



Original article

## Independent Versus Co-occurring Substance Use in Relation to Gambling Outcomes in Older Adolescents and Young Adults


 Jessica M. Cronce, Ph.D.<sup>\*,1</sup>, Joyce N. Bittinger, Ph.D., Cory M. Di Lodovico, M.S., and Junny Liu

*Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, Washington*
*Article history:* Received June 9, 2016; Accepted October 25, 2016

*Keywords:* Adolescents; Young adults; Alcohol; Cannabis; Gambling

---

 See Related Editorial p. 481
 

---

## A B S T R A C T

**Purpose:** Gambling is prevalent among college students and can be associated with significant negative consequences. Students who report gambling also tend to report use of alcohol and cannabis, but little research has explored the associated risks of using these substances in relation to gambling episodes. This study explored associations between the independent and co-occurring use of alcohol and cannabis before/during gambling episodes and gambling outcomes.

**Methods:** Students ( $n = 1,834$ ) completed an online survey that included measures of gambling frequency, amount lost, negative gambling consequences, gambling problem severity, and substance use.

**Results:** As hypothesized, individuals who reported using either alcohol or cannabis alone or both substances before/while gambling endorsed greater gambling quantity, frequency, negative consequences, and problem severity than individuals who used alcohol and cannabis in general but denied use of either substance before/while gambling. Use of both substances compared to use of alcohol alone was associated with greater gambling quantity, frequency, and negative consequences, although these groups did not differ on gambling problem severity. Cannabis use alone was no different on any outcome than use of both substances, and alcohol use alone was no different than cannabis use alone on any outcome.

**Conclusions:** Use of cannabis alone before/while gambling may confer the same level of risk for negative gambling outcomes as use of both cannabis and alcohol. Prevention efforts may, therefore, benefit from targeting cannabis use in relation to gambling. Additional investigation is needed in light of recent and upcoming state legislation on the legalization of cannabis.

© 2016 Society for Adolescent Health and Medicine. All rights reserved.

**IMPLICATIONS AND CONTRIBUTION**

This study builds on the growing literature showing that alcohol use before/while gambling is associated with negative outcomes. The study also examines the temporal relation between cannabis use and gambling outcomes and sets the stage for subsequent experimental cannabis administration studies.

**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

**Disclaimer:** The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, the University of Washington or the University of Oregon.

\* Address correspondence to: Jessica M. Cronce, Ph.D., Department of Counseling Psychology and Human Services, 5251 University of Oregon, Eugene, OR 97403-5251.

E-mail address: [jcronce@uoregon.edu](mailto:jcronce@uoregon.edu) (J.M. Cronce).

<sup>1</sup> Present address: Department of Counseling Psychology and Human Services, College of Education, University of Oregon, Eugene, Oregon.

Approximately 3.2% [1] to 6% [2] of the U.S. adult population experiences problems related to their gambling. Adverse effects of gambling have wide reach and can include health and social consequences such as family problems, criminal arrests, employment or school difficulties, psychological distress, and suicide [3,4]. U.S. college students appear to be at uniquely high risk for negative gambling-related outcomes. Specifically, rates of disordered gambling in college students have been estimated to be from 7.89% [5] to 18% [6].

Risk for gambling consequences appears to be affected by co-occurring behaviors and conditions. For example, the presence of comorbid mental disorders has been associated with increased gambling problems and severity of associated consequences [7,8]. Substance use problems are especially prevalent for those with disordered gambling [9–11], with lifetime prevalence rates of substance use disorders averaging about 57.5% among those experiencing disordered gambling [11]. Alcohol use disorder is estimated to affect 28.1% of those experiencing disordered gambling [11], with cannabis use disorder being the next most common [12]. Comorbidity may also be an indicator of severity. Those with pathological gambling who have a substance use treatment history have been shown to have more severe gambling and psychiatric problems than those without [8].

Independent of clinical psychopathology, greater frequency of gambling behavior has been reported among youth aged 14–21 years who also report using alcohol or cannabis compared to youth who deny use of these substances [13]. Extant research also suggests that drinking before or during gambling episodes is associated with, or leads to, increased financial loss and negative consequences [14–19]. However, no studies could be identified that assessed the impact of cannabis use immediately before or while gambling on gambling outcomes or the potential effect of the use of both alcohol and cannabis before or during gambling episodes. Given that cannabis use is frequently reported in association with gambling [12], understanding the impact of its use on gambling behavior appears key to prevention of associated harms. Moreover, although most students who drink do not use cannabis, over 65% of those who use cannabis also drink alcohol [20,21], suggesting those who use cannabis may be at greater risk because of greater likelihood of multiple substance use.

The purpose of the present study, therefore, is to examine the associations between the independent and co-occurring use of alcohol and cannabis in relation to gambling behavior on gambling outcomes among college students who report general use of both substances. It was anticipated that individuals reporting use of either (*alcohol only* or *cannabis only*) or both alcohol and cannabis (*alcohol–cannabis*) before or while gambling would report greater negative gambling outcomes (i.e., greater quantity of losses, greater frequency, more consequences, and higher problem severity) than those reporting use of *neither* substance before or while gambling. It was also anticipated that individuals reporting use of both substances before or while gambling would report greater negative gambling outcomes than those reporting use of alcohol only or cannabis only. As limited data are available on the association, an exploratory aim was to evaluate the difference between use of cannabis only and alcohol only on gambling outcomes. The present study represents secondary data analysis of screening data obtained as part of a larger clinical trial assessing the effectiveness of an early intervention for disordered gambling and thus only includes a small subset of the total sample from the original study who reported any gambling and any alcohol and cannabis use in the recent past.

## Method

### Participants and procedures

All aspects of the research protocol were approved by the university's Institutional Review Board in accordance with federal guidelines for the protection of human subjects and the Health Insurance Portability and Accountability Act. Participants

in the original clinical trial (<https://clinicaltrials.gov/ct2/show/NCT01529047>) were college students from a large west-coast university who were randomly chosen from the entire student body over the course of the study (2010–2014) and invited to participate in an initial online screening survey. Participants were required to confirm their agreement with an online information statement containing all elements of informed consent prior to completion of the survey. Parental consent was obtained for participants aged <18 years. A total of 26,335 were invited to the screening survey, of which 37.5% consented and provided complete or partial data (8,769 complete, 1,097 partial) on measures of gambling frequency and amount lost, negative consequences experienced while gambling, and substance use. As the outcome variables of interest in this study were gambling behavior and related consequences, only data for participants between the ages of 17 and 24 years who reported any gambling in the past 6 months were selected for analysis (N = 4,761). Of these, 84.9% (n = 4,040) reported use of alcohol and 42.4% (n = 2,019) reported use of cannabis in the past 3 months (n = 4,067 total reporting use of one or both substances). Although some forms of gambling are more accessible on a routine basis (e.g., online betting), a 6-month time frame was used to assess whether participants gambled versus a 3-month time frame for substance use as gambling behavior tends to be more infrequent than substance use in the general college student population (i.e., someone may only gamble during school breaks or they may only purchase a lottery ticket when there is a large jackpot). As the purpose of this study was to disentangle the relationship between the use of alcohol alone versus cannabis alone versus the use of both of these drugs in relation to gambling behavior, a final sample of 1,834 students was selected who provided data on their use of both alcohol and cannabis and also provided data on whether they had used these substances in relation to gambling. A co-occurring use grouping variable was created (see section on *Substance use and gambling in relation to substance use* for more information), denoting participants who used neither alcohol nor cannabis before or while gambling (*neither*; n = 1,018; 55.5%), those who only used alcohol before or while gambling (*alcohol only*; n = 559; 30.5%), those who only used cannabis before or while gambling (*cannabis only*; n = 54; 2.9%), or those who reported use of both alcohol and cannabis before or while gambling (*alcohol–cannabis*; n = 203; 11.1%). The final sample had a mean age of 20.01 years (SD = 1.44) and 43.6% identified as women. Most students self-identified as Caucasian (66%), followed by Asian (16.9%) and multiracial (8.9%), with only a minority (between 1.1% and 4.5%) endorsing other racial categories; 7.8% of the sample identified as Hispanic or Latino/a across racial categories. See Table 1 for demographic and other information on the four substance use groups.

### Measures

**Gambling quantity (losses).** A single item from the Gambling Quantity and Perceived Norms Scale [3] was used to calculate gambling quantity in terms of losses over the past 3 months on a 10-point Likert-type scale ranging from <\$5.00 to >\$1,000. This single item was selected to maintain parity with the 3-month time frame used by the measure of gambling frequency and consequences.

**Gambling frequency.** A single item from the Gambling Quantity and Perceived Norms Scale [3] was used to assess the average

**Table 1**

Means and standard deviations for gambling outcome variables by co-occurring substance use group

Variable	Neither		Alcohol		Cannabis		Both	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Quantity <sup>a</sup>	1.41	1.67	2.22	2.05	2.68	2.30	3.26	2.24
Frequency <sup>b</sup>	1.15	2.90	2.27	4.79	4.56	8.79	5.52	9.09
Negative consequences <sup>c</sup>	.28	1.26	1.17	3.22	1.61	3.85	2.48	4.87
Problem severity <sup>d</sup>	.39	1.06	1.20	2.16	1.41	2.65	2.14	3.16

Values represent means and standard deviations (SD) for untransformed variables to facilitate interpretation using original scales.

<sup>a</sup> Gambling quantity (losses) values represent: 1 = <\$10, 2 = \$10–\$20, 3 = \$20–\$40, 4 = \$40–\$60.

<sup>b</sup> Gambling frequency is the number of gambling occasions in the past 3 months.

<sup>c</sup> Gambling consequences indicate the total number of gambling-related consequences experienced.

<sup>d</sup> Gambling problem severity represents number of South Oaks Gambling Screen items endorsed.

number of days per month on which the individual gambled over the past 6 months. This value was multiplied by three to estimate the total number of gambling days during the past 3 months.

**Gambling consequences.** The Gambling Problem Index (GPI [3]), a 23-item self-report measure modeled after the Rutgers Alcohol Problem Index [22], was used to measure negative consequences experienced as a result of gambling during the past 3 months on a five-point scale ranging from 0 = none to 4 = >10. GPI items were recoded to be dichotomous (absent vs. present), and these items were summed to generate the total number of problems experienced in the past 3 months (range, 0–23). The GPI has previously demonstrated good internal consistency reliability ( $\alpha = .84$ ) and convergent validity [3]. Internal consistency in the current sample was  $\alpha = .94$  for the dichotomized items.

**Disordered gambling.** The South Oaks Gambling Screen (SOGS; [23]) is a 20-item questionnaire which measures the extent to which participants have evidenced symptoms of gambling-related psychopathology. Higher total scores indicate a greater degree of probable gambling disorder. Although the SOGS is typically given as a lifetime measure, a past-6-month time frame was used in the original study, and the present study, to assess recent gambling problem severity. The SOGS correlates with the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) [23] and DSM-V [24] with demonstrated validity and reliability in assessing gambling problems. Internal consistency in the current sample was  $\alpha = .83$ .

**Substance use and gambling in relation to substance use.** Frequency of substance use and severity of involvement with specific substances was measured with the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST) [25]. The ASSIST consists of eight items and identifies substances used and associated harms experienced both in the participant's lifetime and in the past 3 months. Specific substance involvement scores, totaled from the individual item scores for each substance, indicate the intensity of use and the severity of harms experienced. The past-3-month frequency items were adapted to create a measure of participants' gambling behavior in relation to substance use. Specifically, for each substance that a participant reported using in the past 3 months, the participant was asked to indicate separately if they used that substance in (1) the 2 hours preceding gambling or (2)

while gambling. These two categories were collapsed in the present analyses to account for the often asynchronous nature of co-occurring behaviors (e.g., a person starts drinking and then decides to gamble and continues drinking; a person starts gambling and then is offered a drink and continues to gamble). Substances consumed within 2 hours of initiating gambling (or while gambling) were assumed to still exert an effect on behavior [26,27] and used to create the co-occurring use grouping variable.

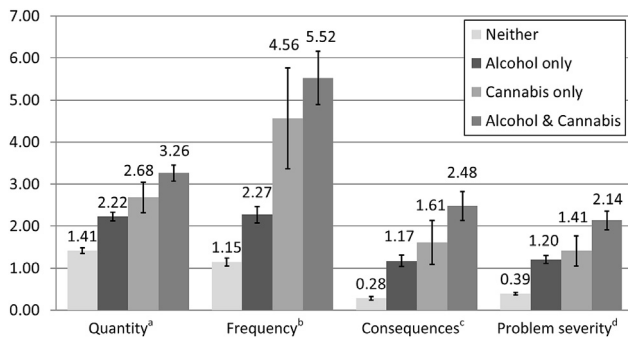
## Results

Before conducting primary analyses, outcome variables were log-transformed to reduce apparent positive skew, owing to a larger proportion of students endorsing no or limited gambling losses, consequences, or psychopathology. A general linear multivariate model was used to test study hypotheses, with the co-occurring use grouping variable entered as a fixed factor and ASSIST specific substance involvement scores for alcohol and cannabis entered as covariates predicting the log-transformed variables of gambling quantity, frequency, consequences, and problem severity. The overall model was significant,  $F(12, 3,468) = 11.795, p < .001$ , partial  $\eta^2 = .039$ , as were omnibus effects of the co-occurring grouping variable on each of the outcome variables: gambling quantity,  $F(3, 1,157) = 29.025, p < .001$ , partial  $\eta^2 = .070$ ; gambling frequency,  $F(3, 1,157) = 16.587, p < .001$ , partial  $\eta^2 = .041$ ; total number of gambling consequences,  $F(3, 1,157) = 30.591, p < .001$ , partial  $\eta^2 = .073$ ; and gambling problem severity,  $F(3, 1,157) = 30.180, p < .001$ , partial  $\eta^2 = .073$ .

Planned contrasts between those in the *neither* group and those in the alcohol-only, cannabis-only and alcohol-cannabis groups, and those in the alcohol-only group and those in the alcohol-cannabis group showed a relatively consistent pattern across outcomes. Specifically, relative to those who reported using neither substance before or while gambling, those in the alcohol-only, cannabis-only, and alcohol-cannabis groups reported greater gambling losses,  $F(1, 1,159) = 66.105, p < .001$ , partial  $\eta^2 = .054$ ; more gambling occasions per month,  $F(1, 1,159) = 43.087, p < .001$ , partial  $\eta^2 = .036$ ; more gambling-related consequences,  $F(1, 1,159) = 61.328, p < .001$ , partial  $\eta^2 = .050$ ; and greater gambling problem severity,  $F(1, 1,159) = 44.175, p < .001$ , partial  $\eta^2 = .037$ . Compared to those in the alcohol-only group, those in the alcohol-cannabis group reported greater gambling losses,  $F(1, 509) = 12.689, p < .001$ , partial  $\eta^2 = .024$ ; more gambling occasions per month,  $F(1, 509) = 29.194, p < .001$ , partial  $\eta^2 = .054$ ; and more gambling-related consequences,  $F(1, 509) = 10.374, p = .001$ , partial  $\eta^2 = .02$ ; however, there was no difference between groups in terms of gambling problem severity (see Figure 1, which depicts these relationships for the untransformed variables to facilitate interpretation of means using the original scales). In contrast to study hypotheses, individuals reporting use of cannabis only before or while gambling were no different than those in the alcohol-cannabis group on any outcome (all  $p$  values  $> .088$ ). Similarly, those in the alcohol-only group did not differ from those in the cannabis-only group on any outcome (all  $p$  values  $> .052$ ); however, means were higher for all outcomes among those reporting use of cannabis only than alcohol only before or while gambling (Figure 1 and Table 1).

## Discussion

As hypothesized, reported use of both alcohol and cannabis immediately before or while gambling was associated with



**Figure 1.** Gambling outcomes by co-occurring substance use group (untransformed variables). Group means are based on untransformed variables to facilitate interpretation of scores using the original scales. The apparent difference between the alcohol-only group and cannabis-only group on gambling frequency and the difference between the alcohol-only group and the alcohol-cannabis group on problem severity were *not* significant when using the transformed variables and including covariates in the model; all other relationships are accurate as depicted here. <sup>a</sup>Gambling quantity (losses) values represent: 1 = <\$10, 2 = \$10–\$20, 3 = \$20–\$40, 4 = \$40–\$60. <sup>b</sup>Gambling frequency is the number of gambling occasions in the past 3 months. <sup>c</sup>Gambling consequences indicate the total number of gambling-related consequences experienced. <sup>d</sup>Gambling problem severity represents number of South Oaks Gambling Screen items endorsed.

greater gambling quantity, frequency, and negative consequences than use of alcohol only in relation to gambling. Contrary to hypotheses, use of cannabis only was no different than use of both alcohol and cannabis before or while gambling on any gambling outcome. Exploratory analyses similarly revealed that use of alcohol only was no different than use of cannabis only on any outcome, although use of alcohol only before or while gambling was significantly different than use of both substances.

As all participants reported past-3-month use of both alcohol and cannabis and only differed in terms of their reported use of these substances before or while gambling, the findings cannot be attributed to the effect of multiple substance use alone. Moreover, analyses controlled for level of alcohol and cannabis involvement, suggesting severity of use or related problems is not a plausible explanation for the current findings. Substantial research exists suggesting why use of the substances before or while gambling may lead to undesirable outcomes. Both alcohol and cannabis have been shown to generally impair judgment and/or disinhibit behavior [28–31], and alcohol has been experimentally shown to contribute to persistence in the face of losses [18] and risky betting behavior [15], specifically; however, comparable experimental research examining the effect of cannabis on gambling has not been published. Furthermore, as these drugs both exert a depressant effect on the central nervous system [32], they may potentiate each other when taken contemporaneously, leading to even more pronounced impairment than either drug alone. It is interesting, then, that in the present study, those that reported use of cannabis only before or while gambling were no different in terms of gambling quantity, frequency, consequences, or psychopathology than those who reported use of both alcohol and cannabis before or while gambling. Why cannabis use may be more associated with negative gambling outcomes remains an open question. It may be that the ability to detect differences between the cannabis-only group and the alcohol-cannabis group was limited because of the small number of students who reported sole use

of cannabis in the absence of co-occurring alcohol use. Alternatively, it may be that college students who use cannabis before or while gambling do so for different reasons (e.g., self-medication for anxiety vs. enjoyment) that may place them at greater risk. It may also be that cannabis dosage cannot be as easily controlled as alcohol consumption—the potency, and therefore duration and intensity of effects, of cannabis may differ more significantly from one occasion of cannabis use to the next. It will be interesting to see if these relationships change as potency becomes more tightly controlled (or less tightly controlled as more potent cannabis products are made available) in states that have legalized cannabis. Regardless, more research is necessary to confirm this finding given the small size of this sample.

This study adds to the literature on the relationship between substance use and gambling; however, certain limitations must be considered when interpreting the results. First, the sample was restricted to college-attending older adolescents and young adults (17–24 years) from a single university in the United States who reported any gambling in the past 6 months and who also endorsed use of both alcohol and cannabis in the past 3 months. The sample was further restricted to only those individuals who provided data on whether they had used alcohol and/or cannabis before or while gambling, to allow for analysis of the research questions in this secondary data analysis. Thus, the findings may not generalize to non-college adolescents and young adults, or to those who engage in these behaviors less frequently.

Moreover, it was not possible with the current design to ascertain the precise timing of alcohol and cannabis use in relation to gambling behavior or the probable degree of impairment. That is, it is possible that an individual who positively endorsed consuming alcohol before gambling could have consumed only one drink and fully oxidized the alcohol in their system before initiating gambling. It is highly probable that some individuals were on the ascending limb of the blood alcohol concentration curve, whereas others were on the descending limb of the blood alcohol concentration curve, which would have exerted different effects on behavior [33]. So too, behavior after cannabis use would likely differ based on when it was used and how potent it was; thus, the current findings only speak of use of alcohol and cannabis broadly. Use of real-time data collection methods or experimental designs is warranted to establish the exact effects of cannabis on gambling as have been used for examining the effects of alcohol on gambling [15,18]. In addition, data were collected during a period of transition in cannabis legalization in Washington State. The first 2 years of data were collected before passage of Initiative 502 in Washington in November, 2012, which decriminalized use of cannabis in private spaces (e.g., a person's home) for those age 21 and older. This law slowly went into effect over the next 2 years, with the first state-regulated cannabis retail outlet opening in July, 2014. It is possible that the anticipation of legalization, and the ultimate unfolding of this process, may have affected cannabis usage patterns in our sample, thus limiting generalizability.

In addition, gambling behaviors and substance use were assessed via self-report. It is possible that information provided by participants may not accurately represent their actual behavior; however, research suggests self-report of both substance use and gambling is generally accurate when confidentiality is assured and validated measures are used [34–37]. Another limitation was that very few students reported only using cannabis in general, and even fewer endorsed use of

cannabis alone in relation to gambling, leading to disparate cell sizes in analyses and potentially limited statistical power. Thus, future research wishing to replicate or explore the present findings would be well served by purposefully recruiting those who report cannabis use without alcohol use. As this was a secondary data analysis, this was not possible in the present study. Future research may also wish to consider matching participants on alcohol and cannabis use at baseline and assessing the relationship between independent and co-occurring use and gambling outcomes longitudinally, so that baseline gambling behaviors could be added as covariates; this would allow for a more stringent test of the model proposed by this study. In addition, future research may wish to assess participants' preferred gambling venue and knowledge (or perceptions) of cannabis laws, as these factors may impact substance use in relation to gambling. Finally, although participants reported use of substances independently before or while gambling, for those who reported use of both alcohol and cannabis before or while gambling, it was not possible to assess for each occasion of gambling if alcohol or cannabis was used alone or in combination. Moreover, it was not possible to disentangle what percentage of occasions substances were used before versus during a gambling occasion. At most, it can be concluded that among individuals who report general use of alcohol and cannabis that those who report using both substances in the 2 hours before or while gambling engage in greater gambling behavior and experience more negative consequences and that cannabis use in particular may drive these relationships as cannabis use alone was no different than combined alcohol and cannabis use on any outcome. However, as the present study is correlational, experimental research using a cannabis administration paradigm [38] should be conducted to establish a causal relationship.

In conclusion, among adolescent and young adult college students using both alcohol and cannabis, use of both substances before or while gambling appears to be associated with greater potential for negative gambling outcomes, and use of cannabis alone and alcohol alone before or while gambling confers more risk than use of neither substance. Moreover, cannabis use alone before or while gambling is associated with similar outcomes as using both cannabis and alcohol before or while gambling. Especially with the recent legalization of cannabis in Washington, Oregon, Alaska, and Colorado and the imminent potential for legalization in additional states that have proposals on forthcoming ballots, future research should more fully explore the impact of cannabis use on gambling behavior and consequences. In particular, experimental research that can establish causal links between proximal cannabis use and increased gambling behaviors and consequences may help shape preventive interventions targeting drug use and gambling in this population.

### Acknowledgments

The authors thank Annie Fairlie for comments on an earlier draft of this manuscript.

### Funding Sources

Preparation of this article was supported in part by grants from the National Institute on Drug Abuse (R01DA025051; PI: Larimer) and the National Institute on Alcohol Abuse and Alcoholism (T32AA007455; PI: Larimer).

### References

- [1] Williams RJ, Volberg RA, Stevens RMG. The population prevalence of problem gambling: Methodological influences, standardized rates, jurisdictional differences, and worldwide trends. Report prepared for the Ontario Problem Gambling Research Centre and the Ontario Ministry of Health and Long Term Care. 2012. Available at: [https://www.uleth.ca/dspace/bitstream/handle/10133/3068/2012-PREVALENCE-OPGRC\\_\(2\).pdf](https://www.uleth.ca/dspace/bitstream/handle/10133/3068/2012-PREVALENCE-OPGRC_(2).pdf). Accessed December 6, 2016.
- [2] Shaffer HJ, Hall MN. Updating and refining prevalence estimates of disordered gambling behavior in the United States and Canada. *Can J Public Health* 2001;92:168–72.
- [3] Neighbors C, Lostutter TW, Larimer ME, Takushi RY. Measuring gambling outcomes among college students. *J Gambl Stud* 2002;18:339–60.
- [4] Oei TS, Gordon LM. Psychosocial factors related to gambling abstinence and relapse in members of Gamblers Anonymous. *J Gambl Stud* 2008;24:91–105.
- [5] Blinn-Pike L, Worthy SL, Jonkman JN. Disordered gambling among college students: A meta-analytic synthesis. *J Gambl Stud* 2007;23:175–83.
- [6] Engwall D, Hunter R, Steinberg M. Gambling and other risk behaviors on university campuses. *J Am Coll Health* 2004;52:245–55.
- [7] Kessler RC, Hwang I, LaBrie R, et al. DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychol Med* 2008;38:1351–60.
- [8] Ladd G, Petry N. A comparison of pathological gamblers with and without substance abuse treatment histories. *Exp Clin Psychopharmacol* 2003;11:202–9.
- [9] Petry NM, Stinson FS, Grant BF. Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the national epidemiologic survey on alcohol and related conditions. *J Clin Psychiatry* 2005;66:564–74.
- [10] Pilver CE, Libby DJ, Hoff RA, Potenza MN. Gender differences in the relationship between gambling problems and the incidence of substance-use disorders in a nationally representative population sample. *Drug Alcohol Depend* 2013;133:204–11.
- [11] Lorains FK, Cowlishaw S, Thomas SA. Prevalence of comorbid disorders in problem and pathological gambling: Systematic review and meta-analysis of population surveys. *Addiction* 2011;106:490–8.
- [12] Kausch O. Patterns of substance abuse among treatment-seeking pathological gamblers. *J Subst Abuse Treat* 2003;25:263–70.
- [13] Barnes GM, Welte JW, Hoffman JH, Tidwell MO. Gambling, alcohol, and other substance use among youth in the United States. *J Stud Alcohol Drugs* 2009;70:134–42.
- [14] Baron E, Dickerson M. Alcohol consumption and self-control of gambling behaviour. *J Gambl Stud* 1999;15:3–15.
- [15] Cronce JM, Corbin WR. Effects of alcohol and initial gambling outcomes on within-session gambling behavior. *Exp Clin Psychopharmacol* 2010;18:145–57.
- [16] Ellery M, Stewart SH, Loba P. Alcohol's effects on video lottery terminal (VLT) play among probable pathological and non-pathological gamblers. *J Gambl Stud* 2005;21:299–324.
- [17] Giacompassi D, Stitt BG, Vandiver M. An analysis of the relationship of alcohol to casino gambling among college students. *J Gambl Stud* 1998;14:135–49.
- [18] Kyngdon A, Dickerson M. An experimental study of the effect of prior alcohol consumption on a simulated gambling activity. *Addiction* 1999;94:697–707.
- [19] Phillips JG, Ogeil RP. Alcohol consumption and computer blackjack. *J Gen Psychol* 2007;134:333–53.
- [20] Primack BA, Kim KH, Shensa A, et al. Tobacco, marijuana, and alcohol use in university students: A cluster analysis. *J Am Coll Health* 2012;60:374–86.
- [21] Whitehill JM, Rivara FP, Moreno MA. Marijuana-using drivers, alcohol-using drivers, and their passengers: Prevalence and risk factors among underage college students. *JAMA Pediatr* 2014;168:618–24.
- [22] White HR, Labouvie EW. Towards the assessment of adolescent problem drinking. *J Stud Alcohol* 1989;50:30–7.
- [23] Lesieur HR, Blume SB. The South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. *Am J Psychiatry* 1987;144:1184–8.
- [24] Goodie AS, MacKillop J, Miller JD, et al. Evaluating the South Oaks Gambling Screen with DSM-IV and DSM-5 criteria: Results from a diverse community sample of gamblers. *Assessment* 2013;20:523–31.
- [25] World Health Organization ASSIST Working Group. The Alcohol, smoking and substance involvement screening test (ASSIST): Development, reliability, and feasibility. *Addiction* 2002;97:1183–94.
- [26] Crean RD, Crane NA, Mason BJ. An evidence based review of acute and long-term effects of cannabis use on executive cognitive functions. *J Addict Med* 2011;5:1–8.
- [27] George S, Rogers RD, Duka T. The acute effect of alcohol on decision making in social drinkers. *Psychopharmacology* 2005;182:160–9.

- [28] Fromme K, Katz E, D'Amico E. Effects of alcohol intoxication on the perceived consequences of risk taking. *Exp Clin Psychopharmacol* 1997;5:14–23.
- [29] Lane SD, Cherek DR, Tcheremissine OV, et al. Acute marijuana effects on human risk taking. *Neuropsychopharmacology* 2005;30:800–9.
- [30] Metrik J, Kahler CW, Reynolds B, et al. Balanced placebo design with marijuana: Pharmacological and expectancy effects on impulsivity and risk taking. *Psychopharmacology* 2012;223:489–99.
- [31] Steele C, Josephs R. Alcohol myopia: Its prized and dangerous effects. *Am Psychol* 1990;45:921–33.
- [32] McKim W. *Drugs and behavior: An introduction to behavioral pharmacology*. 6th edition. Upper Saddle River, NJ: Prentice Hall; 2006.
- [33] Earleywine M, Martin CS. Anticipated stimulant and sedative effects of alcohol vary with dosage and limb of the blood alcohol curve. *Alcohol Clin Exp Res* 1993;17:135–9.
- [34] Hodgins DC, Makarchuk K. Trusting problem gamblers: Reliability and validity of self-reported gambling behavior. *Psychol Addict Behav* 2003;17:244–8.
- [35] Laforge RG, Borsari B, Baer JS. The utility of collateral assessment in college alcohol research: Results from a longitudinal prevention trial. *J Stud Alcohol* 2005;66:479–87.
- [36] Smith GT, McCarthy DM, Goldman MS. Self-reported drinking and alcohol-related problems among early adolescents: Dimensionality and validity over 24 months. *J Stud Alcohol* 1995;56:383–94.
- [37] Taber JJ, McCormick RA, Russo AM, et al. Follow-up of pathological gamblers after treatment. *Am J Psychiatry* 1987;144:757–61.
- [38] Metrik J, Rohsenow DJ, Monti PM, et al. Effectiveness of a marijuana expectancy manipulation: Piloting the balanced-placebo design for marijuana. *Exp Clin Psychopharmacol* 2009;17:217–25.