

An Examination of the Relationship Between Gambling and Antisocial Behavior

Sandeep Mishra · Martin L. Lalumière · Michael Morgan · Robert J. Williams

Published online: 22 September 2010
© Springer Science+Business Media, LLC 2010

Abstract Problem gambling is significantly more prevalent in forensic populations than in the general population. Although some previous work suggests that gambling and antisocial behavior are related, the extent and nature of this relationship is unclear. Both gambling and antisocial behavior are forms of risk-taking, and may therefore share common determinants. We investigated whether individual differences in personality traits associated with risk-taking, the Big Five personality traits, and antisocial tendencies predicted gambling and antisocial behavior among 180 male students recruited for a study of gambling (35.0% non-problem gamblers, 36.7% low-risk gamblers, 21.7% problem gamblers, and 6.7% pathological gamblers). All forms of gambling and antisocial behavior were significantly correlated. Personality traits associated with risk-acceptance explained a significant portion of the variance in problem gambling, general gambling involvement, and all forms of antisocial behavior. Antisocial tendencies (aggression and psychopathic tendencies) explained a significant portion of additional variance in severe antisocial behavior but not moderate or minor antisocial behavior. When controlling for personality traits associated with risk-acceptance, the relationship between gambling and antisocial behavior was greatly diminished. The results are consistent with the hypothesis that gambling and antisocial behavior are associated because they are, in part, different manifestations of similar personality traits.

Keywords Gambling · Antisocial behavior · Risk-taking · Personality · Antisocial tendencies · Delinquency

S. Mishra (✉) · M. L. Lalumière · M. Morgan
Department of Psychology, University of Lethbridge, 4401 University Drive West, Lethbridge,
AB T1K 3M4, Canada
e-mail: mishrs@gmail.com

R. J. Williams
Faculty of Health Sciences, University of Lethbridge, 4401 University Drive West, Lethbridge,
AB T1K 3M4, Canada

Criminal offenders tend to engage in problem gambling—a pattern of gambling behavior leading to negative consequences for an individual or others in his or her immediate social group—at a significantly higher rate than the general population (Ferris et al. 1999; Williams et al. 2005). A review of 27 studies based in several different countries demonstrated that over 30% of prison inmates were diagnosed as problem gamblers, the highest prevalence rate yet found in any population (Williams et al. 2005). Turner et al. (2007) found a similar problem gambling prevalence rate in a sample of Canadian federal offenders. In contrast, in the general population, estimates of problem gambling prevalence have ranged from 1 to 4% (Shaffer and Hall 2001; Shaffer et al. 1997; Walker and Dickerson 1996).

Problem gamblers also report frequent participation in criminal activity. Blaszczynski et al. (1997) found that 58% of a sample of problem gamblers had committed a gambling-related offense, and 21% had committed criminal offenses unrelated to gambling. Meyer and Fabian (2005) showed that 55% of a sample of members of Gamblers Anonymous engaged in criminal activities in order to obtain money for gambling. Although there appears to be a significant relationship between gambling and criminal behavior, the reasons for this relationship are unclear. One possibility is that gamblers engage in crime to support gambling habits. Some studies have found that criminal behavior sometimes directly funds gambling (Blaszczynski et al. 1997; Turner et al. 2007; Williams et al. 2005), including among youth (Yeoman and Griffiths 1996). The severity of gambling problems is also significantly associated with the number of income producing offenses reported (Turner et al. 2007). There is, however, another possible explanation for the common co-occurrence of gambling and antisocial behavior. Several theories suggest that various forms of risk-taking, including gambling and antisocial behavior, are linked because they share common determinants. In the following, we summarize evidence for the generality of risk-taking, and describe some individual differences that may be determinants of general risk-taking behavior.

The Generality of Risk

Gottfredson and Hirschi (1990) argued that individuals who exhibit low self-control—a preference for immediate rewards at the cost of possible long-term negative consequences—tend to engage in a variety of risk-taking behaviors. They further suggested that low self-control gives rise to what they called the “generality of deviance”, where low self-control combined with opportunity accounts for most, if not all, risky and criminal behavior (Hirschi and Gottfredson 1994). Jessor’s (1991) problem-behavior theory suggests that a balance of instigations (e.g., peer modeling) and controls (e.g., parental monitoring) determine the degree to which individuals engage in a “syndrome” of problem behaviors including substance use, delinquent behaviors, risky driving, and early sexual intercourse. Daly and Wilson (2001) suggest that risky behaviors are the product of “rational” decision-making processes designed to solve adaptive problems that arise in certain situations or environments.

These theories are supported by a large body of evidence suggesting that various forms of risky behavior, including substance use, dangerous driving, early sexual intercourse, and antisocial behavior tend to co-occur within individuals (e.g., Bartusch et al. 1997; Donovan and Jessor 1985; Hirschi and Gottfredson 1994; LeBlanc and Girard 1997, Osgood et al. 1988). Both problem and non-problem gambling have also been associated with risky behavior among both youths and adults (e.g., Kassinove 1998; Martins et al. 2004; Powell

et al. 1999). Vitaro et al. (2001) demonstrated that antisocial behavior and gambling share similar precursors, and suggested that gambling forms part of a general problem behavior syndrome. The hypothesis that gambling is part of a general pattern of risk-accepting behavior has been discussed and supported in several studies conducted among both youth and adults (Barnes et al. 1999, 2005; Mishra et al. 2010; Petry 2005; Stinchfield 2004; Winters et al. 2002). Together, these findings suggest that gambling and antisocial behaviors are both part of a general phenomenon of risk-acceptance. If different forms of risky behavior are outcomes of similar risk-related tendencies, gambling and antisocial behavior should co-occur within individuals and share the same common determinants as other forms of risky behavior.

Individual Differences, Antisocial Behavior, and Gambling

Personality

Individual differences in personality may underlie various forms of risk-taking. Personality traits such as impulsivity, sensation-seeking, and low self-control have been significantly correlated with antisocial behavior (reviewed in Quinsey et al. 2004; Zuckerman 2007) and both problem and non-problem gambling (e.g., Blaszczyński et al. 1997; Blaszczyński et al. 1986; Langewisch and Frisch 1998; McDaniel and Zuckerman 2003; Mishra et al. 2010; Skitch and Hodgins 2004; reviewed in Toneatto and Nguyen 2007). Several dimensions of the Big Five personality traits (which consist of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism; Costa and McRae 1992) have also been associated with risk-taking: High scores on neuroticism, and low scores on agreeableness and conscientiousness have been associated with elevated gambling behavior, severity of gambling, and self-reported antisocial behavior (Bagby et al. 2007; Heaven 1996; Myrseth et al. 2009). It is therefore possible that these personality traits may explain some portion of the relationship between antisocial behavior and gambling behavior.

Antisocial Tendencies

Individual differences in antisocial tendencies may also play an important role in the facilitation of some forms of risk-taking. Jones and Quisenberry (2004) distinguished between antisocial and prosocial risk-taking behaviors, suggesting that these different forms of risk-taking may have different etiologies. Minor forms of antisocial behavior—for example, getting drunk, making prank telephone calls, and truancy—represent normative forms of risk-taking in adolescence and early adulthood (Moffitt 1993; Quinsey et al. 2004). Severe antisocial behavior, however, is typified by behaviors that indicate a lack of concern for others' well-being (e.g., sexual coercion), destruction of others' property (e.g., vandalism), and other breaking of social norms (e.g., breaking and entering). Antisocial tendencies, such as psychopathic traits, may therefore differentiate between those who engage in severe antisocial behavior from those who engage in less severe forms of antisocial behavior.

Antisocial tendencies may similarly distinguish between problem and non-problem gamblers. It has been suggested that antisocial tendencies may develop among problem gamblers as a result of having to deal with the consequences of their addiction (Blaszczyński and McConaghy 1994). This hypothesis is supported by studies

demonstrating that criminal activities sometimes seem to directly support gambling habits (Blaszczynski et al. 1997; Turner et al. 2007; Williams et al. 2005). High rates of antisocial activities have been associated with both problem gambling (Hardoon and Derevensky 2002; Vitaro et al. 1996) and general gambling involvement (Barnes et al. 1999, 2005), however, suggesting that antisocial tendencies may be relevant to less severe general gambling involvement, in addition to being an outcome of problem gambling.

It has been hypothesized that there exists an impulsive/antisocial subtype of problem gamblers (Blaszczynski and Nower 2002; Blaszczynski et al. 1997; Williams et al. 2008). Slutske et al. (2001) suggest that antisocial behavior and problem gambling may co-occur within individuals because of common genetic vulnerability. Furthermore, antisocial personality disorder—a “pervasive pattern of disregard for, and violation of, the rights of others that begins in childhood or early adolescence and continues into adulthood” (American Psychological Association, 1994, p. 645)—appears to be more common among pathological gamblers (e.g., Blaszczynski et al. 1997; Blaszczynski and McConaghy 1994; Blaszczynski et al. 1989; Pietrzak and Petry 2005). Together, these results suggest that antisocial tendencies are associated with gambling behavior.

Overview

Previous research has shown that gambling and antisocial behavior are related, but has not addressed whether common personality traits underlie this relationship. Furthermore, antisocial tendencies have not been studied in the context of the relationship between gambling and antisocial behavior. Therefore, in this study, we investigated whether personality traits and antisocial tendencies could explain the association between gambling and antisocial behavior. We hypothesized that (1) personality traits associated with risk-acceptance would effectively predict both antisocial behavior and gambling, (2) antisocial tendencies would predict engagement in severe antisocial behavior and general gambling involvement, but not minor antisocial behavior, (3) antisocial behavior would be significantly associated with both problem gambling and general gambling involvement within individuals, and (4) personality traits associated with general risk-acceptance would in part explain the association between antisocial behavior and gambling.

Method

Participants

To investigate the relationship between gambling and antisocial behavior, it is necessary to investigate a population that exhibits substantial variation in both behaviors. Outside of forensic populations, young males exhibit some of the highest rates of antisocial behavior and gambling. Therefore, we recruited 180 male student volunteers (age: $M = 21.6$, $SD = 4.4$, $Range = 18–56$) from a university campus using advertisements specifying a study on gambling. Problem gamblers were not explicitly targeted, but it was expected that individuals recruited would exhibit a full range of gambling habits (from none to recreational to problematic). Male volunteers were chosen because they show more variability in gambling and delinquent tendencies than female volunteers (Hraba and Lee 1996; Moffitt et al. 2001). Participants were tested individually in a quiet room. Most participants took approximately 45–60 min to complete the dependent measures.

Measures

The dependent measures were self-reported gambling behavior (general gambling involvement and problem gambling) and antisocial behavior (minor, moderate, severe). Predictor variables were personality traits (impulsivity, sensation-seeking, self-control, the Big Five), and antisocial tendencies (psychopathy, aggression, childhood and adolescent predictors of psychopathy). All measures have been previously demonstrated to have good reliability and validity. All measures were presented in random order.

Gambling

The Problem Gambling Severity Index (PGSI; Ferris and Wynne 2001) is a nine-item self-report measure of problem and pathological gambling behavior based on problematic gambling behavior in the last 12 months (e.g., “Have you bet more than you could afford to lose?”, 1 = never, 4 = almost always). The total score can be used to categorize an individual’s gambling tendencies into one of four categories: Non-problem gambling (score of 0), low-risk gambling (scores of 1–2), problem gambling (scores of 3–7), and pathological gambling (scores of 8–9; Ferris and Wynne 2001). The PGSI was chosen over other measures of problem gambling such as the South Oaks Gambling Screen, Gambling Anonymous 20 Questions, and the criteria of the DSM-IV because of its demonstrably higher reliability and validity (e.g., Arthur et al. 2008; Young and Stevens 2008)

General gambling involvement was measured using a self-report questionnaire, which we call the Gambling Behavior Scale (GBS; modified from Williams et al. 2006). This instrument measured the total number of different gambling activities engaged in within the past year, and the typical monthly frequency of different forms of gambling in the past 12 months.

Antisocial Behavior

Antisocial behavior was measured using the Self-Report Early Delinquency Instrument (SRED; modified from Moffitt and Silva 1988). The modified SRED consisted of a list of 36 delinquent behaviors (e.g., “Carried a weapon”, 0 = never, 1 = once, 2 = more than once). The rating scale was modified to assess past year frequency instead of lifetime frequency to better capture present tendencies for antisocial behavior. Items were divided into three categories of antisocial behavior: minor (e.g., “Trespassing”, “Taking a car without permission”), moderate (e.g., “Stealing over \$10”, “Getting suspended or expelled from school”), and severe (e.g., “Struggling with a police officer”, “Hitting a person to seriously hurt them”). Minor, moderate, and severe antisocial behavior scores were calculated by summing the relevant items for each subscale.

Personality

Eysenck’s Impulsivity Scale

Eysenck’s Impulsivity Scale (EIS) (Eysenck et al. 1985) consists of 19 yes/no statements about impulsive behaviors (e.g., “Do you often buy things on impulse?”). A total impulsivity score was obtained by summing the number of high impulsivity choices.

Zuckerman's Sensation Seeking Scale

The Sensation Seeking Scale (SSS), Version 5 (Zuckerman 1994), consists of 40 forced choices between pairs of antithetical statements about preferences for varied, stimulating experiences and disinhibited behavior (e.g., “A sensible person avoids activities that are dangerous” versus “I sometimes like to do things that are a little frightening”). A total sensation-seeking score was obtained by summing the number of high sensation-seeking choices.

Retrospective Behavioral Self-Control Scale (RBS)

The Retrospective Behavioral Self-Control Scale (Marcus 2003) consists of 67 items measuring the frequency of behaviors associated with low self-control across the lifespan (e.g., “I have been late for school or work because I stayed out too late the night before”, 1 = never, 7 = always). A total self-control score was obtained by summing ratings of frequency of engagement in risky behavior. Higher scores indicated lower self-control.

Neuroticism-Extroversion-Openness Five-Factor Inventory

The Neuroticism-Extroversion-Openness Five-Factor Inventory (NEO-FFI) (Costa & McCrae, 1992) assesses personality traits in the factor domains of Neuroticism (e.g., “I often feel inferior to others”, 0 = strongly disagree, 4 = strongly agree), Extraversion (e.g., “I laugh easily”), Openness to Experience (e.g., “I often try new or foreign foods”), Agreeableness (e.g., “I am a cheerful, high-spirited person”), and Conscientiousness (e.g., “I work hard to accomplish my goals”). Some items were reverse scored, in accordance with Costa and McCrae (1992). Total scores were obtained by summing the appropriate scores for each subscale.

Antisocial Tendencies

Levenson Psychopathy Scale

The Levenson Psychopathy Scale (LPS) measures antisocial dispositions in non-institutionalized populations, and is comprised of primary and secondary psychopathy scales (Levenson et al. 1995). Primary psychopathy refers to deliberate and premeditated violence resulting from emotional detachment and indifference to others' interests, and a consistent pattern of callous, remorseless, and insincere behavior (e.g., “For me, what's right is whatever I can get away with,” 1 = disagree strongly, 4 = agree strongly). Secondary psychopathy reflects antisocial behavior borne of emotional disorder or distress, such as anger, anxiety, or distress (e.g., “I have been in a lot of shouting matches with other people”). Some items were reverse scored, in accordance with Levenson et al. (1995). A total psychopathy score was computed by summing all of the items.

Aggression Questionnaire

The aggression questionnaire (AQ) is a self-report measure of four facets of attitudes regarding aggression: physical aggression (e.g., “Once in a while I can't control the urge to strike another person”, 1 = strongly disagree, 7 = strongly agree), verbal aggression (e.g., “I can't help getting into arguments when people disagree with me”), anger (e.g., “I have

trouble controlling my temper”), and hostility (e.g., “I have threatened people before”; Buss and Perry 1992). Some items were reverse scored, in accordance with Buss and Perry (1992). A total aggression score was computed by summing all of the items.

Childhood and Adolescent Taxon Scale

The Childhood and Adolescent Taxon Scale (CATS) measures early indicators of psychopathy (e.g., “Before the age of 15, did you initiate physical fights often?” 0 = no, 2 = yes; Lalumière et al. 1996). A total early psychopathy score was obtained by summing all appropriate responses.

Data Manipulation and Analyses

Several items on the SRED overlapped with items on some of the personality measures associated with risk. As a consequence, we removed all overlapping items from the relevant scales involving crime, violence, substance use, truancy, and vandalism (RBS, $n = 18$ removed; SSS, $n = 4$ removed) for all analyses. No overlapping items were observed for the other personality measures. CATS scores were significantly positively skewed and were corrected using an inverse transformation. Days per month spent gambling, antisocial behavior scores, RBS, and PGSI scores were all significantly skewed, and could not be corrected with any transformations; non-parametric statistics were used where possible for tests involving these scores. Parametric statistics were used for all other analyses. Missing values for sensation-seeking ($n = 1$), Levenson’s psychopathy scale ($n = 2$), and the NEO Big Five personality traits ($n = 3$ for extraversion and openness to experience; $n = 2$ for agreeableness and conscientiousness) were imputed using the appropriate variable’s mean. Four PGSI scores were missing; these participants were excluded from all analyses. Total scale scores (rather than subscale scores) were used in correlation and regression analyses to avoid type I errors and to maximize the ratio of subjects to variables.

Results

All scales showed high reliability, as measured by Cronbach’s *alpha* (Table 1). Two measures included items that overlapped with the antisocial behavior scale (RBS, SSS). The reliability of both scales remained largely unchanged after these items were removed: RBS, $\alpha = .935$, RBS_{modified}, $\alpha = .923$; SSS, $\alpha = .700$, SSS_{modified}, $\alpha = .688$. Categorization of degree of problem gambling and reported engagement in antisocial conduct among participants (in the past year) is shown in Table 2.

What Predicts Gambling Behavior?

Measures of problem gambling, general gambling involvement, and antisocial behavior (minor, moderate, and severe) were regressed on three blocks of variables: Personality traits associated with risk-acceptance (SSS, EIS, RBS), the Big Five personality traits (openness to experience, conscientiousness, extraversion, agreeableness, neuroticism), and antisocial tendencies (AQ, LPS, CATS). The order of these blocks was determined by the *a priori* prediction that traits associated with risk-acceptance would explain the most

Table 1 Chronbach's alpha coefficients for dependent measures used in this study

Measure	Reliability (Chronbach's α)
AQ	.913
CATS	.722
EIS	.771
LPS	.802
NEO-O	.680
NEO-C	.838
NEO-E	.784
NEO-A	.746
NEO-N	.840
PGSI	.846
SRED	.784

Table 2 Number and proportion of participants categorized as non-problem, low-risk, problem, and severe/pathological gamblers (A), and number and proportion of participants reporting engagement in minor, moderate, and severe antisocial conduct in the past year (B)

	Number	Proportion (%)
(A) Problem gambling		
Non-problem	63	35
Low-risk	66	36.7
Problem	39	21.7
Severe/pathological	12	6.7
(B) Antisocial conduct (past year)		
Minor	126	92.2
Moderate	71	39.4
Severe	56	31.1

variance in gambling and antisocial behavior. Antisocial tendencies were ordered last in the regression because of the prediction that antisocial tendencies would distinguish forms of gambling and antisocial behavior, above and beyond any common variance explained due to individual differences in personality.

Problem Gambling

Personality traits associated with risk-acceptance significantly predicted problem gambling as measured by the PGSI, adjusted $R^2 = .075$, $P = .001$ (significant predictors: impulsivity, $\beta = .294$, $P < .001$). The Big Five personality traits significantly added to variance explained, R^2 change = .089, $P = .004$ (significant predictors: neuroticism, $\beta = .276$, $P = .002$; extraversion, $\beta = .180$, $P = .03$). Antisocial tendencies did not significantly add to the variance explained in problem gambling, R^2 change = .020, $P = .25$.

General Gambling Involvement

To simplify regression analyses of general gambling involvement, the two GBS variables of number of gambling activities in the last 12 months and the monthly frequency of gambling were reduced using principal components analysis (these two variables were highly correlated with each other, $r = .535$, $P < .001$). The single principal component

obtained, labeled General Gambling Involvement (GGI), accounted for 76.7% of the variance, and both variables loaded highly and positively ($>.876$).

Personality traits associated with risk-acceptance significantly predicted general gambling involvement, adjusted $R^2 = .045$, $P = .04$ (significant predictors: sensation-seeking, $\beta = .169$, $P = .03$). The Big Five personality traits (R^2 change = .044, $P = .15$) and antisocial tendencies (R^2 change = .034, $P = .09$) did not significantly add to the variance explained.

What Predicts Antisocial Behavior?

Minor Antisocial Behavior

Minor antisocial behavior was significantly predicted by personality traits associated with risk-acceptance, adjusted $R^2 = .226$, $P < .001$ (significant predictors: low self-control, $\beta = .244$, $P = .001$; sensation-seeking, $\beta = .346$, $P < .001$). The Big Five personality traits explained a significant amount of variance in minor antisocial behavior above and beyond personality traits associated with risk-acceptance, R^2 change = .056, $P = .02$ (significant predictors: neuroticism, $\beta = .209$, $P = .007$; extraversion, $\beta = .222$, $P = .005$). Antisocial tendencies explained no additional variance, R^2 change = .016, $P = .27$.

Moderate Antisocial Behavior

Moderate antisocial behavior was significantly predicted by personality traits associated with risk-acceptance, adjusted $R^2 = .137$, $P < .001$ (significant predictors: low self-control, $\beta = .294$, $P < .001$; sensation-seeking, $\beta = .140$, $P = .05$). The Big Five personality traits, R^2 change = .040, $P = .14$, did not explain additional variance. Antisocial tendencies marginally added to variance explained in moderate antisocial behavior, R^2 change = .037, $P = .052$, with no significant individual predictors.

Severe Antisocial Behavior

Severe antisocial behavior was significantly predicted by personality traits associated with risk-acceptance, adjusted $R^2 = .103$, $P < .001$ (significant predictors: low self-control, $\beta = .180$, $P = .02$; sensation-seeking, $\beta = .215$, $P = .004$). The Big Five personality traits did not explain any additional variance in severe antisocial behavior, R^2 change = .016, $P = .68$. Antisocial tendencies, however, significantly explained additional variance in severe antisocial behavior above and beyond personality traits associated with risk-acceptance, R^2 change = .089, $P < .001$ (significant predictors: aggression, $\beta = .338$, $P = .001$; psychopathic tendencies, $\beta = .179$, $P = .049$).

Are Gamblers Delinquent?

Correlations between the gambling measures (PGSI, GGI) and the three measures of antisocial behavior (SRED) are shown in Table 3. Both problem gambling and general gambling involvement were significantly correlated with all types of antisocial behavior (all $r_s > .14$, all $p_s < .03$).

We conducted Kruskal–Wallis tests to investigate whether minor, moderate, and severe antisocial behavior varied based on degree of problem gambling as measured by the PGSI. Because there were few pathological gamblers in our sample, we combined problem and

Table 3 Correlations between measures of general gambling involvement, problem gambling, and three types of antisocial behavior before controlling for personality traits associated with risk-acceptance (impulsivity, sensation-seeking, and low self-control; *left panel*), and after controlling for traits associated with these personality traits (*right panel*)

	Correlations before controlling for personality				Correlations after controlling for personality			
	PGSI	SRED1	SRED2	SRED3	PGSI	SRED1	SRED2	SRED3
GGI	.418 (.00)**	.358 (.00)**	.150 (.02)*	.161 (.02)*	.433 (.00)**	.243 (.00)**	-.035 (.64)	.135 (.04)*
PGSI		.197 (.00)**	.185 (.01)**	.138 (.03)*		.093 (.11)	.044 (.28)	.092 (.12)
SRED1			.546 (.00)**	.390 (.00)**			.519 (.00)**	.292 (.00)**
SRED2				.451 (.00)**				.392 (.00)**

Notes: The *P* value for each correlation is provided in *parentheses* (one-tailed); ** $P < .01$; * $P < .05$. *PGSI* problem gambling, *GGI* general gambling involvement, *SRED1* minor antisocial behavior, *SRED2* moderate antisocial behavior, *SRED3* severe antisocial behavior. The values in *bold italics* and *italics* represents correlations between antisocial behavior and gambling. *Bold italics* indicates correlations that lost significance after controlling for personality traits associated with risk-acceptance

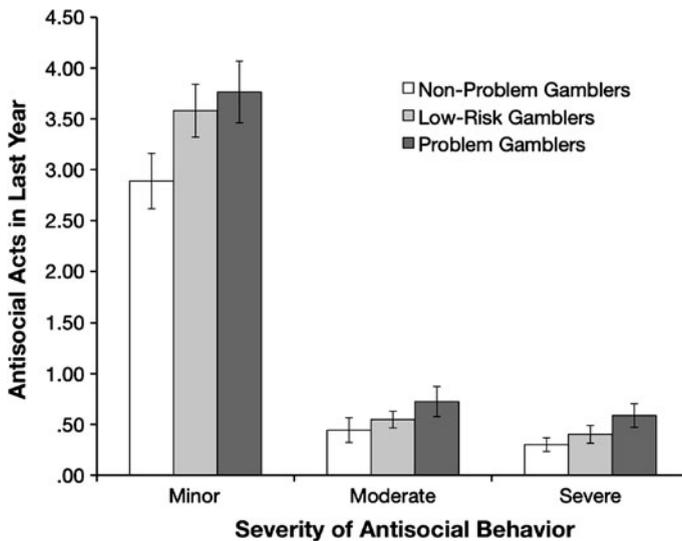


Fig. 1 Mean (\pm SE) number of delinquent acts committed in the last year as a function of problem gambling severity

pathological gamblers into a single category, which we labeled problem gamblers. Figure 1 suggests that the number of delinquent acts increased as a function of problem gambling severity.

Minor antisocial behavior significantly varied based on degree of problem gambling, $\chi^2(2, N = 176) = 7.741, P = .02, M_{\text{non-problem}} = 2.89, M_{\text{low-risk}} = 3.58, M_{\text{problem}} = 3.76$. Follow-up Mann–Whitney *U*-tests indicated that compared to non-problem gamblers, low-risk and problem gamblers exhibited significantly higher levels of minor antisocial behavior, $Z = -2.272, P = .02$, and $Z = -2.511, P = .01$, respectively. Low-risk and problem gamblers did not differ in degree of minor antisocial behavior, $Z = -.061, P = .95$. Moderate antisocial behavior marginally varied based on degree of problem gambling, $\chi^2(2, N = 176) = 5.728, P = .06, M_{\text{non-problem}} = .44, M_{\text{low-risk}} = .55, M_{\text{problem}} = .73$. Follow-up Mann–Whitney *U*-tests indicated that compared to non-problem gamblers, low-risk and problem gamblers exhibited significantly higher levels of moderate antisocial behavior, $Z = -2.026, P = .04$, and $Z = -2.141, P = .03$, respectively. Low-risk and problem gamblers did not differ in degree of moderate antisocial behavior, $Z = -.345, P = .73$. Severe antisocial behavior did not significantly differ based on degree of problem gambling, $\chi^2(2, N = 176) = 3.213, P = .20, M_{\text{non-problem}} = .30, M_{\text{low-risk}} = .40, M_{\text{problem}} = .59$. Problem gamblers engaged in marginally more severe antisocial behavior than non-problem gamblers, however, $Z = -1.885, P = .06$, suggesting a possible relationship.

What Explains the Relationship Between Gambling and Antisocial Behavior?

The regression analyses indicated that personality traits associated with risk-acceptance significantly predicted all forms of gambling and antisocial behavior. To investigate whether the relationship between gambling and antisocial behavior was due to the common effect of personality traits associated with risk-acceptance, partial correlations were

conducted between the gambling measures and antisocial behavior, controlling for impulsivity, sensation-seeking, and low self-control. These correlations are shown in Table 3. Antisocial behavior was no longer significantly associated with problem gambling or general gambling involvement after controlling for personality traits associated with risk-acceptance, with two exceptions: Minor antisocial behavior and severe antisocial behavior were both still significantly correlated with general gambling involvement.

The regression analyses indicated that severe antisocial behavior was significantly predicted by antisocial tendencies, above and beyond personality traits associated with risk-acceptance. Controlling for both antisocial tendencies and personality traits associated with risk-acceptance eliminated the significant correlation between severe antisocial behavior and general gambling involvement, $r = .093$, $P = .12$. The significant relationship between minor antisocial behavior and general gambling involvement, however, could not be statistically eliminated, even when controlling for antisocial tendencies and the Big Five personality traits in addition to personality traits associated with risk-acceptance (all r s $> .227$, p s $< .003$).

Discussion

Results indicate that antisocial behavior is associated with gambling, and that they share common determinants. Personality traits associated with risk-acceptance such as impulsivity, sensation-seeking, and low self-control appear to play an important role in problem gambling, general gambling involvement, and all forms of antisocial behavior. Beyond the variance explained by personality traits associated with risk-acceptance, the Big Five explained additional variance in problem gambling and minor antisocial behavior, with neuroticism and extraversion as important predictors. Severe antisocial behavior was the only measure in which antisocial tendencies explained additional variance above and beyond personality traits associated with risk and the Big Five.

Previous findings were replicated indicating a strong positive association between gambling and antisocial behavior. That the relationship between antisocial behavior and gambling was largely statistically eliminated after controlling for personality traits associated with risk-acceptance is a novel finding, and suggests that these traits underlie a significant portion of the relationship observed between gambling and antisocial behavior. Important exceptions were the relationship between minor antisocial behavior and general gambling involvement, and the relationship between severe antisocial behavior and general gambling involvement. The former relationship remained significant even after controlling for personality traits associated with risk-acceptance, the Big Five, and antisocial tendencies. The latter relationship lost significance after controlling for antisocial tendencies in addition to personality traits associated with risk.

This study is the first to demonstrate that (1) antisocial tendencies such as aggression and psychopathic tendencies are relevant to the production of severe antisocial behavior, but not more minor or moderate forms of antisocial behavior, or gambling, and (2) personality traits (including self-control, which has not been previously studied) associated with risk-propensity in part facilitate the relationship between gambling and antisocial behavior.

Personality, Gambling, and Antisocial Behavior

Different personality traits appear to motivate engagement in different types of gambling and delinquent behavior. Impulsivity was most effective in predicting problem gambling,

and sensation-seeking significantly predicted general gambling involvement. Low self-control significantly predicted all forms of antisocial behavior. These personality traits are highly intercorrelated, however, and may represent different manifestations of a similar tendency to prefer risky outcomes. As a block in the regression analyses, personality traits associated with risk-acceptance explained significant variance in every measure of gambling and antisocial behavior. Together with the finding that personality traits associated with risk-acceptance significantly account for the relationship between gambling and antisocial behavior, these results suggest that both gambling and antisocial behavior may represent different behavioral manifestations of a risk-accepting personality.

Neuroticism and extraversion were significant predictors of problem gambling behavior and minor antisocial behavior in this study, beyond personality traits associated with risk-acceptance. Neuroticism describes susceptibility toward experiencing negative emotional states, such as anxiety, guilt, anger, or depression. Extraversion describes gregariousness, assertiveness, and interest in seeking out excitement and stimulation. These traits have been associated with gambling tendencies in past research (e.g., Bagby et al. 2007; Myrseth et al. 2009). Neuroticism and extraversion may be considered extensions of traits associated with risk-acceptance, however, in that impulsivity is a component of neuroticism, and extraversion is consistently associated with sensation-seeking and impulsivity (reviewed in Zuckerman and Kuhlman 2000). That neuroticism and extraversion explained additional variance beyond known, well-established correlates of gambling behavior and antisocial behavior (e.g., impulsivity), is a novel finding, however, and suggests that these traits require further study.

Data suggest that delinquent behavior in adolescence and early adulthood is normative, and that few people refrain from such behaviors during this period (reviewed in Moffitt 1993; Quinsey et al. 2004). In the present study, we found that controlling for personality traits associated with risk-acceptance, the Big Five, and antisocial tendencies did not eliminate the relationship between general gambling involvement and minor antisocial behavior. Ninety-two percent of our sample engaged in minor antisocial behavior in the past year. If such behavior is normative among young males, as has been suggested (e.g., Moffitt 1993), then individual differences should play a limited role in explaining variance in less serious forms of risk-taking such as minor antisocial behavior.

Antisocial Tendencies, Gambling, and Antisocial Behavior

Antisocial tendencies did not explain significant additional variance in problem gambling, general gambling involvement, or minor antisocial behavior beyond personality traits associated with risk-acceptance. Severe antisocial behavior, however, was effectively predicted by antisocial tendencies, above and beyond the variance explained by personality traits associated with risk-acceptance. Furthermore, the relationship between general gambling involvement and severe antisocial behavior remained significant when controlling for personality traits associated with risk-acceptance, but was no longer significant once antisocial tendencies were controlled for. Severe antisocial behavior involves the breaking of social norms and often causes harm to other people or their property. It is therefore unsurprising that the combination of personality traits associated with risk-acceptance and antisocial tendencies explained the relationship between severe antisocial behavior and gambling in this study. Antisocial tendencies thus appear to motivate engagement in more severe delinquent conduct (i.e., antisocial risk-taking), as previously suggested (Jones and Quisenberry 2004).

Antisocial tendencies have been implicated as a possible outcome of gambling problems, and an impulsive/antisocial subtype of problem gamblers has been proposed

(Blaszczynski et al. 1997). We did not find that antisocial tendencies were predictive of additional variance in problem gambling or general gambling involvement beyond individual differences in risky personality. It is possible that we did not observe this relationship because our sample of pathological gamblers was small, and because relatively few of our participants engaged in more than one act of severe antisocial behavior in the past year (10.6% engaged in two acts or more). We do note, however, that in our sample, problem gamblers engaged in marginally more severe antisocial behavior than non-problem gamblers. A larger sample size may shed more light on this relationship.

Limitations

Male students were used in this study because young males exhibit higher levels of risk-accepting personality traits, gambling behavior, and antisocial behavior compared to females (reviewed in Byrnes et al. 1999; Mishra and Lalumière 2008). In our sample of students, we found a high rate of gambling behavior. Only 35% of our sample consisted of non-gamblers, and a large portion of our sample comprised problem and pathological gamblers (28.4%). This rate of problem and pathological gambling is substantially higher than general population estimates (1–4%; Shaffer et al. 1997; Shaffer and Hall 2001; Walker and Dickerson 1996), although it is somewhat similar to previous studies using male students (e.g., Engwall et al. 2004; Winters et al. 1998). The relatively high proportion of problem gamblers in our sample may also be explained by the fact that recruitment for this study specified a study on gambling, thus facilitating higher interest among problem gamblers. Because of the high proportion of problem gamblers in this study, the results cannot necessarily be generalized to the general population, among which problem gambling rates are lower. We are currently conducting a study among a broader sample of community members (including males and females of all ages) in an attempt to replicate these findings more broadly with higher external validity.

Our methods cannot determine whether gambling behavior leads to increased antisocial behavior, or vice versa. Blaszczynski and McConaghy (1994) suggested that antisocial tendencies among problem gamblers may develop as a consequence of having to deal with hiding a gambling addiction, or to deal with financial and personal problems that are often associated with problem gambling. Clearly, some criminal activities seem to directly support gambling habits (Blaszczynski et al. 1997; Turner et al. 2007; Williams et al. 2005). Gambling may therefore sometimes cause or facilitate antisocial behaviors.

In the present study, the relationship between antisocial behavior and gambling tendencies was conceived generally. However, some evidence suggests that the relationship between gambling and criminal behavior is more specific. For example, some types of gambling (e.g., non-continuous formats such as lotteries) have been associated with lesser criminal behavior (Smith et al. 2003). Conversely, faster-paced continuous gambling formats such as video lottery terminal gambling and slot machines have been associated with elevated levels of fraud, domestic violence, and theft (Smith et al. 2003). Future research should examine whether individual differences in personality and antisocial tendencies differentiate sub-types of gamblers, and whether these individual differences can also explain different patterns of criminal behavior associated with gambling.

The data collected in this study were obtained through self-report, and as a consequence, must be interpreted with some caution given the limitations of self-report studies, including the potential for unreliable, exaggerated, or biased answers. Furthermore, because participants were given a large set of questionnaires to complete, participant fatigue may have been a concern. We do note, however, that the order of all dependent measures was

randomized, reducing any systemic effect of fatigue. Also of concern, an alpha level of 5% was used as a threshold of significance in this study. Because of the multiple analyses and comparisons comprising this study, we note that smaller effects (i.e., those that did not meet the more stringent alpha level of 1%) should be interpreted with some caution.

Implications and Conclusions

The personality traits associated with risk-acceptance that were correlated with gambling and antisocial behavior in this study have also been reliably associated with criminal behavior among forensic populations (e.g., Longshore et al. 2006; Lynam et al. 2000; Zuckerman 1994). Several theorists have suggested that crime is a form of risk-taking, and that crime and risky behavior are products of similar causal factors (Daly and Wilson 2001; Gottfredson and Hirschi 1990; Jessor 1991). This idea has been supported by studies of individuals (Bartusch et al. 1997; Donovan and Jessor 1985; LeBlanc and Girard 1997, Osgood et al. 1988) and aggregate behavioral trends (Mishra and Lalumière 2009). Our results shed light on some of the common mechanisms through which crime and risky behavior manifest, namely, personality traits such as sensation-seeking, impulsivity, and low self-control.

Our results have important implications for the prevention of such risk-accepting behaviors as gambling and antisocial behavior. Targeted interventions for specific risk-factors for gambling behavior may not be as effective as interventions directed at reducing risk-acceptance more generally. This notion has been echoed by other researchers (e.g., Stinchfield 2004; Vitaro et al. 2001), and is supported by studies that have identified instigative factors that are associated with both problem gambling and other types of risky behavior, such as poor academic performance, being male, traumatic life events, disrupted family relationships, early risky behavior, low socioeconomic status, and low perceived social support (reviewed in Stinchfield 2004). It may be worthwhile to target generic risk factors associated with general risky behavior in addition to unique instigative factors associated with problem gambling (Vitaro et al. 2001).

References

- Arthur, D., Tong, W. L., Chen, C. P., Hing, A. Y., Sagara-Rosemeyer, M., Kua, E. H., et al. (2008). The validity and reliability of four measures of gambling behavior in a sample of Singapore University students. *Journal of Gambling Studies*, 24, 451–462.
- Bagby, R. M., Vachon, D. D., Bulmash, E., Toneatto, T., Quilty, L. C., & Costa, P. T. (2007). Pathological gambling and the five-factor model of personality. *Personality and Individual Differences*, 43, 873–880.
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (1999). Gambling and alcohol use among youth: Influences of demographic, socialization, and individual factors. *Addictive Behaviors*, 24, 749–767.
- 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.
- Bartusch, D. R. J., Lynam, D. R., Moffitt, T., & Silva, P. A. (1997). Is age important? Testing a general versus developmental theory of antisocial behavior. *Criminology*, 35, 13–49.
- Blaszczyński, A., & McConaghy, N. (1994). Antisocial personality disorder and pathological gambling. *Journal of Gambling Studies*, 10, 129–145.
- Blaszczyński, A., McConaghy, N., & Frankova, A. (1989). Crime, antisocial personality and pathological gambling. *Journal of Gambling Studies*, 5, 137–152.
- Blaszczyński, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, 97, 487–499.

- Blaszczynski, A., Steel, Z., & McConaghy, N. (1997). Impulsivity in pathological gambling: The antisocial impulsivist. *Addiction*, *92*, 75–87.
- Blaszczynski, A., Wilson, A. C., & McConaghy, N. (1986). Sensation seeking and pathological gambling. *British Journal of Addiction*, *81*, 113–117.
- Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, *63*, 452–459.
- Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk-taking: A meta-analysis. *Psychological Bulletin*, *125*, 367–383.
- Costa, P. T., & McRae, R. R. (1992). *The revised NEO personality inventory (NEO-PI-R) and NEO five factor inventory (NEO-FFI) professional manual*. Odessa, FL: Psychological Assessment Resources.
- Daly, M., & Wilson, M. (2001). Risk taking, intrasexual competition, and homicide. *Nebraska Symposium on Motivation*, *47*, 1–36.
- Donovan, J. E., & Jessor, R. (1985). Structure of problem behavior in adolescence and young adulthood. *Journal of Consulting and Clinical Psychology*, *53*, 890–904.
- Engwall, D., Hunter, R., & Steinberg, M. (2004). Gambling and other risk behaviors on university campuses. *Journal of American College Health*, *52*, 245–256.
- Eysenck, S. B. G., Pearson, P. R., Easting, G., & Allsopp, J. F. (1985). Age norms for impulsiveness, venturesomeness and empathy in adults. *Personality and Individual Differences*, *6*, 613–619.
- Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index: Final report*. Ottawa, Ontario: Canadian Centre on Substance Abuse. (Submitted to the Canadian Centre on Substance Abuse).
- Ferris, J., Wynne, H., & Single, E. (1999). *Measuring problem gambling in Canada: Final report*. Ottawa, Ontario: Canadian Centre on Substance Abuse. (Submitted to the Canadian Centre on Substance Use).
- Gottfredson, M. R., & Hirschi, T. (1990). *A general theory of crime*. Stanford: Stanford University Press.
- Hardoon, K. K., & Derevensky, J. L. (2002). Child and adolescent gambling behaviour: Current knowledge. *Clinical Child Psychology & Psychiatry*, *7*, 263–281.
- Heaven, P. C. L. (1996). Personality and self-reported delinquency: Analysis of the “Big Five” personality dimensions. *Personality and Individual Differences*, *20*, 47–54.
- Hirschi, T., & Gottfredson, M. R. (1994). The generality of deviance. In T. Hirschi & M. R. Gottfredson (Eds.), *The generality of deviance*. New Brunswick, NJ: Transaction Publishers.
- Hraba, J., & Lee, G. (1996). Gender, gambling and problem gambling. *Journal of Gambling Studies*, *12*, 83–101.
- Jessor, R. (1991). Risk behavior in adolescence: A psychosocial framework for understanding and action. *Journal of Adolescent Health*, *12*, 597–605.
- Jones, S., & Quisenberry, N. (2004). The general theory of crime: How general is it? *Deviant Behavior*, *25*, 401–426.
- Kassinove, J. (1998). Development of the gambling attitude scales: Preliminary findings. *Journal of Clinical Psychology*, *54*, 763–771.
- Lalumière, M. L., Chalmers, L. J., Quinsey, V. L., & Seto, M. C. (1996). A test of the mate deprivation hypothesis of sexual coercion. *Ethology and Sociobiology*, *17*, 299–318.
- Langewisch, M. W. J., & Frisch, G. R. (1998). Gambling behaviour and pathology in relation to impulsivity, sensation seeking, and risky behaviour in male college students. *Journal of Gambling Studies*, *14*, 245–262.
- LeBlanc, M., & Girard, S. (1997). The generality of deviance: Replication over two decades with a Canadian sample of adjudicated boys. *Canadian Journal of Criminology*, *39*, 171–183.
- Levenson, M. R., Kiehl, K. A., & Fitzpatrick, C. M. (1995). Assessing psychopathic attributes in a non-institutionalized population. *Journal of Personality and Social Psychology*, *68*, 151–158.
- Longshore, D., Rand, S. T., & Stein, J. A. (2006). Self-control in a criminal sample: An examination of construct validity. *Criminology*, *34*, 209–228.
- Lynam, D. R., Caspi, A., Moffitt, T. E., Wikstrom, P. H., Loeber, R., & Novak, S. (2000). The interaction between impulsivity and neighborhood context on offending: The effects of impulsivity are stronger in poorer neighborhoods. *Journal of Abnormal Psychology*, *109*, 563–574.
- Marcus, B. (2003). An empirical examination of the construct validity of two alternative self-control measures. *Educational and Psychological Measurement*, *63*, 674–706.
- Martins, S. S., Tavares, H., da Silva Lobo, D. S., Galetti, A. M., & Gentil, V. (2004). Pathological gambling, gender, and risk-taking behaviors. *Addictive Behaviors*, *29*, 1231–1235.
- McDaniel, S. R., & Zuckerman, M. (2003). The relationship of impulsive sensation seeking and gender to interest and participation in gambling activities. *Personality and Individual Differences*, *35*, 1385–1400.
- Meyer, G., & Fabian, T. (2005). Delinquency among pathological gamblers: A causal approach. *Journal of Gambling Studies*, *8*, 61–77.

- Mishra, S., & Lalumière, M. L. (2008). Risk taking, antisocial behavior, and life histories. In J. Duntley & T. K. Shackelford (Eds.), *Evolutionary forensic psychology* (pp. 139–159). Oxford: Oxford University Press.
- Mishra, S., & Lalumière, M. L. (2009). Is the crime drop of the 1990s in Canada and the USA associated with a general decline in risky and health-related behaviors? *Social Science and Medicine*, *68*, 39–48.
- Mishra, S., Lalumière, M. L., & Williams, R. J. (2010). Gambling as a form of risk-taking: Individual differences in personality, behavioral preferences for risk, and risk-accepting attitudes. *Personality and Individual Differences*, *49*, 616–621.
- Moffitt, T. E. (1993). Adolescent-limited and life-course persistent antisocial behavior: A developmental taxonomy. *Psychological Bulletin*, *100*, 674–701.
- Moffitt, T. E., Caspi, A., Rutter, M., & Silva, P. A. (2001). *Sex differences in antisocial behavior: Conduct disorder, delinquency, and violence in the Dunedin longitudinal study*. Cambridge: Cambridge University Press.
- Moffitt, T. E., & Silva, P. A. (1988). Self-reported delinquency: Results from an instrument for New Zealand. *Australia and New Zealand Journal of Criminology*, *21*, 227–240.
- Myrseth, H., Pallesen, S., Molde, H., Johnsen, B. H., & Lorvik, I. M. (2009). Personality factors as predictors of pathological gambling. *Personality and Individual Differences*, *47*, 933–937.
- Osgood, D. W., Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (1988). The generality of deviance in late adolescence and early adulthood. *American Sociological Review*, *53*, 81–93.
- Petry, N. M. (2005). *Pathological gambling: Etiology, comorbidity, and treatment*. Washington, DC: American Psychological Corporation.
- Pietrzak, R. H., & Petry, N. M. (2005). Antisocial personality disorder is associated with increased severity of gambling, medical, drug and psychiatric problems among treatment-seeking pathological gamblers. *Addiction*, *100*, 1183–1193.
- Powell, J., Hardoon, K., Derevensky, J. L., & Gupta, R. (1999). Gambling and risk-taking behavior among university students. *Substance Use and Misuse*, *34*, 1167–1184.
- Quinsey, V. L., Skilling, T. A., Lalumière, M. L., & Craig, W. M. (2004). *Juvenile delinquency: Understanding the origins of individual differences*. Washington: American Psychological Association.
- Shaffer, H. J., & Hall, M. N. (2001). Updating and refining meta-analytic 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., & VanderBilt, J. (1997). Estimating the prevalence of disordered gambling behavior in the United States and Canada: A research synthesis. *American Journal of Public Health*, *89*, 1369–1376.
- Skitch, S., & Hodgins, D. (2004). Impulsivity, compulsivity and pathological gambling: An exploratory study of pathological gambling as an impulsivity-compulsivity spectrum disorder. *International Gambling Studies*, *4*, 175–188.
- Slutske, W. S., Eisen, S., Xian, H., True, W. R., Lyons, M. J., Goldberg, J., et al. (2001). A twin study of the association between pathological gambling and antisocial personality disorder. *Journal of Abnormal Psychology*, *110*, 297–308.
- Smith, G., Wynne, H., & Hartnagel, T. (2003). *Examining police records to assess gambling impacts: A study of gambling-related crime in the city of Edmonton*. Report prepared for the Alberta Gaming Research Institute.
- Stinchfield, R. (2004). Demographic, psychosocial, and behavioural factors associated with youth gambling and problem gambling. In J. L. Derevensky & R. Gupta (Eds.), *Gambling problems in youth: Theoretical and applied perspectives*. New York: Kluwer.
- Toneatto, T., & Nguyen, L. (2007). Individual characteristics and problem gambling behavior. In G. Smith, D. C. Hodgins, & R. J. Williams (Eds.), *Research and measurement issues in gambling studies* (pp. 279–303). Amsterdam: Elsevier.
- Turner, N. E., Preston, D. L., McAvoy, S., & Saunders, C. (2007). *Problem gambling in Canadian federal offenders: Prevalence, comorbidity, and correlates*. Guelph, Ontario: Ontario Problem Gambling Research Centre. (Submitted to the Ontario Problem Gambling Research Centre).
- Vitaro, F., Brendgen, M., Ladouceur, R., & Tremblay, R. E. (2001). Gambling, delinquency, and drug use during adolescence: Mutual influences and common risk factors. *Journal of Gambling Studies*, *17*, 171–190.
- Vitaro, F., Ladouceur, R., & Bujold, A. (1996). Predictive and concurrent correlates of gambling in early adolescent boys. *Journal of Early Adolescence*, *16*, 211–228.
- Walker, M. B., & Dickerson, M. G. (1996). The prevalence of problem and pathological gambling: A critical analysis. *Journal of Gambling Studies*, *12*, 233–249.
- Williams, R. J., Connolly, D., Wood, R. T., & Nowatzki, N. (2006). Does learning about the mathematics of gambling change gambling behavior? *Psychology of Addictive Behaviors*, *20*, 62–68.

- Williams, R. J., Royston, J., & Hagen, B. F. (2005). Gambling and problem gambling within forensic populations: A review of literature. *Criminal Justice and Behavior*, *32*, 665–689.
- Williams, R. J., West, B. L., & Simpson, R. I. (2008). *Prevention of problem and pathological gambling: A comprehensive review of the evidence*. Report prepared for the Ontario Problem Gambling Research Centre.
- Winters, K. C., Bengston, P., Dorr, D., & Stinchfield, R. (1998). Prevalence and risk factors of problem gambling among college students. *Psychology of Addictive Behaviors*, *12*, 127–135.
- Winters, K. C., Stinchfield, R. D., Botzet, A., & Anderson, N. (2002). A prospective study of youth gambling behaviors. *Psychology of Addictive Behaviors*, *16*, 3–9.
- Yeoman, T., & Griffiths, M. D. (1996). Adolescent machine gambling and crime. *Journal of Adolescence*, *19*, 99–104.
- Young, M., & Stevens, M. (2008). SOGS and CPGI: Parallel comparison on a diverse population. *Journal of Gambling Studies*, *24*, 337–356.
- Zuckerman, M. (1994). *Behavioural expressions and biosocial bases of sensation seeking*. Cambridge: Cambridge University Press.
- Zuckerman, M. (2007). *Sensation seeking and risky behavior*. Washington, DC: American Psychological Association.
- Zuckerman, M., & Kuhlman, D. M. (2000). Personality and risk-taking: Common biosocial factors. *Journal of Personality*, *68*, 999–1029.