

A typological study of gambling and substance use among adolescent students

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Abstract

Cluster analysis was used to define subpopulations of youth involved in drugs, alcohol, and gambling. Data from a 2001 cross-sectional survey of Ontario grade 7 to 13 students ($N = 2,243$; mean age 15 years; 51% males) were examined. The analysis suggested four clusters: Mainstreamers (66.0%), Party Goers (26.2%), Drug Takers (5.9%), and Heavy Gamblers (1.9%). This cluster structure was validated across a number of additional external variables that were not used in the original cluster analysis. The findings indicated that Drug Takers and Heavy Gamblers formed two distinct clusters. Probable pathological gamblers were found in all four clusters, but they were most concentrated in the heavy gambling cluster. The results suggest that troubled youths are not a single entity, but display heterogeneity in their configuration of risk behaviours.

Introduction

Since the 1970s, there has been an exponential expansion of gambling opportunities for adults across Canada and around the world (Ladouceur, 1996; Shaffer, Hall, & Vander Bilt, 1999). This rapid expansion of legalized gambling has raised concerns about the potential for gambling disorders in vulnerable populations (Korn, 2000; Ladouceur, Jacques, Ferland, & Giroux, 1999; Room, Turner, & Ialomiteanu, 1999). One population that has been viewed as vulnerable to gambling and gambling disorders has been adolescents (Derevensky & Gupta, 2000; Shaffer et al., 1999). Youth are exposed to marketing campaigns about gambling on television, on websites, in junk e-mail, and through corner store lottery displays. Gambling can be a fun or relaxing way of spending time and money, but youths, lured by the promise of excitement, prestige, and instant wealth, may be particularly vulnerable to these messages.

Given the ubiquity of gambling messages, it is important to examine behavioural and gambling problems among adolescents. The basis for this concern is threefold. First, research on

problem gambling among youth suggests that a substantial number endorse a wide variety of gambling problem symptoms (e.g., more than 20% endorse at least one SOGS item; Adlaf & Ialomiteanu, 2000). In fact, the prevalence of problem gambling amongst youth has been found to be 2 to 3 times higher than that of adults (Shaffer & Hall, 2001). However, the higher prevalence has been questioned by some researchers (Ladouceur et al., 2000; Welte, Barnes, Tidwell, & Hoffman, 2008). Second, it has been argued that gambling disorders tend to originate in adolescence (Griffiths, 1995; Gupta & Derevensky, 1998a; Kaminer & Petry, 1999; Shaffer & Hall, 1996). Third, because the current cohort of adolescents are immersed in a society awash in legal gambling opportunities, this cohort may experience higher rates of future gambling disorders compared with previous cohorts.

In order to develop effective prevention and treatment strategies, we first need to examine the distribution of problem gambling, substance use, and emotional distress in the youth population. In particular, we need to know if troubled youth form a single homogeneous group or if they comprise several different types. High rates of comorbidity are the norm in psychiatric disorders (Beitchman et al., 2001) and this is also true for problem gambling and substance abuse (Derevensky & Gupta, 2000; Gupta & Derevensky, 1998a; Haroon & Derevensky, 2002; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2004). Welte et al. (2004) found that probable pathological gamblers were significantly more likely to also report alcohol abuse or dependence. Barnes, Welte, Hoffman, and Dintchiff (2005) also reported a strong correlation between drug use, alcohol use, gambling, and delinquency. Derevensky and colleagues have found that, in general, problem gambling is correlated with other addictive behaviours (smoking, drinking, drug use/abuse), and with emotional problems such as depression, low self-esteem, and suicide ideation (Derevensky & Gupta, 2000; Gupta & Derevensky, 1998a; Haroon & Derevensky, 2002). Vitaro, Wanner, Ladouceur, Brendgen, and Tremblay (2004) have shown that the nature of gambling problems may vary depending on the age at which gambling starts. They found that adolescents who had an early or late onset of gambling took more risks than did those adolescents who did not gamble (low gamblers). In addition, adolescents who had an early onset of gambling showed lower inhibition and were more impulsive compared with low gamblers.

Strong correlations between substance use and problem gambling suggest that probable pathological gamblers and substance abusers are part of a single underlying deviant population and those at high risk for one type of problem, substance use, are also at high risk for problem gambling. However, variable-based analyses techniques (e.g., regression, factor analysis) can mask group differences (Beitchman et al., 2001). A key question in the present study is whether or not adolescent probable pathological gamblers, problem drinkers, and substance abusers are all part of the same basic deviant group or if they form a number of subtypes.

Cluster analysis

In this paper, we used cluster analysis to identify groups of students who are similar to each other across a variety of variables. This method, which is inherently exploratory in that it tries to uncover hidden structures, is a useful strategy for classifying individuals into

relatively homogeneous groups on the basis of their similarity across variables (Beitchman et al., 2001). Cluster analysis has several advantages over other statistical techniques such as regression and factor analysis. First, a wide variety of variables can be incorporated into a single cluster analysis. Second, contingent and non-linear relationships between variables that might be hidden in a regression analysis become the basis for defining groups in a cluster analysis. Third, although factor analysis only estimates quantitative linear differences between people, clustering allows the researcher to find categorical distinctions between groups of individuals. Fourth, the cluster typology lends itself to the pragmatic needs of mental health service providers. Indeed, the small number of subpopulations defined by the analyses can be used as the basis for developing screening tools to identify specific groups and for offering specific services for different clusters (Slater, Basil, & Maibach, 1999).

However, because of its exploratory nature and the possibility of finding chance results, the cluster structure must be validated (Sharma, 1996; Slater et al., 1999). In this paper, we employed two methods of validating a cluster structure. The first method is replication. Does the same analysis with a different set of data produce the same sort of cluster structure? In the present study, we randomly divided the sample in half and used one half to uncover the cluster structure and the other half to confirm it. This cross-validation is necessary, but not sufficient to give us confidence in the reality of the cluster structure. The second method is predictive validity (Slater et al., 1999). Do the groups found through the analysis also differ on a number of other variables that were not used in the initial analysis? In the present study, we assessed group differences between clusters on a number of external variables to confirm that we had actually discovered distinct groups of people.

Method

Sample

The data analysed in this paper were derived from self-report questionnaires completed by 2,243 students (mean age = 15 years; 51% males). The analytical sample size was reduced to 2,032 as a result of listwise deletion. The data were collected as part of the 2001 *Ontario Student Drug Use Survey* (OSDUS; Adlaf & Paglia, 2001), a cross-sectional anonymous survey of Ontario students enrolled in grades 7 to 13. A total of 41 school boards, 106 schools, and 272 classes participated in the survey. The completion rate was 71% of all eligible students. The two main reasons for non-completion were absenteeism (13%) and the absence of parental consent (16%).

The study employed a stratified (region and school type) two-stage (school, class) cluster sample design. In elementary schools (students 12 to 14 years old), two classes were randomly selected (one grade 7, one grade 8) and in secondary schools (students 14 to 18 years old), three classes were randomly selected regardless of grade. To promote anonymity and privacy, trained staff of the Institute for Social Research, York University, administered self-report questionnaires on a classroom basis.

Measures

In total, our analysis employed 31 variables: 17 variables for the cluster analysis and an additional 14 external variables to examine the validity of the final cluster solution. For the cluster analysis, we selected 17 variables, including measures of behaviour (gambling, drug use, alcohol use, and tobacco use), gambling problems, and substance use problems.

The *gambling variables* included seven gambling activity frequency items, one item asking what was the largest amount of money gambled in the past 12 months and the 12-item South Oaks Gambling Screen Revised for Adolescents (SOGS-RA; Winters, Stinchfield, & Fulkerson, 1993). The preface for the gambling frequency items was, “How often (if ever) in the past 12 months have you done each of the following?” The seven activities included (a) played cards for money; (b) played bingo for money; (c) bet money in sports pools; (d) bought sports lottery tickets (such as Sports Select or ProLine); (e) bought any other lottery tickets, including instant lottery (such as 6–49, Scratch & Win, pull-tabs); (f) bet money on video gambling machines, slot machines, or any other gambling machines; and (g) bet money at a casino in Ontario. Students were asked to indicate the number of times they engaged in the activity (range 0–99). To measure gambling problems, we used the continuous SOGS-RA score (range 0–12; $M = 0.41$; $SD = 1.18$). Scale scores were computed by summing across the 12 binary items (1 = yes/0 = no).

The *substance use measures* included six variables: use of alcohol, tobacco, cannabis, depressants, stimulants, and hallucinogens in the past 12 months. Alcohol use was measured by the frequency of use (nine categories, from never to drinking almost every day, coded 0–8); tobacco consumption was measured by the number of cigarettes smoked daily (nine categories, from 0 to more than 20 per day, coded 0–8); and cannabis use was measured by the number of times cannabis was consumed in the past 12 months (seven categories, from never to 40 or more times, coded 0–6).

Use of depressants was defined by summing across three non-medical depressant drugs used in the past 12 months: barbiturates, heroin, and tranquillizers (from 0 to 3); use of stimulants was measured by summing the total number of the five non-medical stimulant drugs used: methamphetamine, crystal methamphetamine, cocaine, crack, and stimulants pills (from 0 to 5); and use of hallucinogens was defined by summing the total number of the four hallucinogenic drugs used in the past 12 months: LSD, PCP, ecstasy, and other hallucinogens (e.g., psilocybin; from 0 to 4).

Substance use problems included alcohol-related problems and drug use problems. To measure *alcohol-related problems*, we used the Alcohol Use Disorders Identification Test (AUDIT), a 10-item screening instrument developed by the World Health Organization (1992). The AUDIT assesses hazardous drinking, an established pattern of drinking that increases the likelihood of future physical and mental health problems (e.g., liver disease), and harmful drinking, a pattern of drinking that is already causing damage to health (e.g., alcohol-related injuries, depression). Responses were scored by using a Likert scale and then summed (range 0 to 40) such that a higher score indicated a greater likelihood of alcohol-related problems. In our analysis, we used the continuous AUDIT score ($M = 3.5$;

$SD = 4.8$). *Drug use problems* were measured by using a shortened version of the Drug Abuse Screening Test (DAST; Skinner, 1982). The DAST yields a quantitative index of drug problems, including dependence items and other consequences resulting from the abuse of psychoactive drugs (not including alcohol). We used four binary DAST items, with the response options yes (coded 1) or no (coded 0). The wording of the four items was as follows: (a) Are you always able to stop using drugs when you want to? (reverse coded); (b) Have you gone to anyone for help for a drug problem?; (c) Have you had “blackouts” or “flashbacks” due to your drug use?; (d) Have you had any medical problems as a result of your drug use? Responses were summed (range 0–4) such that a higher score indicates a greater likelihood of drug-related problems. As with the other measures, we used the continuous score for our analysis ($M = 0.15$; $SD = 0.46$).

Items Used as External Variables

In addition, 14 external variables were included to determine whether the clusters found in the analysis also predicted other differences in variables not directly related to any of the clusters. This validation determines whether the clusters we found were linked to meaningful differences amongst the groups. These external variables, z -standardized for plotting, pertained to demography, scholastic achievement, distress, mental health (self-esteem and depressive symptoms), and delinquent activity. *Demographic* measures included age (range 12–19); gender (males = 1, females = 0); non-intact family (living with a single parent or with neither natural parent = 1, else = 0); amount of money free to spend each week (more than \$50 = 1, less than \$50 = 0); and family’s socio-economic status (a composite index, incorporating self-reported family financial situation, the number of automobiles and personal computers owned by the family, and parental education, range 1–10). *Scholastic achievement* measures included poor grades (lower than an average letter grade of C = 1, C and higher = 0; note that a letter grade of C is typically equivalent to 60% to 70%) and low school attachment. School attachment was based on a summation score (range 0–8) from the level of agreement on two statements: “I feel close to people at this school” and “I feel like I am a part of this school.” Responses were summed such that a higher score indicates lower school attachment.

Our measure of *psychological distress* was based on the General Health Questionnaire (GHQ-12; Goldberg & Hillier, 1979), a 12-item screening instrument used to detect current psychological distress. Each item started with “Over the last few weeks” and then ended with questions such as “have you been able to concentrate on whatever you’re doing?”; “have you felt constantly under stress?” or “have you felt you couldn’t overcome difficulties?” Response categories were based on a 4-point scale ranging from “better (more so) than usual” to “much less than usual” (coded 0–3). Positive items (e.g., “Have you been able to enjoy your normal day-to-day activities?”) were negatively keyed. Responses were scored on a Likert scale and summed (range 0 to 36) so that higher scores indicated elevated psychological distress ($M = 10.5$; $SD = 5.8$). When we examined the factor structure of the 12-item questions, we found two eigenvalues greater than 1 (5.1 and 1.6). We extracted a two-factor solution that corresponded closely to Goldberg’s scales for depression (e.g., feeling unhappy and depressed, losing confidence, constantly stressed) and social dysfunction (e.g., capable of making decisions, playing a useful part, able to enjoy activities).

In the Results section below and in the accompanying tables, we report the GHQ total scale score and the two factor scores for depression and social dysfunction.

Self-esteem was measured with six items derived from Rosenberg's Self-Esteem Scale (Rosenberg, Schooler, & Schoenbach, 1989). The items were based on the following statements: (a) I feel good about myself; (b) I feel that I'm a person of worth; (c) I am able to do most things as well as other people can; (d) Sometimes I feel that I can't do anything right (reverse coded); (e) I feel I do not have much to be proud of (reverse coded); (f) Sometimes I think I am not good at all (reverse coded). The response options were based on a 5-point scale, ranging from *never true* to *almost always true*. The summated six-item scale resulted in values from 1 to 30 ($M = 23.9$; $SD = 4.7$). A higher score indicates higher self-esteem.

Depression was measured by using a shortened four-item version of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The following four CES-D items were asked: (a) How often have you felt sad? (b) How often have you felt lonely? (c) How often have you felt depressed? (d) How often have you felt like crying? The time frame was the "past 7 days." The response options were based on a 4-point scale, ranging from *never or rarely* (scored as 0) to *always* (scored as 3). The summated score resulted in values from 0 to 12 ($M = 2.4$; $SD = 2.7$). A higher score indicates greater likelihood of being depressed.

Delinquent activity included violent delinquency and theft. Violent delinquency (or violence) was scored 1 for each of the following items that were endorsed, for a total ranging from 0 to 4: (a) beat up, hurt anyone; (b) taken part in gang fights; (c) carried a weapon (e.g., gun or knife); and (d) taken part in physical fights at school. Theft was reported as a percentage of the sample who endorsed either one of two theft items: (a) number of times the student took things worth \$50 or less or (b) worth more than \$50.

Data Analysis

We used a two-stage procedure to determine the number of clusters. First, prior to the data analysis, the sample was randomly divided into an exploration sample and a cross-validation sample. In the first stage, the exploration sample ($n = 1,031$) was used to explore clusters. We used the SPSS method of hierarchical cluster analysis, using Ward's method between groups as the merging criterion and squared Euclidian distance as the similarity measure to form the initial cluster solution. In hierarchical clustering, clusters are formed by grouping cases into larger and larger clusters until all cases are members of a single cluster. Ward's method, which constructs clusters by minimizing within-cluster sums of squares, has been found to provide reasonable cluster solutions in empirical studies (Sharma, 1996). All 17 variables employed in the cluster analysis were first z-standardized to ensure equal weighting. We used two strategies to determine the number of clusters: first, we examined the Euclidean distance schedule for large increases in coefficients between agglomeration steps; second, we examined cluster profiles for meaningful cluster differences. Based on this analysis, three-, four-, and five-cluster solutions were selected for further tests.

Table 1

Mean absolute within-cluster distance from cluster centre for three-, four-, and five-cluster models in exploratory (n = 1,031) and confirmatory samples (n = 1,007)

Sample		3 Clusters	4 Clusters	5 Clusters
Exploratory (n = 1,031)	<i>M</i>	1.015 ^a	0.954 ^b	1.309 ^a
	<i>SD</i>	1.068	1.1	1.34
Confirmatory (n = 1,007)	<i>M</i>	1.030 ^a	0.886 ^b	1.050 ^a
	<i>SD</i>	1.046	1.062	1.406
Total (N = 2,038)	<i>M</i>	1.029 ^a	0.916 ^b	0.904 ^b
	<i>SD</i>	1.102	1.086	1.05

Note. The average within-cluster distance was computed by using the absolute difference of the observed distance of a score from the mean distance of the cluster. Significant differences within a row are indicated by different superscripts.

In the second stage, we used the cross-validation sample (N = 1,007) to confirm the cluster structure. We conducted the same analysis of three-, four-, and five-cluster solutions on the cross-validation sample. The goal was to select the largest number of distinct clusters that could be replicated across samples.

Results

Initial clustering with exploration sample

We evaluated three-, four-, and five-cluster solutions. The three-cluster solution did not separate heavy gamblers from moderate gamblers. The five-cluster solution included only four people in the fifth cluster, and core features of the fifth cluster did not replicate across samples. In addition, the first four clusters were easily interpretable (see Description of clusters section below), but the fifth cluster, which included only a small subgroup of people mostly taken from Cluster 4 in the four-cluster solution was not interpretable as a distinct group. The average within-cluster distances for the three-, four-, and five-solutions are displayed in Table 1.

Cross-validation Clustering

The three- and four-cluster solutions were replicated across the samples, but the fifth solution was not (details available from authors). The four-cluster solution yielded the largest number of clusters that were interpretable and were replicated across samples. Thus, we chose the four-cluster solution as the best fit to the data.

Final Cluster Derivation

Because the cluster solution appeared to be robust, producing similar results on the validation sample, we decided to recombine the two half samples and re-estimate the clustering

process again on the total sample as a double check on the validity of the four-cluster solution. Again, the four-cluster solution was the best fit to the data.

Having determined the number of clusters by using hierarchical methods, we then performed non-hierarchical methods (K-means). Using the cluster centroids derived from the hierarchical solution in the K-means method has the advantage of further refining the cluster solution (Sharma, 1996).

We then used one-way analysis of variance to compare the clusters on the variables used in the cluster solution (see Table 2) as well as the validation variables (see Table 3) not employed in the cluster analysis.

Description of Clusters

These groups were assigned names on the basis of their modal behaviour. These names are mainly a mnemonic device and not intended to oversimplify the differences or similarities between the groups or within groups (Slater et al., 1999). The solution revealed four clusters of differing size and behavioural configurations: (a) “Mainstreamers” ($N = 1,346$; 66.0%); (b) “Party Goers” ($N = 533$; 26.2%); (c) “Drug Takers” ($N = 121$; 5.9%); and (d) “Heavy Gamblers” ($N = 38$; 1.9%). In Table 2, we present data on the 17 variables employed in the cluster analysis. To understand better the character of the four clusters and to provide further evidence of meaningful cluster differences, we also present data for the 14 external variables not employed in the selection of the cluster solution (Table 3). Figures 1 and 2 illustrate the different profiles of the four groups across the cluster (Figure 1) and validation variables (Figure 2). These figures present the data in standard units (z -scores) so that the reader can assess effect size by simply reading the distance that separates two points on the figures. The rest of the Results section illustrates the profiles of the clusters across both cluster and external variables. Although one of the groups was defined as Heavy Gamblers, and another group was defined as Drug Takers, it should be noted that alcohol and drug use and gambling problems occurred in all four groups. As such, we will examine the drug and alcohol use and gambling problems in each of the four groups.

Mainstreamers. Mainstreamers accounted for about 66% of the sample. They were more likely to be female (56.9%), and were the youngest group, with an average age of 14.4 years. They had the lowest rate of alcohol, cigarette, and drug use; the lowest gambling frequency and lowest SOGS-RA score; and the highest self-esteem. They were less likely to have poor grades and low school attachment. They had the lowest delinquency and were the least depressed. None of the Mainstreamers had a drinking problem and only two scored 2 or more on the DAST, indicating a drug problem. Nearly a quarter (23.8%) of the Mainstreamers reported some psychological distress.

Party Goers. Party Goers accounted for about 26% of the sample. Over half were male (54.6%), and they were more likely to be older compared with Mainstreamers, but not significantly older than the other two groups. Compared with Mainstreamers, they had higher rates of alcohol, cigarette, and cannabis use and higher AUDIT scores. In addition, they reported gambling more frequently (mostly cards and lotteries) and spending

Table 2
Profile of variables employed in the cluster solution (raw score means and 95% CI)

Variable ^a	Clusters														
	Total sample N = 2,038			Mainstreamers n = 1,346			Party Goers n = 533			Drug Takers n = 121			Heavy Gamblers n = 38		
	M	95% CI	M	95% CI	M	95% CI	M	95% CI	M	95% CI	M	95% CI	M	95% CI	Significance ^b
SOGS-RA (range 0-12)	0.39	(±0.05)	0.20	(±0.04)	0.57	(±0.11)	0.94	(±0.33)	2.97	(±1.02)					4 > 3 > 2 > 1
Cards	1.61	(±0.29)	0.60	(±0.15)	2.76	(±0.84)	3.50	(±1.78)	15.1	(±6.41)					4 > (3 = 2) > 1
Bingo	0.63	(±0.16)	0.29	(±0.08)	0.62	(±0.17)	1.17	(±0.67)	11.1	(±6.94)					4 > 3 > 1; 4 > 2
Sports pools	1.13	(±0.22)	0.31	(±0.06)	1.30	(±0.25)	1.91	(±0.69)	25.2	(±7.60)					4 > (3 = 2) > 1
Sport lottery	1.08	(±0.25)	0.21	(±0.08)	1.04	(±0.33)	1.91	(±0.78)	30.0	(±7.33)					4 > (3 = 2) > 1
Any lottery	2.00	(±0.31)	0.77	(±0.215)	2.90	(±0.61)	4.69	(±1.80)	24.5	(±8.92)					4 > 3 > 2 > 1
Video/Slots	0.63	(±0.22)	0.13	(±0.06)	0.77	(±0.29)	0.92	(±0.45)	15.5	(±10.00)					4 > (3 = 2) > 1
Casino (in Ontario)	0.12	(±0.06)	0.01	(±0.01)	0.21	(±0.16)	0.21	(±0.20)	2.63	(±2.43)					4 > (3 = 2) > 1
Money spent gambling	1.20	(±0.07)	0.75	(±0.06)	1.87	(±0.14)	2.31	(±0.33)	4.00	(±0.56)					4 > 3 > 2 > 1
Alcohol	1.86	(±0.08)	0.82	(±0.06)	3.78	(±0.11)	4.57	(±0.29)	3.26	(±0.69)					3 > (4 = 2) > 1
Cigarettes/day	0.99	(±0.08)	0.24	(±0.04)	2.18	(±0.18)	4.01	(±0.43)	1.21	(±0.57)					3 > 2 > 4 > 1
Cannabis	0.89	(±0.08)	0.10	(±0.02)	1.95	(±0.17)	4.91	(±0.29)	1.26	(±0.63)					3 > 2 > 4 > 1
Depressants	0.07	(±0.01)	0.01	(±0.01)	0.07	(±0.02)	0.64	(±0.15)	0.24	(±0.19)					3 > 4 > 2 > 1
Stimulants	0.16	(±0.02)	0.03	(±0.01)	0.12	(±0.03)	1.64	(±0.20)	0.37	(±0.22)					3 > 4 > 2 > 1
Hallucinogens	0.22	(±0.03)	0.02	(±0.01)	0.26	(±0.05)	2.22	(±0.20)	0.42	(±0.33)					3 > (4 = 2) > 1
AUDIT (range 0-40)	3.47	(±0.22)	0.99	(±0.08)	7.63	(±0.40)	11.36	(±0.94)	7.89	(±2.55)					3 > (4 = 2) > 1
DAST (range 0-4)	0.15	(±0.02)	0.03	(±0.01)	0.19	(±0.03)	1.19	(±0.17)	0.47	(±0.29)					3 > 4 > 2 > 1

Note. M = mean; CI = confidence interval; DAST = Drug Abuse Screening Test; AUDIT = Alcohol Use Disorders Identification Test; SOGS-RA = South Oaks Gambling Screen Revised for Adolescents.

^bThe significance column indicates which means differed at the .05 level after Bonferroni adjustment. Numbers indicate cluster membership: 1 = Mainstreamers, 2 = Party Goers, 3 = Drug Takers, and 4 = Heavy Gamblers.

^aCards, bingo: average number of times played; sport lottery, any lottery: average number of times bought; sports pools, video/slots, casino: average number of times bet; alcohol, cannabis: average frequency of use; cigarettes: average number of cigarettes smoked daily; depressants: count of all depressants used; stimulants: count of all stimulants used; hallucinogens: count of all hallucinogens used.

Table 3
Profile of external variables (raw score means or percentages, and 95% CI)

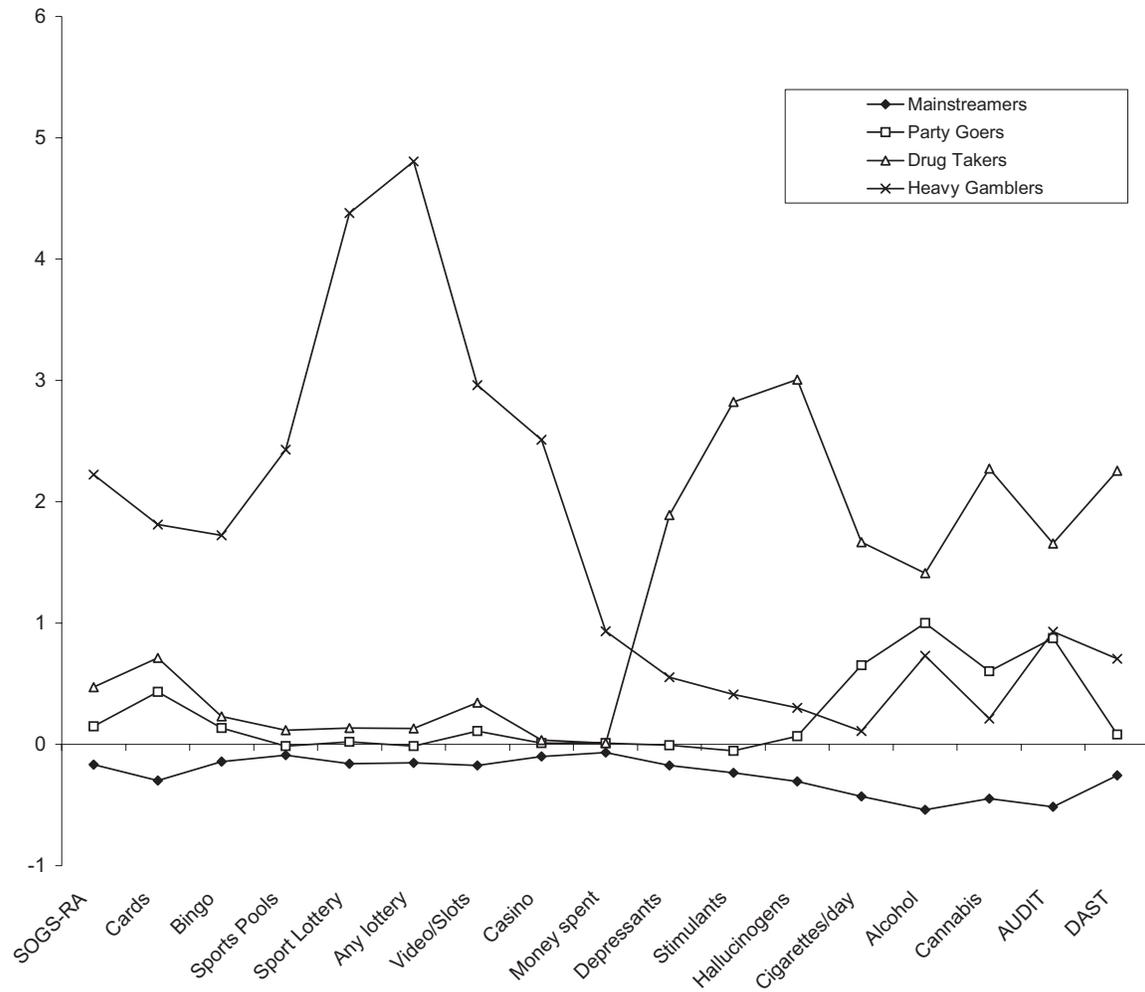
Variable	Clusters												Significance ^a		
	Total sample N = 2,038		Mainstreamers n = 1,346		Party Goers n = 533		Drug Takers n = 121		Heavy Gamblers n = 38						
	M	or%	95% CI	M	or%	95% CI	M	or%	95% CI	M	or%	95% CI	M	or%	95% CI
Age (range 12–19 years)	14.93		(±0.08)	14.36		(±0.10)	16.07		(±0.14)	15.91		(±0.26)	15.78		(±0.65)
% Male	48%		(±2%)	43%		(±3%)	55%		(±4%)	59%		(±9%)	92%		(±9%)
GHQ-12 (range 0–36)	10.51		(±0.25)	9.76		(±0.29)	11.81		(±0.53)	12.34		(±1.08)	12.95		(±2.63)
GHQ – Depression ^b	0.03		(±0.04)	-0.09		(±0.05)	0.22		(±0.09)	0.47		(±0.20)	0.18		(±0.33)
GHQ – Social Dysfunction ^b	-0.01		(±0.04)	-0.05		(±0.05)	0.08		(±0.08)	-0.13		(±0.20)	0.53		(±0.52)
Depression (CES-D; range 0–4)	2.40		(±0.12)	2.21		(±0.14)	2.69		(±0.24)	3.13		(±0.51)	2.92		(±1.08)
Self-esteem	23.77		(±0.22)	24.09		(±0.25)	23.45		(±0.39)	22.17		(±0.84)	21.97		(±2.04)
SES	6.75		(±0.07)	6.74		(±0.09)	6.80		(±0.13)	6.53		(±0.29)	7.13		(±0.47)
Money free to spend (% able to spend \$50/week)	22%		(±2%)	15%		(±2%)	33%		(±4%)	35%		(±9%)	47%		(±15%)
% Non-intact family	24%		(±2%)	22%		(±2%)	25%		(±4%)	41%		(±9%)	34%		(±15%)
% Poor grades (<C)	16%		(±2%)	11%		(±2%)	20%		(±3%)	38%		(±9%)	37%		(±16%)
Low school attachment	3.44		(±0.05)	3.36		(±0.07)	3.51		(±0.11)	3.83		(±0.24)	3.73		(±0.59)
Theft (%)	14%		(±2%)	7%		(±1%)	22%		(±3%)	45%		(±9%)	29%		(±15%)
Violent delinquency (range 0–4)	0.42		(±0.04)	0.25		(±0.03)	0.57		(±0.08)	1.40		(±0.24)	1.03		(±0.39)

Note. M = mean; CI = confidence interval; GHQ = General Health Questionnaire; CES-D = Center for Epidemiological Studies Depression Scale; SES = Rosenberg's Self-Esteem Scale.

^aThe significance column indicates which groups differ significantly at the .05 level after Bonferroni adjustment. Numbers indicate cluster membership: 1 = Mainstreamers, 2 = Party Goers, 3 = Drug Takers, and 4 = Heavy Gamblers.

^bThe scores for the GHQ depression and GHD social dysfunction are standardized factor scores.

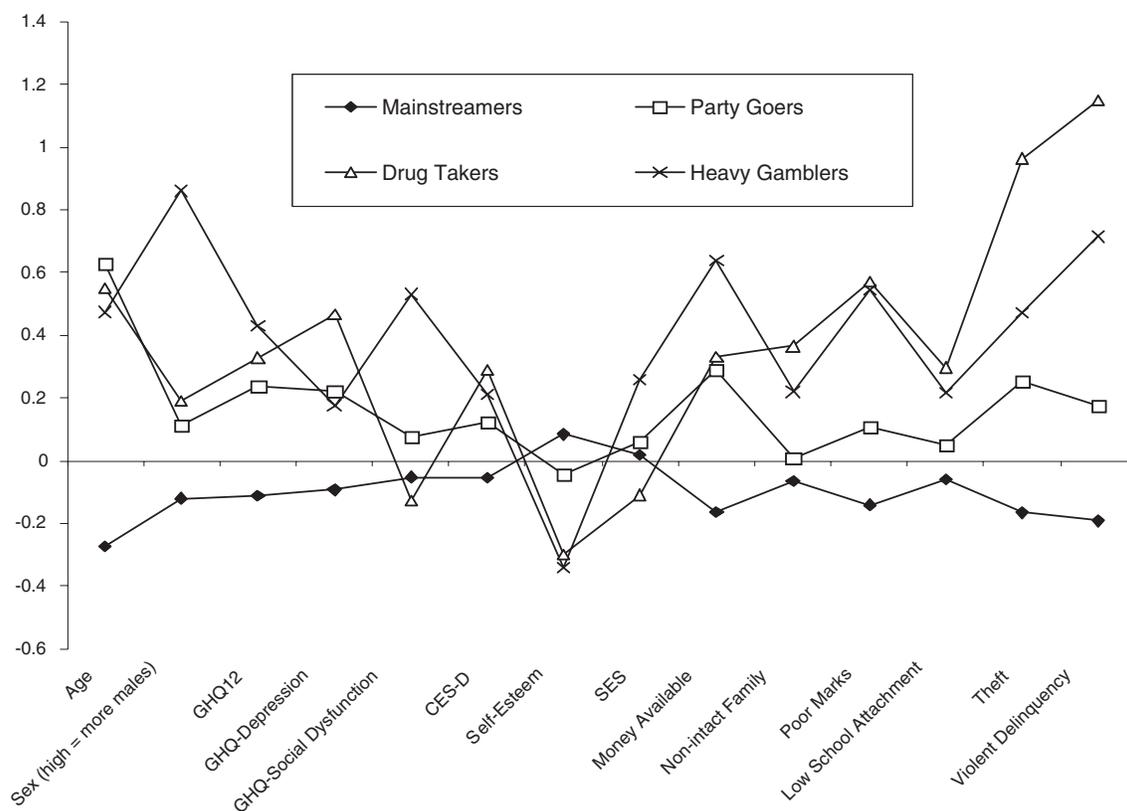
Figure 1. Final four-cluster typology based on the total sample (N = 2,032): z-scores of cluster variables. DAST = Drug Abuse Screening Test; AUDIT = Alcohol Use Disorders Identification Test; SOGS-RA = South Oaks Gambling Screen Revised for Adolescents.



more money on gambling and had a higher SOGS-RA score, poorer grades, lower self-esteem, higher psychological distress, and higher delinquency. However, compared with Drug Takers, they reported lower rates of substance use; had lower AUDIT and lower DAST scores; and were less likely to come from a non-intact family, to have poor grades, and to be involved in delinquent activities. Compared with Heavy Gamblers, Party Goers gambled significantly less.

Drug Takers. Drug Takers accounted for about 6% of the sample. Slightly more than half (59%) were male. They had the highest rates of alcohol, cigarette, cannabis, and other drug use and the highest AUDIT and DAST scores. Compared with Party Goers, Drug Takers gambled more frequently (but this reaches significance only for lotteries and money spent) and had a higher SOGS-RA score. However, compared with Heavy Gamblers they

Figure 2. Final four-cluster typology based on the total sample ($N = 2,032$): z -scores of external variables. GHQ = General Health Questionnaire; CES-D = Center for Epidemiological Studies Depression Scale; SES = Rosenberg's Self-Esteem Scale.



gambled less frequently, spent less money on gambling, and scored lower on the SOGS-RA. They had the highest delinquency and, compared with Party Goers and Mainstreamers, they were more likely to be from a non-intact home and to report lower grades. Almost half (47.9%) of the Drug Takers reported psychological distress as measured by a GHQ-12 score of 3 or more. Interestingly, when we separated the GHQ according to its two factors, we found that Drug Takers scored high on depression, but very low on social dysfunction.

Heavy Gamblers. Heavy Gamblers accounted for about 2% of the sample. They had the highest proportion of males (92%); the highest gambling frequency, especially on sports and lotteries; the highest SOGS-RA score; and the most money to spend freely. In terms of substance use, they reported smoking fewer cigarettes and having lower cannabis use than Party Goers and having lower substance use and lower rates of theft than Drug Takers. However, no difference was found between Heavy Gamblers and Party Goers in terms of alcohol consumption and abuse. Heavy gamblers had the lowest self-esteem compared with other groups. However, this group scored no higher on the GHQ depression scale than the Party Goers, but scored very high on the GHQ social dysfunction scale. This cluster was defined mainly in terms of frequency of gambling, but this group also includes a substantial

Table 4
A breakdown of the number of adolescents with drug, alcohol, and gambling problems by cluster

Group	DAST 2+		AUDIT 8+		SOGS-RA 4+	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Mainstreamers (<i>n</i> = 1,346)	2	0.1	7	0.5	11	0.8
Party Goers (<i>n</i> = 533)	8	1.5	228	42.8	25	4.7
Drug Takers (<i>n</i> = 121)	45	37.2	93	76.9	13	10.7
Heavy Gamblers (<i>n</i> = 38)	5	13.2	14	36.8	13	34.2
Entire sample	60	2.9	342	16.8	62	3.0

Note. DAST = Drug Abuse Screening Test; AUDIT = Alcohol Use Disorders Identification Test; SOGS-RA = South Oaks Gambling Screen Revised for Adolescents.

number of students who score above the criterion on the SOGS-RA for probable pathological gambling (34.2%). A further 23.7% report subclinical problem scores (SOGS-RA of 2 or 3).

Breakdown of Problem Gambling, Drug Use, and Alcohol Abuse Across the Four Groups

In the Introduction, we posed the question of whether or not adolescent probable pathological gamblers, problem drinkers, and substance abusers are all part of the same basic deviant group or if they form a number of subtypes. In this section, the clusters are examined to determine how the different groups are related to these problem behaviours. Recommended cut-off scores (e.g., Paglia-Boak, Mann, Adlaf, & Rehm, 2009) were used for the DAST (2 or more), AUDIT (8 or more), and SOGS-RA (4 or more). As shown in Table 4, very few Mainstreamers scored in the problem range of any of the problem measures. Nearly half (42.8%) of the Party Goers group reported some hazardous drinking, but only 4.7% reported gambling problems and 1.5% reported drug problems. Over a third of the group we call Drug Takers reported drug use problems, 76.9% reported hazardous drinking, and 10.7% reported gambling problems. Finally, for the Heavy Gamblers, over a third (34.2%) reported gambling problems and hazardous drinking (36.8%), and 13.2% reported drug-related problems. Clearly, these groups differ substantially in the proportion of students who have problems with substances and gambling.

Although we have labelled Cluster 4 as “Heavy Gamblers” on the basis of their gambling behaviour, probable pathological gamblers in fact appear in all four clusters. In total, 62 adolescents reached the criteria for problem gambling as identified in this study. Several probable pathological gamblers were members of the Heavy Gamblers, but some probable pathological gamblers were also members of the Drug Takers and the Party Goers, and a small number were even in the Mainstreamers. Less than 1% of the Mainstreamers scored in the range for probable pathological gamblers (SOGS-RA ≥ 4); however, there were 11

probable pathological gamblers in the Mainstreamers group, and they make up 18% of the probable pathological gamblers that were identified in the study. Bearing in mind that the Mainstreamers make up a majority of the sample (66.1%), when we examined subclinical cases (SOGS-RA = 2 or 3), nearly half of them (49.5%) were Mainstreamers.

Discussion

These results revealed several interesting findings about the nature and distribution of substance use and problem gambling among a non-clinical community-derived sample of youths. First, we found and replicated a four-cluster solution. Second, these clusters were different on several validation variables in addition to their differences on the cluster variables. Of particular interest is that Drug Takers and Heavy Gamblers formed two separate clusters that not only differed in terms of addiction, but also in terms of social dysfunction and depression. These results suggest that adolescent probable pathological gamblers, problem drinkers, and substance abusers are not all part of a single group but form a number of subpopulations.

It could be argued that these groups really only differ in terms of delinquency, with Mainstreamers at one extreme and Drug Takers at the other extreme. Indeed, for both violent delinquency and theft, the Drug Takers had the highest scores and the Mainstreamers the lowest, with Heavy Gamblers and Party Goers falling in-between. However, on the measure of social dysfunction, Heavy Gamblers scored higher than any of the other three groups. In addition, Party Goers scored significantly higher than the Heavy Gamblers on cigarette smoking and cannabis use.

A cluster analysis is an exploratory method that does not always divide people into groups that are perfectly clear. In the current study, some problematic behaviours occurred in all of the groups. Even amongst Mainstreamers, we found a small number of people who apparently have a drug problem, engage in hazardous drinking, or gamble problematically. Although probable pathological gamblers were concentrated in the Heavy Gambling cluster, some probable pathological gamblers were found in all four clusters. A small number of probable pathological gamblers were Mainstreamers. This finding suggests that probable pathological gamblers are not a single unified group.

The group of students who were most strongly defined by their gambling behaviour also reported having the most money to spend freely, had the lowest self-esteem, and scored highest on the social dysfunction scale. These findings have important implications for parenting and prevention. In particular, parents need to be aware of the amount of money their adolescent children have available to spend.

Turning now to the broader context, today's youth are amongst the first to be exposed to ready access to gambling opportunities (Gupta & Derevensky, 1998a; Hardoon & Derevensky, 2002; Jacques, Ladouceur, & Ferland, 2000). They are inundated with advertisements that encourage their interest in gambling by the promise of wealth, success, status, and excitement. Not surprisingly, a large number of youth engage in some form of gambling and some even score in the problem range on the SOGS-RA. Previous studies have shown

strong correlations between gambling, alcohol, and drug problems (Barnes et al., 2005; Derevensky & Gupta, 2000; Gupta & Derevensky, 1998a; Hardoon & Derevensky, 2002; Welte et al., 2004). The current study replicated these previous findings, and in addition revealed that troubled youth do not form a single unitary group, but are made up of different subgroups. Although gambling and alcohol and drug use overlap, there were significant differences between each of the groups identified that suggest that the behaviours examined do not vary as a simple linear function of delinquency.

In order to develop effective prevention and treatment strategies, we first need to understand the nature of problem gambling amongst these youths. Co-morbidity of drug and alcohol use was high amongst probable pathological gamblers, but nearly 18% of the probable pathological gamblers and 49.5% of the subclinical probable pathological gamblers were in fact Mainstreamers. Our findings suggest that messages targeted at identified high-risk groups (e.g., Drug Takers) would, in fact, miss a large percentage of subclinical problem gamblers.

Characteristics of the Heavy Gambler and Drug-Taker clusters are consistent with the general addiction model (Gupta & Derevensky, 1998b; Jacobs, 1986) in that we found evidence in support of a fairly high co-morbidity between problem gambling and drug and alcohol use. Furthermore, Heavy Gamblers report high levels of psychological distress (social dysfunction). Both Drug Takers and Heavy Gamblers scored low on self-esteem and high on depression and delinquency. Also consistent with the general theory of addiction, Drug Takers report high levels of depression, low school attachment, and poor grades.

The data are also somewhat consistent with Blaszczynski and Nower's (2002) pathways model. According to their model, some pathological gamblers are otherwise normal, some are emotionally vulnerable, and others are impulsive. In our study, we found some probable pathological gamblers in all four clusters. Drug Takers appear to be the most distressed group, and roughly 10% of this group scored as probable pathological gamblers. The Mainstreamers had strong school attachment, high grades, and in general did not consume alcohol or drugs. This group was the least depressed of the groups and had the highest self-esteem. Very few Mainstreamers reported having drug or alcohol problems or gambling problems; nonetheless, 11 Mainstreamers (0.8%) had high scores on the SOGS-RA. The pathological gamblers in the Mainstreamers group appear to be consistent with Blaszczynski's (2000) "otherwise normal" problem gambler. Furthermore, although only 18% of the pathological gamblers identified in the study were in the Mainstreamers group, half of the subclinical problem cases found in the sample were Mainstreamers. This is consistent with the idea that people who are otherwise normal except for gambling problems have relatively mild cases of problem gambling (see also Turner, Littman-Sharp, & Zangeneh, 2006). However, more study is needed to help understand why some probable pathological gamblers were placed in the Mainstreamers group.

There are limitations to this study. The data were based on an anonymous survey of students in a classroom setting using self-report measures. The study has the advantage of being a probability sample of students in the school system, but it is possible that so-called troubled youth or high-risk youth may be less likely to be in attendance on the day that

the questionnaire was administered. Another important limitation is that cluster analysis is inherently exploratory in nature. As such, there is always the possibility that the method produced sample specific clusters that will not generalize. This possibility was controlled by randomly dividing the sample into initial exploratory and confirmatory half samples. Nonetheless, the results may still not generalize to other samples.

In conclusion, in this paper we set out to determine whether youths that engage in deviant acts such as gambling, drug use, alcohol consumption, and crime were all members of a single deviant group or whether they belonged to different subpopulations. We found that although drug use, gambling, and alcohol use are correlated, clusters can be defined that separate groups of adolescents into those who consume only alcohol (Party Goers), those who consume both drugs and alcohol (Drug Takers), and those who gamble extensively (Heavy Gamblers). The Drug Takers appear to be a particularly troubled group of adolescents. In addition to their reported use of alcohol and drugs, they scored high on depression, violent delinquency, and theft and low on self-esteem and school attachment. The Heavy Gamblers were similar to the Drug Takers on most variables, but scored substantially higher than all other groups on social dysfunction. Although gambling, alcohol, and drug use overlap, there were significant differences between each of the groups identified, which suggests that the people who are at high risk for one problem (e.g., drugs) are not necessarily those at high risk for another (e.g., gambling). Cluster analysis is inherently exploratory in nature and thus more research is needed to determine whether these group differences generalize to other samples.

References

- Adlaf, E.M., & Ialomiteanu, A. (2000). Prevalence of problem gambling in adolescents: Findings from the 1999 Ontario Student Drug Use Survey. *Canadian Journal of Psychiatry, 45*, 752–755.
- Adlaf, E.M., & Paglia, A. (2001). *Drug use among Ontario students 1977–2001: Findings from the OSDUS* (CAMH Research Document Series No. 10). Toronto, ON: Centre for Addiction and Mental Health.
- Barnes, G.M., Welte, J.W., Hoffman, J.H., & Dintcheff, B.A. (2005). Shared predictors of youthful gambling, substance use, and delinquency. *Psychology of Addictive Behaviors, 19*, 165–174.
- Beitchman, J.H., Adlaf, E.M., Douglas, L., Atkinson, L., Young, A., Johnson, C.J., Escobar, M., & Wilson, B. (2001). Comorbidity of psychiatric and substance use disorders in late adolescence: A cluster analytic approach. *American Journal of Drug and Alcohol Abuse, 27*, 421–440.
- Blaszczynski, A. (2000). Pathways to pathological gambling: Identifying topologies. *Journal of Gambling Issues, 1*.

- Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction, 97*, 487–499.
- Derevensky, J.L., & Gupta, R. (2000). Youth gambling: A clinical and research perspective. *Journal of Gambling Issues, 2*, 1–11.
- Goldberg, D.P., & Hillier, V.F. (1979). A scaled version of the General Health Questionnaire. *Psychological Medicine, 9*, 139–145.
- Griffiths, M. (1995). *Adolescent gambling*. London, England: Routledge.
- Gupta, R., & Derevensky, J.L. (1998a). Adolescent gambling behavior: A prevalence study and examination of the correlates associated with problem gambling. *Journal of Gambling Studies, 14*, 319–345.
- Gupta, R., & Derevensky, J.L. (1998b). An empirical examination of Jacobs' general theory of addictions: Do adolescent gamblers fit the theory? *Journal of Gambling Studies, 14*, 17–49.
- Hardoon, K.K., & Derevensky, J.L. (2002). Child and adolescent gambling behavior: Current knowledge. *Clinical Child Psychology and Psychiatry, 7*(2), 263–281.
- Jacobs, D.F. (1986). A General Theory of Addictions: A new theoretical model. *Journal of Gambling Behavior, 4*, 27–37.
- Jacques, C., Ladouceur, R., & Ferland, F. (2000). Impact of availability on gambling: A longitudinal study. *Canadian Journal of Psychiatry, 45*(9 (Nov)), 810–815.
- Kaminer, V., & Petry, N.M. (1999). Gambling behavior in youths: Why we should be concerned. *Psychiatric Services, 50*, 167–168.
- Korn, D.A. (2000). Expansion of gambling in Canada: Implications for health and social policy. *Canadian Medical Association Journal, 163*, 61–64.
- Ladouceur, R. (1996). The prevalence of pathological gambling in Canada. *Journal of Gambling Studies, 12*, 129–142.
- Ladouceur, R., Bouchard, C., Rheume, N., Jacques, C., Ferland, F., Leblond, J., & Walker, M. (2000). Is the SOGS an accurate measure of pathological gambling among children, adolescents and adults? *Journal of Gambling Studies, 16*, 1–24.
- Ladouceur, R., Jacques, C., Ferland, F., & Giroux, I. (1999). Prevalence of problem gambling: A replication study 7 years later. *Canadian Journal of Psychiatry, 44*, 802–804.
- Paglia-Boak, A., Mann, R.E., Adlaf, E.M., & Rehm, J. (2009). *Drug use among Ontario students 1977–2009: Detailed OSDUHS findings* (CAMH Research Document Series No.

- 27). Toronto, ON: Centre for Addiction and Mental Health. Retrieved from www.camh.net/Research/Areas_of_research/Population_Life_Course_Studies/OSDUS/Detailed_DrugReport_2009OSDUHS_Final_Web.pdf
- Radloff, L.S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385–401.
- Room, R., Turner, N., & Ialomiteanu, A. (1999). Community effects of the opening of the Niagara casino. *Addiction, 94*, 1449–1466.
- Rosenberg, M., Schooler, C., & Schoenbach, C. (1989). Self-esteem and adolescent problems: Modeling reciprocal effects. *American Sociological Review, 54*, 1004–1018.
- Shaffer, H.J., & Hall, M.N. (1996). Estimating the prevalence of adolescent gambling disorders: A quantitative synthesis and guide toward standard gambling nomenclature. *Journal of Gambling Studies, 12*, 193–214.
- Shaffer, H.J., & Hall, M.N. (2001). Updating and refining prevalence estimates of disordered gambling behavior in the United States and Canada. *Canadian Journal of Public Health, 92*, 168–172.
- Shaffer, H.J., Hall, M.N., & Vander Bilt, J. (1999). Estimating the prevalence of disordered gambling behavior in the United States and Canada: A research synthesis. *American Journal of Public Health, 89*, 1369–1376.
- Sharma, S. (1996). *Applied multivariate techniques*. New York, NY: Wiley.
- Skinner, H.A. (1982). The Drug Abuse Screening Test. *Addictive Behaviors, 7*, 363–371.
- Slater, M.D., Basil, M.D., & Maibach, E.W. (1999). A cluster analysis of alcohol-related attitudes and behaviors in the general population. *Journal of Studies on Alcohol, 60*, 667–674.
- Turner, N., Littman-Sharp, N., & Zangeneh, M. (2006). The experience of gambling and its role in problem gambling. *International Gambling Studies, 6*, 237–266.
- Vitaro, F., Wanner, B., Ladouceur, R., Brendgen, M., & Tremblay, R.E. (2004). Trajectories of gambling during adolescence. *Journal of Gambling Studies, 20*, 47–69.
- Welte, J.W., Barnes, G.M., Tidwell, M.O., & Hoffman, J.H. (2008). The prevalence of problem gambling among U.S. adolescents and young adults: Results from a national survey. *Journal of Gambling Studies, 24*, 119–133.
- Welte, J.W., Barnes, G.M., Wieczorek, W.F., Tidwell, M.O., & Parker, J.C. (2004). Risk factors for pathological gambling. *Addictive Behaviors, 29*, 323–335.

Winters, K.C., Stinchfield, R.D., & Fulkerson, J. (1993). Toward the development of an adolescent gambling problem severity scale. *Journal of Gambling Studies*, 9, 63–84.

World Health Organization. (1992). The ICD-10 classification of mental and behavioural disorders: Clinical descriptions and diagnostic guidelines. Geneva, Switzerland: Author.

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