the rates of problem gambling were higher among male students than female students (4.3 vs. 1.2 %, respectively) with nearly 1 in 23 males falling in the problem gambling category. The multivariate statistical analysis demonstrated that these sex differences were not explained by the differential participation in substance use and delinquent behavior, as males continued to have significantly greater odds of engaging in problematic drinking than females after controlling for the impact of these variables.

It is possible that the drop in the prevalence rate from older studies indicates that recent prevention efforts in the province, such as the incorporation of probability into the math curriculum as well as prevention programs run for youth by various other agencies in Ontario have had some impact. Similarly the lower rates of problem gambling found in more recent studies in Quebec (e.g., Martin et al. 2009) could also be the result of prevention programs run in that province. However, without the appropriate longitudinal data, it is not possible to determine if the relatively low rate of problems found in this study were causally linked to the prevention and educational efforts carried out in these provinces. While a prevalence rate of 2.8 % is relatively low, it equates to about 20,500 Ontario students who are experiencing a gambling problem, which is a large number of students in need of support. Thus prevention efforts are still needed, and further research is warranted.

Gambling problems are not unique to the Ontario context, but are a problem encountered in many countries. The results from the current study highlight the continued need to be aware of gambling amongst youth and in particular its association with other problematic behaviors.

The second aim of the current study was to examine the relationship between problem gambling and a broad series of comorbid risk factors, including substance use, elevated psychological distress, suicidality, and delinquency. Our findings confirm the results of other studies in demonstrating that there are high rates of substance use problems among adolescent problem gamblers (Barnes et al. 2005; Brunelle et al. 2012); Derevensky and Gupta 2000). However, in the multivariate analysis, only cannabis dependence had a net influence on youth problem gambling while hazardous drinking behavior did not. That is not to say that there is no association between hazardous drinking and problem gambling, but that once other variables were entered the effect of hazardous drinking as measured by the AUDIT did not contribute any unique variance. Given the relatively common participation in hazardous drinking for both problem and non-problem gambling students, it is not surprising that hazardous drinking does not distinguish problem gamblers from non-problem gamblers in the multivariate context.

In addition to cannabis dependence, significantly higher levels of psychological distress, suicidal ideation and suicide attempts were seen among problem gamblers. Other studies have observed higher levels of mental health problems in this group (Derevensky and Gupta 2000), and our analyses confirm that these problems are common in Ontario adolescent problem gamblers. A very striking finding was that about a quarter of the problem gambling group reported a suicide attempt in the past year, and the odds of suicide attempts were about 18 times higher than in the general student population. After controlling for the effects of the other variables examined, the odds of youth problem gamblers attempting suicide was more than 6 times greater compared to the rest of the sample. This finding points to a very serious health risk that this group may be facing. The link between gambling problems and suicide has been reported before (Hodgins et al. 2006; Nower et al. 2004), but this finding is particularly alarming because of the high incidence of reported suicide attempts among young problem gamblers. Due to the cross sectional nature of the data the cause and effect relationship between these variables cannot be determined.

Significantly higher rates of both violent and non-violent delinquency were observed among adolescent problem gamblers. This is consistent with the published literature on gambling problems (Barnes et al. 2005; Cheung 2012; Magoon et al. 2005; Williams et al. 2005). Illegal behaviors amongst youth that could progress to create significant criminal involvement in adulthood appeared common in this group, including theft, selling cannabis and other drugs, gang involvement and carrying weapons. While these may result in part from a need to obtain funds to support gambling habits, they also point to the links of gambling with a more deviant lifestyle (Zangeneh et al. 2010), and point to the possible criminogenic influence of gambling involvement among young people that could account for at least part for the large number of adult problem gamblers who engage in criminal behavior (Abbott et al. 2005; Turner et al. 2009).

Several limitations must be kept in mind when interpreting the results from the current study. The results are based on self-reports, and thus could be subject to bias from under-reporting or over-reporting. However, self-reports of substance use and other sensitive behaviors have been found to have acceptable validity when information is provided anonymously and with no associated consequences (Adlaf 2005). In addition only a small number of people ( $n = 129$ ; 2.6 %) had to be excluded due to validity issues (e.g., endorsing a fictitious drug). In addition, it is important to note that the results are derived

from a cross-sectional survey, and thus causation cannot be inferred from our data. These observations are based on Ontario students in grades 7–12, and may not generalize to other groups. Finally, our measure of problem gambling is based on a shortened version of the SOGS-RA. Thus, prevalence estimates derived from this instrument is estimated to be 43 % higher than the prevalence estimates derived from the full version of the SOGS-RA. As noted we measured problems, rather than pathological gamblers. However, this limitation has to be weighed against the strength of including a broad range of variables in a large probability sample.

Taken together, the results from this study demonstrate that substance use, psychological distress, suicidality and delinquent behavior are important risk factors for understanding adolescent problem gambling. While each of these risk factors may be partially understood within specific theoretical frameworks, such as an ‘addiction behaviors spectrum’ (Jacobs 2000; Molde et al. 2009) or as part of ‘life-course persistent’ offending behavior (Wanner et al. 2006), in isolation, these explanations do not offer a complete picture of the multidimensional nature of adolescent problem gambling. The reality is that many youth problem gamblers have comorbid substance use problems, significant psychological distress, and participate in a variety of delinquent behaviors. Future research would benefit from more closely investigating the link between these risk factors, and by taking a more broad theoretical perspective, it may be possible to better understand the significant impairment problem gambling creates across multiple spheres of these individual’s lives. It is also possible that adolescent problem gamblers are more likely to come from adverse living conditions and difficult social surroundings, and future research would benefit from investigating the link between these risk factors and one’s social environment. It is through better understanding these risk factors that better prevention efforts and programming can be developed to ameliorate adolescent problem gambling and its attendant consequences.

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