

# The association of at-risk, problem, and pathological gambling with substance use, depression, and arrest history

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## Abstract

We examined at-risk, problem, or pathological gambling co-occurrence with frequency of past-year alcohol, tobacco, and marijuana use; depressive symptoms; and arrest history. Data included the responses of over 3,000 individuals who participated in a 2006 telephone survey designed to understand the extent of at-risk, problem, and pathological gambling; comorbidity levels with substance use; mental health; and social problems among Southwestern U.S. residents. Data were analyzed with multinomial and bivariate logistic regression. Respondents at risk for problem gambling were more likely to use alcohol, tobacco, and marijuana than those respondents not at risk. Pathological gamblers were no more or less likely to consume alcohol or tobacco than were non-gamblers or those not at risk. A dose-response relationship existed between degree of gambling problems and depressive symptoms and arrest history. Interventions for at-risk or problem gamblers need to include substance use treatment, and the phenomenon of low levels of substance use among pathological gamblers needs further exploration.

**Keywords:** problem gambling, substance use, depression, arrest history

## Introduction

Gambling, at the recreational, at risk, problem, and pathological level, is on the rise in the United States and internationally (Gerstein et al., 1999; National Gambling Impact Study Commission, 1999; Stucki & Rihs-Middel, 2007). Additionally, problem or pathological gamblers tend to have higher rates of alcohol abuse (Sellman, Adamson, Robertson, Sullivan, & Coverdale, 2005; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2001), tobacco dependence (Petry & Oncken, 2002; Rodda, Brown, & Phillips, 2004), marijuana use (Engwall, Hunter, & Steinberg, 2004; Kausch, 2003), depressive symptoms (Goodyear-Smith et al., 2006), and arrest history (Gerstein et al., 1999; Thompson & Schwer, 2005).

In general, gambling disorders and substance use disorders are commonly comorbid conditions. Crockford and el-Guebaly (1998) found in a review of clinical and community gambling studies conducted between 1966 and 1999 that 25% to 63% of pathological gamblers had a lifetime substance abuse disorder. Cunningham-Williams, Cottler, Compton, and Spitznagel (1998) found in the St. Louis Epidemiologic Catchment Area Study that among problem gamblers with alcohol abuse or dependence, gambling problems developed within 2 years of the onset of alcoholism in 65% of the cases and problem gambling occurred after the onset of nicotine dependence in 67% of the cases. In a 2000–2001 study of 960 callers to the Connecticut Council on Problem Gambling Helpline, Potenza, Steinberg, and Wu (2005) reported that 173 callers to the helpline reported alcohol use problems; compared with those callers without an alcohol use problem ( $N = 787$ ), they were more likely to acknowledge problems with more forms of gambling. Petry, Stinson, and Grant (2005) analyzed the National Epidemiologic Survey on Alcohol and Related Conditions (2001–2002) and found that 73% of the 192 pathological gamblers in this large, nationally representative sample had lifetime alcohol use disorders and that 60.4% reported lifetime nicotine dependence. Associations between problem gambling and marijuana use are less well-known. In a chart review of 113 pathological gamblers in treatment at a Veterans Administration Center, those reporting a history of drug abuse or dependence reported the highest lifetime rates of marijuana use (72.7%; Kausch, 2003). Petry and Tawfik (2001) reported that 20% of youth seeking treatment for marijuana had a gambling problem.

Both general population and gambling treatment studies of gamblers have shown elevated depression scores and higher frequencies of major depressive disorders among those with gambling problems (Bland, Newman, Orn, & Stebelsky, 1993; Cunningham-Williams et al., 1998; Lynch, Macejowski, & Potenza, 2004; Petry et al., 2005). Kausch (2003) found in chart reviews of gamblers in treatment that 43% ( $N = 113$ ) had a clinical diagnosis of depressive disorder. In a Scottish study, pathological gamblers had significantly higher rates of depression than did problem gamblers, non-problem gamblers, and non-gamblers (Moodie & Finnigan, 2006). Although data on problem gamblers and arrest history are limited, Potenza et al. (2005) found that, compared with general population samples, problem and pathological gamblers are more likely to report legal issues, including crimes, arrest, and incarceration. Adult male pathological gamblers, for instance, are more likely to be involved in illegal activities (Abbott & Volberg, 1999), and a study of incarcerated women who scored high on a measure of problem gambling found that preincarceration levels of gambling involvement and expenditures on gambling were higher than in general population samples (Abbott & McKenna, 2005).

The literature clearly delineates the associations between problem and pathological gambling and substance use disorders. However, most of this literature focuses on people who meet diagnostic criteria for substance use disorders. Such an approach examines whether or not people are above a clinical cutoff for substance disorders rather than examining their position in the full range of the distribution of substance use behaviors. Also, rates of these disorders are generally compared between individuals who meet some type of gambling problem criteria versus no gambling problem or between individuals who meet pathological gambling criteria versus non-gamblers or those who do not meet pathological gambling criteria. Statistically, using dichotomous outcomes in measuring associations

between independent and dependent variables makes less use of the available information on the relationship between gambling and substance use behaviors than would be achieved with more finely graded measures of both constructs. That is, the focus has for the most part been on individuals whose substance use has progressed over the years to become extremely deleterious such that they meet diagnostic criteria for abuse and dependence. Far less is known about the associations between various degrees of gambling problems and substance use among people who consume substances in smaller amounts and who may not meet diagnostic criteria. Given that most people who consume substances do not progress to abuse and dependence, an important gap in knowledge concerning comorbid gambling and substance use exists. Further, multivariate examinations of these relationships with large survey data sets are rare.

Equally important, relationships between gambling and substance use may be nonlinear in nature, suggesting that examinations of these relationships with standard ordinary least squares regression techniques may be inappropriate. The present study contributes to a better understanding of the relationship between comorbid gambling problems and substance use consumption by using binomial and multinomial logistic regression to examine associations between lifetime gambling (not a gambler or not at risk, at risk, problem, and pathological) and frequency of past-year substance use. We also examine associations between lifetime gambling, number of lifetime depressive symptoms, and lifetime arrest history. The overarching goal is to add to the literature on these discrete associations by using a large sample of adult individuals living in a large southwestern state to better understand the connections between distinct levels of gambling and levels of substance use, depression, and history of arrests.

## Methods

### Sample

Data are from the 2006 Study of Gambling and Problem Gambling in New Mexico (Volberg & Bernhard, 2006), where a 15- to 20-min phone interview survey was conducted between September of 2005 and January 2006. The main sample for this survey included 3,007 residents of New Mexico aged 18 years and over. These participants were selected through random-digit dialing to ensure that each telephone-owning household in New Mexico had an equal probability of selection into the sample. Nearly 15,000 telephone numbers were initially called. Of these numbers, about 11,000 were potentially eligible numbers. Of the remaining 6,376 households with which contact was made, 3,007 individuals completed the telephone interview, resulting in a completion rate of 47%. Of note is that the Pew Research Center found that rigorously conducted telephone polls obtain representative samples of the public and provide accurate data about the views and experiences of Americans even though response rates have declined from 61% to 51% since 1997 (Pew Research Center for the People & the Press, 2004).

The study also included an additional sample of 589 Native American New Mexico residents aged 18 years and over. These respondents were selected from a random sample of telephone numbers likely to belong to a Native American household. Native American ethnicity was confirmed for all respondents in this subsample before conducting the interview.

Procedurally, the subsample included approximately 3,600 telephone numbers, of which 2,253 were determined to be potentially eligible. Approximately 1,800 of these 3,600 numbers could not be contacted; of the remaining 1,792 households with which contact was made, 1,376 were eligible and 589 individuals completed the telephone interview, resulting in a completion rate of 43%. The overall sample for the present study therefore included 3,596 residents of New Mexico aged 18 years and over.

## Measures

*Demographic characteristics.* Respondents were asked their gender (male vs. female); their date of birth, which was then converted into the participant's age (a continuous variable); their annual family income (eight categories:  $\leq$ \$15,000 to  $\geq$ \$80,000); and their marital status, which included the following response categories: married, common-law, living as married, widowed, divorced, separated, and never married. In this study, individuals who were married, had a common-law arrangement, or had been living as married were combined into one category. Individuals who were widowed, divorced, separated, and never married were combined into a separate category.

Finally, individuals were asked which of the following racial or ethnic groups describe them best: Native American, Asian or Pacific Islander, Black or African American, White or Caucasian, or something else. Participants were also asked if they were Hispanic or Latino. Because of the relatively small sample sizes of Asian or Pacific Islanders, Blacks or African Americans, and those of Other backgrounds, for this study, we created the following four response categories: non-Hispanic/Latino Whites, non-Hispanic/Latino Native Americans, Hispanic/Latino, and non-Hispanic/Latino Other.

*Lifetime problem gambling.* In problem gambling prevalence surveys, individuals are classified as at-risk, problem, or pathological gamblers on the basis of their number of positive responses on a valid and reliable problem gambling screen. The National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS), lifetime measure, was used to provide a measure of problem gambling (Gerstein et al., 1999). The NODS is a reliable and valid screening measure that is based on the most recent psychiatric criteria for pathological gambling (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 1994 [DSM-IV]) and is appropriate for use in population-based telephone surveys (Abbott & Volberg, 2006; Gerstein et al., 1999; Hodgins, 2004). Individuals who meet five or more of the DSM-IV criteria for pathological gambling exhibit "persistent and recurrent maladaptive gambling behavior", are unable to resist impulses to gamble, and gamble in such a way that "disrupts personal, family, or vocational pursuits" (DSM-IV, 1994, p. 615). "Problem gamblers" who meet three or four of the DSM-IV criteria can be preoccupied with gambling, gamble for emotional escape, and may lie repeatedly about gambling (Toce-Gerstein, Gerstein, & Volberg, 2003). "At-risk gamblers" meet one or two DSM-IV criteria, the most common of which is *chasing*, followed by preoccupation and escape (Toce-Gerstein et al., 2003). The NODS consists of two 17-item measures, one that assesses lifetime problem gambling and the other past-year gambling. In this study, we used the lifetime measure of gambling. Examples of questions include the following: "Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness, or

depression?” “Have you ever lied to family members, friends, or others about how much you gamble or how much you lost on gambling?” “Has there ever been a period when, if you lost money gambling one day, you would return another day to get even?” Each criterion item is scored 0 or 1, to produce a maximum score of 10. Several items are administered only if a preliminary screening question is endorsed. Scores of 0 are interpreted as indicating low risk. In this study, individuals who were non-gamblers or who scored 0 were coded as “non-gamblers or not at risk.” Individuals who scored 1 or 2 were coded as being “at risk of problem gambling.” Individuals who scored 3 to 4 were coded as “problem gamblers” and those who scored 5 or more were coded as “pathological gamblers.”

*Frequency of alcohol, tobacco, and marijuana use in the past year.* To assess alcohol, tobacco, and marijuana use in the past year, we asked respondents whether they had consumed alcoholic beverages; used cigarettes, chewing tobacco, or snuff; or used marijuana or hashish during the past 12 months. Response options for all three questions included daily (30 or more times/month), several times a week (6–29 times/month), several times a month (3–5 times/month), once a month or less (6–12 times/year), only a few days all year (1–5 times/year), or never during the past 12 months.

*Lifetime depression symptoms and history of arrest.* Although numerous screening measures have been developed to detect depression, there is good evidence that even very short screens can be as effective as longer screening measures. A recent meta-analysis demonstrated that a two-item screen is effective in identifying clinical depression among adults in primary care settings (U.S. Preventive Services Task Force, 2002). These items query whether a person has “felt down, depressed or helpless” or “felt little interest or pleasure in doing things” over the past 2 weeks.

For the purpose of obtaining a lifetime measure of depression symptoms, answers to the following two questions were included in the analysis: “In your lifetime, have you ever had a period of 2 weeks or longer when nearly every day you felt sad, empty, or depressed for most of the day?” and “In your lifetime, have you ever had a period of 2 weeks or longer when you lost interest in most things like work, hobbies, and other things you usually enjoyed?” Responses to these questions were dichotomous (Yes-No) and scores on this small depression scale could range from 0 to 2, depending on whether respondents endorsed none, one, or both items (Cronbach’s  $\alpha = 0.76$ ). History of arrest was assessed by the question, “Have you ever been arrested for any reason?” with a dichotomous (Yes-No) response format.

## **Data analysis**

Our independent variables included the demographic characteristics of the respondents and their gambling status. One of our dependent variables (arrest history) was dichotomous. In this case, logistic regression was clearly an appropriate analytic strategy. As described in the Measures subsection, other dependent variables were measured on Likert scales. Modeling these data with standard ordinary least squares (OLS) regression techniques would assume a linear relationship between a unit change in the independent and dependent variables. Further, OLS regression makes the assumption that the outcome variable is continuous and

that each unit change on the dependent variable is equivalent. For example, the change from 0 to 1 is conceptualized as representing an equivalent amount of change as the change from 1 to 2. Because of the scaled nature of most of our dependent variables, we did not believe it was appropriate to assume that each unit change on the dependent variable was equivalent to the next.

Therefore, we first considered the use of an ordinal logistic regression model, which does not require this latter assumption. However, such models test the assumption of a proportional relationship of the independent and dependent variables. A Brant test indicated that a proportional odds assumption for an ordinal logistic regression was not met (Long & Freese, 2005). Therefore, we used bivariate and multivariate multinomial logistic regression to examine the association of the demographic characteristics and problem gambling, with the variables assessing frequency of alcohol, tobacco, and marijuana use, as well as depression symptoms. Our models were estimated with and without statistically adjusting for the demographic controls.

All analyses presented in this paper were conducted with STATA 10.0 (StataCorp, 2008). Coefficients from a multinomial or binomial logistic regression may be difficult to interpret. Therefore, we report odds ratios (ORs), which provide an intuitively meaningful metric of the relationship of different independent variables with the dependent variable of interest. Numerically, ORs are the exponentiated value ( $e^\beta$ ) of the parameters from the logistic regression models. ORs of 1.0 indicate no relationship between the independent variable and dependent variable. ORs greater than 1.0 indicate that increases in the independent variable are associated with *increases* in the dependent variable, whereas ORs below 1.0 indicate that increases in the independent variable are associated with *decreases* in the dependent variable.

## Results

The sample consisted of 3,596 individuals, 60% of whom were women and 40% men. The average age was 51 years ( $SD = 17.0$ ). Most respondents were identified as White/non-Hispanic (51.5%), followed by Latinos (23.3%), Native Americans (18.5%), and Other backgrounds (6.7%). About two thirds were married or living together, 9% widowed, 12% divorced, 1.6% separated, and 16.1% never married. The median total household income in the year prior to the interview fell within the range of \$35,000 to \$50,000. Most respondents were not gamblers or did not meet the criteria for being at risk (91.3%). Approximately 6.5% were at risk of problem gambling, 1.2% were problem gamblers, and 1.0% were pathological gamblers. The percentages of individuals who had consumed alcohol, tobacco, and marijuana in the past year were 54%, 24%, and 3%, respectively. About 33% had experienced at least a depressive symptom and 13% had been arrested in their lives.

### Demographic characteristics, problem gambling, and substance use

The results of the multinomial logistic regression analyses of the associations of demographic characteristics and lifetime problem gambling with past-year alcohol, tobacco, and marijuana use are shown in Table 1. To facilitate the interpretation of the results of the

multinomial logistic regression analyses, we discuss the results for each of the levels of the dependent variables as compared with the reference category. The reference category for all these comparisons is “never consumed alcohol, tobacco, and marijuana in the past year.” The five categories of substance use that are compared with this reference category are as follows: 1 = only a few days per year (1–5 times/year), 2 = once per month or less (6–12 times/year), 3 = several times per month (3–5 times/month), 4 = several times per week (6–29 times/month), and 5 = daily (30 or more times/month).

*Substance use only a few days (1–5 times/year).* People who infrequently use alcohol, tobacco, and marijuana (only a few days all year or 1–5 times/year) are more likely to be older when compared to those people who never consume these substances. Higher income was positively associated with alcohol use in the bivariate and multivariate models. Individuals who were married or living together had lower ORs associated with tobacco in the bivariate and multivariate analyses and lower ORs associated with marijuana use in the bivariate analyses only. Native Americans were less likely to consume alcohol when compared with Whites in the bivariate and multivariate models. Although Native Americans were considerably more likely to use tobacco and marijuana than were Whites, this association was not significant in the multivariate model.

Being at risk of problem gambling was positively associated with alcohol use but not with tobacco and marijuana use. The magnitude of this association increased and remained significant when demographic controls were entered in the model. Being a problem gambler was significantly associated with the use of marijuana a few days during the year (OR = 5.18), though the association became non-significant when the demographic controls were entered in the model.

*Substance use about once per month (6–12 times/year).* The consumption of alcohol and marijuana about once per month (6–12 times/year) was less likely to occur among females than males and the consumption of alcohol, tobacco, and marijuana was less likely to occur among older individuals compared with those who never consumed these substances in the past year. Alcohol use was more likely to occur among those with higher incomes in the bivariate and multivariate models. Individuals who were married or living together were less likely to consume alcohol about once per month in the multivariate model. Native Americans were about half as likely as Whites to consume alcohol (adjusted OR [aOR] = 0.42) but were substantially more likely than Whites to use tobacco, even after including the demographic controls (aOR = 3.48).

Individuals at risk of problem gambling were significantly more likely to use tobacco (aOR = 2.72) and marijuana (aOR = 5.36) about once a month or less when compared with individuals who are not gamblers nor at risk of problem gambling. Pathological gamblers were also substantially more likely to use tobacco (aOR = 6.64).

*Substance use several times per month (3–5 times/month).* The consumption of alcohol, tobacco, and marijuana several times per month (3–5 times/month) was significantly less likely to occur among females and among older individuals compared with those who never consumed these substances in the past year. Alcohol use several times per month was

**Table 1**  
*Association of demographic characteristics and lifetime problem gambling with alcohol, tobacco, and marijuana use in the past 12 months: Results of bivariate and multivariate multinomial regression analysis*

Frequency of substance use by demographics and problem gambling	Alcohol use			Tobacco use			Marijuana use					
	Bivariate		Multivariate	Bivariate		Multivariate	Bivariate		Multivariate			
	OR	SE	aOR	SE	OR	SE	aOR	SE	aOR	SE		
<b>Only a few days all year (1-5 times/year)</b>												
Female (Ref = Male)	1.05	0.11	1.14	0.15	0.59*	0.14	0.69	0.21	0.85	0.28	1.15	0.44
Age	0.98***	0.003	0.98***	0.004	0.96***	0.007	0.97***	0.10	0.95***	0.01	0.96**	0.01
Income	1.19***	0.04	1.19***	0.05	1.00	0.07	1.09	0.09	0.90	0.09	0.95	0.10
Married or living together (Ref = Other)	1.09	0.11	0.80	0.12	0.51**	0.12	0.50*	0.16	0.46*	0.16	0.70	0.28
<b>Race/ethnicity (Ref = White)</b>												
American Indian	0.57***	0.07	0.49***	0.09	2.75***	0.66	1.78	0.66	2.45**	0.85	1.22	0.58
Latino	1.17	0.13	0.81	0.13	0.81	0.23	0.97	0.39	0.89	0.36	1.09	0.51
Other race	0.62*	0.14	0.82	0.30	0.82	0.43	0.72	0.74	0.41	0.42	1.15	1.21
<b>Problem gambling (Ref = Not a gambler or at risk)</b>												
At risk	1.67**	0.33	2.12**	0.53	0.79	0.47	0.30	0.30	0.91	0.67	0.98	0.72
Problem	1.09	0.48	0.75	0.43	2.81	2.10	1.18	1.25	5.18*	3.87	4.13	3.23
Pathological	0.74	0.37	0.38	0.29	1.68	1.73	1.60	1.72	—	—	—	—
<b>Once/month or less (6-12 times/year)</b>												
Female (Ref = Male)	0.70**	0.08	0.79	0.11	0.62	0.19	0.94	0.34	0.24**	0.12	0.33*	0.18
Age	0.98***	0.003	0.97***	0.01	0.96***	0.01	0.97**	0.01	0.97*	0.01	0.97*	0.02
Income	1.26***	0.05	1.26***	0.05	0.90	0.08	0.95	0.10	0.87	0.12	0.90	0.13
Married or living together (Ref = Other)	1.14	0.13	0.70*	0.11	0.57	0.17	1.08	0.42	0.55	0.24	0.42	0.23

Table 1, Continued

Frequency of substance use by demographics and problem gambling	Alcohol use			Tobacco use			Marijuana use					
	Bivariate		Multivariate	Bivariate		Multivariate	Bivariate		Multivariate			
	OR	SE	aOR	SE	OR	SE	OR	SE	aOR	SE		
Race/ethnicity (Ref = White)												
American Indian	0.54***	0.08	0.42***	0.09	3.71***	1.13	3.48**	1.68	1.70	0.82	0.81	0.54
Latino	1.06	0.14	0.91	0.16	1.27	0.42	2.40	1.16	0.72	0.40	0.64	0.45
Other race	0.83	0.19	0.10	0.38	1.08	0.65	1.97	2.12	0.71	0.73	1.81	1.98
Problem gambling (Ref = Not a gambler or at risk)												
At risk	1.18	0.30	1.31	0.14	3.68**	1.55	2.72*	1.38	11.24***	5.02	5.36**	2.98
Problem	1.79	0.76	1.41	0.71	—	—	—	—	7.12	7.51	—	—
Pathological	0.43	0.32	0.49	0.38	6.70*	5.09	6.64*	5.41	—	—	—	—
<b>Several times/month (3–5 times/month)</b>												
Female (Ref = Male)	0.54***	0.06	0.58***	0.08	0.55***	0.02	0.82	0.28	0.26*	0.15	0.18*	0.14
Age	0.98***	0.003	0.97***	0.004	0.95***	0.01	0.96**	0.01	0.95*	0.02	0.96	0.02
Income	1.38***	0.05	1.38***	0.05	0.93	0.08	0.98	0.09	0.90	0.15	0.71	0.15
Married or living together (Ref = Other)	1.11	0.12	0.59***	0.09	0.63	0.17	1.66	0.64	0.81	0.44	2.17	1.69
Race/ethnicity (Ref = White)												
American Indian	0.37***	0.06	0.26***	0.05	4.64***	1.24	4.97***	2.18	2.51	1.41	0.77	0.63
Latino	0.94	0.11	0.71*	0.12	0.73	0.25	1.8	0.88	0.54	0.41	0.28	0.32
Other race	0.62*	0.15	0.51	0.21	0.54	0.39	—	—	—	—	—	—
Problem gambling (Ref = Not a gambler or at risk)												
At risk	1.58*	0.33	1.59	0.44	4.11***	1.48	2.36	1.19	2.73	2.10	—	—

Table 1, Continued

Frequency of substance use by demographics and problem gambling	Alcohol use						Tobacco use						Marijuana use					
	Bivariate		Multivariate		Bivariate		Multivariate		Bivariate		Multivariate		Bivariate		Multivariate			
	OR	SE	aOR	SE	OR	SE	aOR	SE	OR	SE	aOR	SE	OR	SE	aOR	SE		
Problem	0.54	0.34	0.55	0.37	2.20	2.27	1.38	1.46	7.77	8.22	4.96	5.63						
Pathological	1.03	0.48	0.89	0.52	2.62	2.71	3.07	3.12	—	—	—	—						
<b>Several times/week (6–29 times/month)</b>																		
Female (Ref = Male)	0.40***	0.05	0.47***	0.08	0.73	0.16	0.92	0.27	0.12**	0.09	0.24	0.20						
Age	1.00	0.004	0.99*	0.005	0.94***	0.01	0.95***	0.01	0.91***	0.02	0.93*	0.03						
Income	1.50***	0.06	1.50***	0.07	0.87*	0.06	0.94	0.08	0.71	0.15	0.74	0.16						
Married or living together (Ref = Other)	1.16	0.15	0.50***	0.09	0.52**	0.12	0.55	0.17	0.27*	0.16	0.57	0.45						
<b>Race/ethnicity (Ref = White)</b>																		
American Indian	0.33***	0.07	0.20***	0.06	3.01***	0.67	1.61	0.55	2.83	1.62	0.74	0.70						
Latino	0.53***	0.09	0.53**	0.12	0.69	0.19	0.67	0.28	0.97	0.64	1.11	0.96						
Other race	0.67	0.18	0.54	0.26	2.14*	0.71	—	—	1.24	1.29	0.00	0.00						
<b>Problem Gambling (Ref = Not a gambler or at risk)</b>																		
At risk	2.48***	0.54	2.21**	0.67	2.02	0.77	1.26	0.68	4.50*	2.98	3.16	2.7						
Problem	1.17	0.65	0.76	0.59	5.40**	2.98	3.35	2.28	—	—	—	—						
Pathological	0.56	0.41	0.71	0.58	3.22	2.41	3.25	2.62	—	—	—	—						
<b>Daily (≥30 times/month)</b>																		
Female (Ref = Male)	0.42***	0.07	0.48***	0.10	0.63***	0.06	0.73**	0.09	0.26***	0.11	0.29*	0.16						
Age	1.02***	0.005	1.01	0.007	0.98***	0.003	0.98***	0.004	0.93***	0.01	0.92***	0.02						
Income	1.46***	0.08	1.44***	0.09	0.93*	0.03	0.89***	0.30	0.93	0.11	0.95	0.12						
Married or living together (Ref = Other)	1.18	0.20	0.63	0.15	0.71***	0.07	0.81	0.10	0.18***	0.08	0.17**	0.10						

Table 1, Continued

Frequency of substance use by demographics and problem gambling	Alcohol use			Tobacco use			Marijuana use			
	Bivariate		Multivariate	Bivariate		Multivariate	Bivariate		Multivariate	
	OR	SE	aOR	SE	OR	SE	OR	SE	aOR	SE
Race/ethnicity (Ref = White)										
American Indian	0.11***	0.05	0.13***	0.06	0.62***	0.09	0.67	0.36	0.11**	0.09
Latino	0.40***	0.10	0.41**	0.13	0.80*	0.09	0.78	0.35	0.17*	0.14
Other race	0.47	0.20	0.18	0.19	0.97	0.19	1.59	0.97	2.01	1.64
Problem gambling (Ref = Not a gambler or at risk)										
At risk	3.87***	0.95	4.42***	1.47	2.83***	0.43	2.86	1.57	2.68	1.83
Problem	1.79	1.12	2.10	1.66	2.49*	0.88	12.21***	7.80	3.20	3.68
Pathological	0.57	0.58	1.11	1.19	1.98	0.83	13.69***	0.001	14.04**	11.7

Note. Dashes indicate insufficient data available for these analyses. In the multinomial regression analyses, “never having consumed the substance in the past year” is the reference category for the frequency of alcohol, tobacco, and marijuana use variables. OR = odds ratio; aOR = adjusted OR. \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

more likely to occur among individuals with higher incomes and less likely among those who were married or living together. Native Americans were less likely to drink alcohol but more likely to use tobacco several times per month. From the multivariate analysis, Latinos were less likely than Whites to drink alcohol.

Individuals who were at risk of problem gambling were more likely to drink alcohol and use tobacco several times per month than were non-gamblers or those not at risk, but these associations became non-significant when demographic controls were entered.

*Substance use several times per week (6–29 times/month).* The consumption of alcohol several times per week (6–29 times/month) was less likely to occur among women in both the bivariate and multivariate analyses, compared with those who never consumed alcohol in the past year. For marijuana, for the same contrast, only the bivariate analysis was significant. The use of these substances was less likely to occur among older individuals and among those married or living together, though only the coefficients pertaining to the alcohol variable remained significant in the multivariate models. Higher incomes were positively associated with this level of alcohol use in the bivariate and multivariate analyses.

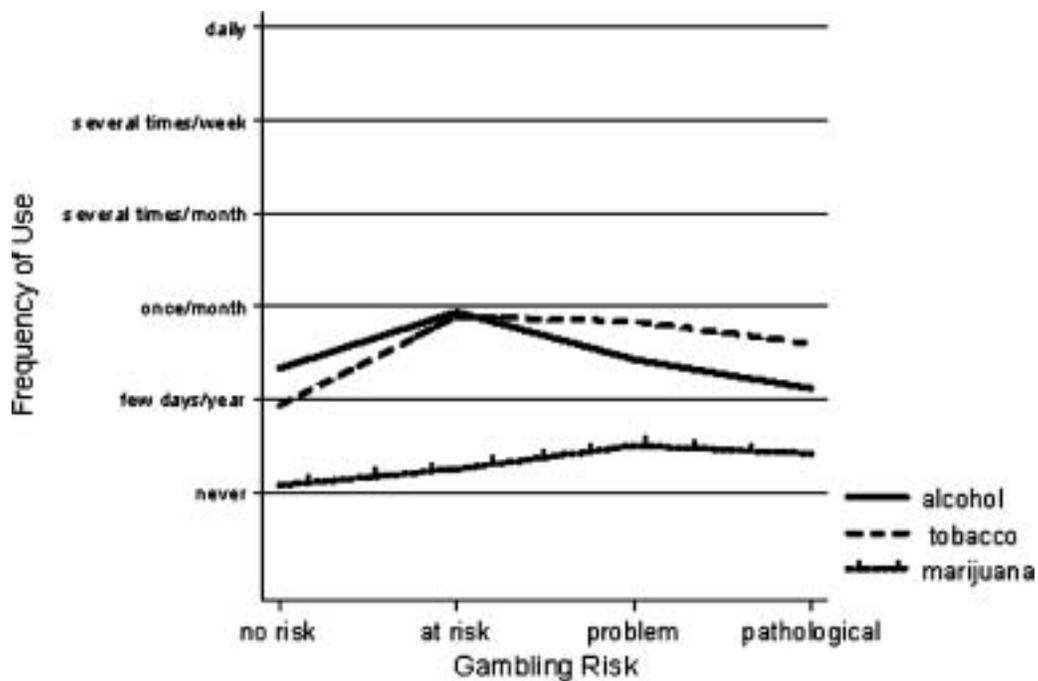
Individuals at risk of problem gambling were more likely to drink alcohol (aOR = 2.21) and use marijuana (OR = 4.50) several times per week, but the association with marijuana was not significant when demographic controls were entered, though the magnitude remained considerably large (aOR = 3.16). Individuals with problem gambling were more likely to use tobacco (OR = 5.40) several times per week, but this association became non-significant when demographic controls were entered in the model (aOR = 3.35).

*Daily substance use (30 or more times/month).* Finally, the consumption of tobacco and marijuana on at least a daily basis (30 or more times/month) was more likely to occur among males and younger individuals in both the bivariate and multivariate models and alcohol use on at least a daily basis was more likely to occur among older individuals in only the bivariate analysis when compared with those who never consumed alcohol, tobacco, and marijuana in the past year. Individuals with higher incomes were more likely to consume alcohol but were less likely to use tobacco. Individuals who were married or living together were significantly less likely to consume tobacco and marijuana at this frequency. Native Americans and Latinos were substantially less likely than Whites to consume these substances on a daily basis.

Being at risk for problem gambling was significantly associated with alcohol (OR = 3.87) and tobacco (OR = 2.83) use. The magnitude of the association with marijuana use was large (aOR = 2.68), but it was not a statistically significant association at the conventional level of .05 because of its large standard error ( $SE = 1.83$ ). Problem gambling was significantly associated with tobacco (OR = 2.49) and marijuana (OR = 12.21) use in the bivariate but not the multivariate models. Finally, pathological gambling was also strongly and significantly associated with marijuana use (aOR = 14.04).

Consistent with these findings, Figure 1 shows that the average frequency of alcohol consumption is highest among participants at risk for problem gambling and lowest among

Figure 1. Mean frequency of alcohol, tobacco, and marijuana use by degree of gambling problem.



those with pathological gambling. The average frequency of tobacco use is also highest among those at risk of gambling problems, with a decline in the frequency observed among those with problem and pathological gambling. We find it interesting that – consistent with the results of the multinomial regression analyses – the average frequency of marijuana use is highest among problem and pathological gamblers.

### Demographic characteristics, problem gambling, and lifetime depression symptoms

The results of the multinomial analyses of the associations of demographic characteristics and lifetime problem gambling with lifetime depression symptoms are shown in Table 2. To facilitate the interpretation of the results of the multinomial regression analyses, we discuss the results for each of the two levels of the dependent variable as compared with the reference category. The reference category is “never having experienced either of the two depression symptoms.” The two categories of depression symptoms that are compared with this reference category are as follows: 1 = any one depression symptom and 2 = two depression symptoms.

*One depression symptom.* Compared with individuals who never experienced either of the two depression symptoms, individuals who experienced one depression symptom were more likely to have lower incomes, but this association lost its significance in the multivariate analyses. Individuals who were married or living together were about half as likely to experience one symptom of depression in both the bivariate and multivariate analyses. We

Table 2

*Association of demographic characteristics and lifetime problem gambling with lifetime depression symptoms: Results of bivariate and multivariate multinomial regression analysis*

Frequency of depression symptoms by demographics and problem gambling	Depression			
	Bivariate		Multivariate	
	OR	SE	aOR	SE
<b>One depression symptom</b>				
Female (Ref = Male)	1.14	0.11	1.25	0.15
Age	1.00	0.003	1.00	0.004
Income	0.90***	0.03	0.94	0.03
Married or living together (Ref = Other)	0.58***	0.06	0.62***	0.08
Race/ethnicity (Ref = White)				
American Indian	0.94	0.12	0.74	0.13
Latino	1.11	0.12	1.03	0.15
Other race	0.70	0.15	1.02	0.36
Problem gambling (Ref = Not a gambler or at risk)				
At risk	1.58*	0.29	1.35	0.32
Problem	3.69**	1.50	4.01**	2.00
Pathological	3.29*	0.01	2.47	1.43
<b>Two depression symptoms</b>				
Female (Ref = Male)	1.72***	0.16	1.96***	0.23
Age	0.99**	0.003	0.99**	0.004
Income	0.91***	0.03	0.94*	0.03
Married or living together (Ref = Other)	0.59***	0.05	0.62***	0.08
Race/ethnicity (Ref = White)				
American Indian	0.68**	0.08	0.47***	0.08
Latino	0.91	0.10	0.56***	0.08
Other race	0.55**	0.12	0.96	0.30
Problem gambling (Ref = Not a gambler or at risk)				
At risk	2.13***	0.34	2.11***	0.42
Problem	5.18***	1.86	7.54***	3.31
Pathological	7.25***	2.88	5.32***	2.52

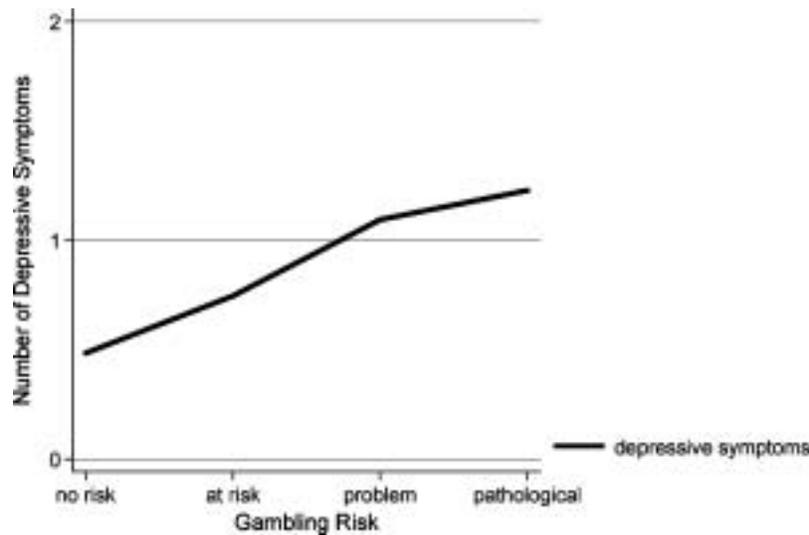
*Note.* In the multinomial regression analyses, “not having experienced any depression symptoms in their lives” is the reference category for the depressive symptoms variable. OR = odds ratio; aOR = adjusted OR.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

find it interesting that there were no racial or ethnic differences in the experience of one symptom of depression.

Individuals at risk of problem gambling were more likely to experience a symptom of depression (OR = 1.58), but this association became attenuated and not significant when demographic controls were added to the model. Problem gamblers also had a substantially higher risk of experiencing a depression symptom (OR = 3.69). When the demographic

Figure 2. Mean number of depressive symptoms by level of gambling problem.



controls were added, the magnitude of the ORs increased and remained significant (aOR = 4.01). On the other hand, pathological gambling was associated with an increased risk of one depression symptom in the bivariate but not the multivariate model.

*Two depression symptoms.* Compared with individuals who never experienced either of the two depression symptoms, individuals who experienced both symptoms in their lives were more likely to be females, younger, have lower incomes, and not be married or living with someone. Native Americans and Latinos also were less likely than Whites to experience two symptoms of depression. Individuals of Other racial or ethnic backgrounds were also less likely than Whites to experience two symptoms of depression, but only in the bivariate analysis.

Being at risk of problem gambling (aOR = 2.13), being a problem gambler (aOR = 7.54), and being a pathological gambler (aOR = 5.32) were all significantly associated with experiencing two symptoms of depression.

Figure 2 displays the dose-response relationship between gambling problems and depressive symptoms estimated with the multinomial logistic regression analyses described earlier. The average number of depressive symptoms increases with the level of gambling problem, though some leveling off occurs once the person has developed problem gambling.

### Demographic characteristics, problem gambling, and history of arrest

The results of the associations of demographic characteristics and problem gambling with a history of arrest are shown in Table 3. Women, older individuals, and those with higher incomes were significantly less likely to have been arrested. Native Americans were more likely to have been arrested, but this association became non-significant in the multivariate model.

Table 3

*Association of demographic characteristics and lifetime problem gambling with history of arrests: Results of bivariate and multivariate logistic regression analysis*

History of arrests by demographics and problem gambling	Arrests			
	Bivariate		Multivariate	
	OR	SE	aOR	SE
Female (Ref = Male)	0.21***	0.02	0.21***	0.03
Age	0.97***	0.003	0.97***	0.004
Income	0.91**	0.03	0.87***	0.03
Married or living together (Ref = Other)	0.60***	0.06	0.74*	0.10
Race/ethnicity (Ref = White)				
American Indian	1.50***	0.18	0.81	0.14
Latino	1.16	0.13	1.03	0.17
Other race	0.94	0.23	0.99	0.36
Problem gambling (Ref = Not a gambler or at risk)				
At risk	2.47***	0.40	1.56*	0.34
Problem	3.08**	1.07	1.59	0.67
Pathological	3.85***	1.38	3.12*	1.43

Note. OR = odds ratio; aOR = adjusted OR.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

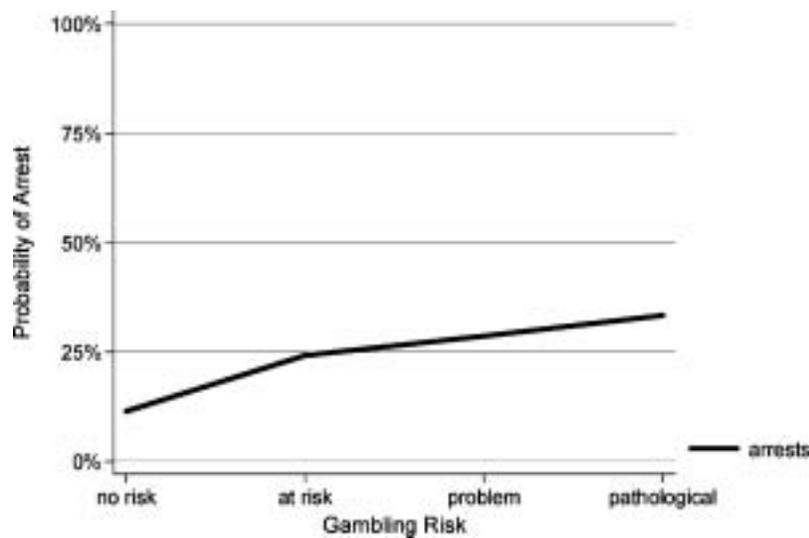
A history of arrest was more likely to be reported among individuals at risk of problem gambling (OR = 2.47), those with problem gambling (OR = 3.08), and those categorized as pathological gamblers (OR = 3.85). When demographic controls were included in the model, the magnitude of the associations decreased for all three but remained significant for those at risk of problem gambling (aOR = 1.56) and those categorized as pathological gamblers (aOR = 3.12).

Figure 3 depicts how the probability of having ever been arrested increases with the level of gambling problem. This is consistent with the earlier findings that showed increased likelihood of an arrest history with an increased degree of gambling problem.

## Discussion

In this study of over 3,000 adults who participated in a telephone survey about gambling and other behaviors, we found that those at risk for problem gambling were more likely to consume alcohol at each of the drinking levels, from relatively infrequent drinking to daily drinking, when compared with individuals who do not gamble or who were not classified as being at risk. A similar finding was observed for tobacco use. These significant findings remained even after controlling for demographic characteristics. These findings suggest that the consumption of alcohol and the use of tobacco are common behaviors among

Figure 3. Percentage of individuals with an arrest history by degree of gambling problem.



individuals at risk of problem gambling. Comorbid substance use is a common factor among gamblers, suggesting that cross-addictive behavior may be occurring (National Research Council, 1999). Substance users might be turning to gambling as another form of addictive behavior and their “at-risk” status is an initial gambling phase that may lead to problem or pathological gambling. This is consistent with the findings of Cunningham-Williams et al. (1998), which suggest that among problem gamblers with alcohol abuse or dependence, their gambling problems developed within 2 years of the onset of alcoholism in 65% of the cases, and problem gambling occurred after the onset of nicotine dependence in 67% of the cases. More longitudinal studies are needed to further investigate the directionality of these associations.

Compared with non-gamblers or those not at risk, individuals at risk of problem gambling had an increased likelihood of using marijuana when the consumption was more frequent, in this case beginning with individuals who use marijuana once per month. This finding is consistent with prior research on frequent marijuana users in treatment who also report increased levels of gambling behaviors (Petry & Tawfik, 2001).

Interestingly, individuals who met criteria for problem gambling were no more or less likely to consume alcohol at the various levels when compared with non-gamblers or those not at risk. These findings are somewhat similar to the 2005 gambling helpline study by Potenza et al., which reported that only a small percentage of individuals with current gambling problems and past alcohol problems reported drinking while gambling. The findings of both studies contradict previous research that shows that problem gamblers report higher levels of drinking while gambling (Baron & Dickerson, 1999; Smart & Ferris, 1996; Welte et al., 2001; Zack, Stewart, Klein, Loba, & Fragopoulos, 2005). Of note is that Sjoberg (1969), in an experimental study, found that participants were less willing to gamble their money when given a high dose of alcohol, but their gambling increased with a low dose of alcohol.

Our results also indicate that problem gamblers were more likely to consume tobacco but only at the higher frequency of consumption (beginning with several times per week). Petry and Oncken (2002) reported that smoking status was associated with more severe gambling, with gamblers who smoke on a daily basis gambling on more days and spending more money per month gambling compared with gamblers who do not smoke on a daily basis. The ORs associated with marijuana use were elevated among problem gamblers when compared with non-gamblers or those not at risk, but at the higher frequencies, these ORs were not statistically significant despite their large magnitudes (i.e., 7.12, 7.77). The lack of statistical significance at conventional levels of alpha is likely due to lack of power resulting from the low prevalence of marijuana use in this study. Finally, pathological gamblers were no more or less likely to consume alcohol and tobacco than were non-gamblers or those not at risk. Unfortunately, there was insufficient data to conduct detailed analysis of the distribution of marijuana use among pathological gamblers. It may be that in this general population sample, the use of substances is not part of the behavioral repertoire of pathological gamblers, who may already be focused on their gambling involvement to the exclusion of drug use. In a study of problem gambling and marijuana use, Kausch (2003) found that among pathological gamblers in treatment who reported a substance abuse problem, marijuana was the second most commonly abused substance after alcohol. Certainly, further research is needed to better understand the association between marijuana use and different levels of gambling problems.

In the case of depression symptoms, problem gamblers were more likely to experience one symptom of depression when compared with non-gamblers or those not at risk. Interestingly, there was a dose-response association between the degree of gambling problem and the likelihood of having experienced two depression symptoms. It might be that depression is a result of increased levels of gambling, which can lead to, for instance, financial losses and serious family problems. However, because gambling can be a positive social event or reinforcing activity (Desai, Desai, & Potenza, 2007), people suffering from depressive symptoms may be more prone to gamble to escape from or cope with, albeit inappropriately, the symptoms of depression. This idea is consistent with prior research that found that pathological gambling was linked to depression (Cunningham-Williams et al., 1998; Maccallum & Blaszczynski, 2003), although the directionality of the association is unknown and merits further investigation.

Consistent with prior research (Potenza et al., 2000), the study findings suggest a dose-response relationship between the likelihood of having a history of arrest and the degree of gambling problem. As gambling problems increase, legal and criminal issues, such as theft and embezzlement to support gambling, can occur and can possibly lead to arrest. Whether or not gambling occurs prior to, or after, being arrested is unknown. However, a New Zealand study (Abbott & McKenna, 2005) reported very high levels of pre-arrest or incarceration gambling involvement, as well as expenditure on continuous forms of gambling (i.e., types of gambling characterized by rapid cycles of stake, play, and determination; Dickerson, 1993) in both women and men in the general adult New Zealand population (Abbott & Volberg, 1999, 2000).

The study findings need to be interpreted with the following limitations in mind. First, the study design was cross-sectional, limiting our ability to examine temporal and causal associations. To mitigate some of the concerns attendant with the use of cross-sectional data, we used a lifetime measure for problem gambling (because this was treated as an independent variable in our analyses) and past-year measures of substance use. Nonetheless, longitudinal studies with appropriately sophisticated analytical methods are needed to establish a temporal and potentially a causal association among the studied variables. Another limitation is the use of self-report data collected via telephone surveys, whereby sensitive questions, especially those reporting on illegal behaviors such as marijuana use, are commonly misreported (Abbot & Volberg, 2000; Galesic, Tourangeau, & Couper, 2006). We believe that this resulted in the underreporting of alcohol, tobacco, and marijuana use. Publicly available data for the particular age group in our sample were not available for the state of New Mexico; hence, we compared the estimates with national data. Compared with 2005 national estimates (Office of Applied Studies, Substance Abuse and Mental Health Services Administration, 2005), the year most of the individuals participated in the survey, a smaller percentage of individuals in our study reported past-year consumption of alcohol, tobacco, and marijuana.

However, even as underreporting occurred, the associations identified, even those that were not statistically significant at the conventional alpha levels of .05, show that problem gambling is associated with substance use, mental health, and social problems. Third, the completion rate of 47% is low but is still comparable to five recent Canadian gambling prevalence surveys whose response rates ranged from 37% to 64% (Miller & Currie, 2008) and a Scandinavian gambling prevalence survey whose response rate was 47% (Bondolfi, Jermann, Ferrero, Zullino, & Osiek, 2008). Participation rates in telephone surveys in the general population have declined precipitously in recent years as individuals in the general population become increasingly reluctant to participate in this type of research and as technological barriers proliferate (e.g., answering machines, caller ID; Jarvis, 2002; Tourangeau & Yan, 2007). Despite the low completion rate, the findings are indicative of the extent to which alcohol, tobacco, and marijuana; depression symptoms; and arrest occur among individuals who are at risk of problem gambling. The study findings also suggest that for individuals with the most severe gambling problems, alcohol and tobacco use are less prevalent than they are among individuals with less severe problems, those without problems, and those who do not gamble. Finally, the study sample included a larger percentage of women, individuals 35 years and older, and racial and ethnic minorities when compared with the characteristics of the population of New Mexico. In light of these demographic differences, and of the underreporting of substance use, it becomes even more critical that additional research be conducted on the comorbidity of gambling disorders with substance use, mental health, and social and legal problems with distinct population groups. We posit that prevention and treatment interventions will be considerably better informed if more is known about the extent of gambling experiences and problems in distinct populations (i.e., men, women, younger and older, minority and non-minority, individuals with and without substance abuse and/or mental health problems).

In conclusion, the study findings suggest that individuals at risk of gambling problems and those with a gambling problem consume alcohol and tobacco more frequently than do

other individuals. Interventions aimed at helping at-risk and problem gamblers to decrease or discontinue their gambling activities may also benefit these individuals by including treatment aimed at reducing their alcohol and tobacco use. Individuals who are pathological gamblers may be too consumed with their gambling activities to seek out and use alcohol and tobacco.

On the other hand, the number of depressive symptoms and the likelihood of arrest increased with the level of gambling problems. These findings suggest that interventions aimed at helping gamblers also need to involve careful attention to the depressive symptoms that gamblers experience and to the likelihood that these individuals have had a history of arrest. This history, which may be gambling related, is likely to require more effort to help problem and pathological gamblers overcome the stigma of being arrested when being reintegrated into their families and society.

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Ethics approval: The New Mexico prevalence survey was carried out by Gemini Research Ltd., under contract to the Responsible Gaming Association of New Mexico (RGANM). RGANM is a not-for-profit organization that provides funding for problem gambling research, training, treatment and prevention throughout the state. Neither RGANM or Gemini Research are affiliated with an academic institution with an established Institutional Review Board. While the New Mexico survey was not subject to specific ethics review, the project was completed to the highest standards of human subject protection. This included procedures to ensure that the selection of subjects was equitable, subjects' privacy was protected, informed consent was obtained, and appropriate safeguards were in place to protect the confidentiality and anonymity of the data.

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