Gambling and substance misuse in Nevada: Applying the common liability to addiction model to behavioral risk factor surveillance system survey data

Mia R. Kirk, MPH
Doctoral student
School of Public Health, University of Nevada, Reno
miakirk@unr.edu

Karla D. Wagner, PhD
Professor
School of Public Health, University of Nevada, Reno

Wei Yang, MD, PhD
Senior Associate Dean, Foundation Professor
School of Public Health, University of Nevada, Reno

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Abstract
Nevada has the largest gambling industry in the country and high rates of prescription painkillers sales and drug overdose deaths. This paper applies the Common Liability to Addiction Theory to a behavioral addiction and considers how identification of substance misuse and gambling behavior may prevent progression to disordered behavior. The aim of this study was to examine whether an association exists between prescription drug misuse (PDMU) and gambling. We analyzed 2020 and 2021 Nevada Behavioral Risk Factor Surveillance System survey data (n=2788). The primary variables of interest were gambling frequency and PDMU. Weighted chi square tests of association and logistic regressions were performed. Unadjusted and adjusted odds ratios are reported. The adjusted logistic regression analysis revealed a statistically significant association between gambling frequency and PDMU. The adjusted odds of frequent gambling were 43% higher among those who reported PDMU**,** compared to those who did not, after adjusting for gender, age, marital status, education, current smoker, and binge drinking (aOR=1.43; 95% CI 1.07-1.89; $p<0.013$). Our findings suggest that behavioral addictions may present as patterns of co-morbidities and occur simultaneously with substance-based addictions.

Keywords
Substance misuse, gambling, behavioral addiction, prescription drug misuse, theory

Introduction

Nevada is a unique environment in which to study gambling and substance use due to the state's elevated rates of prescription pain reliver sales and per capita drug overdose deaths, coupled with the country's largest gambling industry (National Governors Association, 2019). According to the Common Liability to Addiction (CLA) model, some people may possess the propensity, or latent trait, of drug dependence (Huggett et al., 2021; Vanyukov et al., 2012) and this trait may extend beyond substance-based addictions to non-

substance based, or behavioral, addictions. Applying theory to these public health issues may help practitioners better understand their etiology as well as inform targeted prevention, intervention, and treatment strategies. Given the unique environment in Nevada, this study used the CLA model to examine whether an association exists between prescription drug misuse (PDMU) and gambling.

The ongoing overdose epidemic was exacerbated by an overprescribing of prescription pain relievers (Dayer et al., 2019). Now, more than 25 years into the overdose epidemic, prescribing rates have decreased, likely due to policies aimed at reducing inappropriate prescribing and increased awareness of the risks associated with opioids (Dayer et al., 2019). However, prescription pain reliever, stimulant, and sedative misuse persists, with approximately 16 million people misusing prescription drugs in the past 12 months (National Institute on Drug Abuse, 2022). Three classes of prescriptions are most misused: opioids (e.g., OxyContin, Vicodin), stimulants (e.g., Adderall, Ritalin), and sedatives or benzodiazepines (e.g., Xanax) (National Institute on Drug Abuse, 2022). Substance misuse is when substance use results in harms to oneself or others. Substance misuse is a risk factor for developing a substance use disorder (SUD) and the majority of substance use-related harm in the US is caused by substance misuse, not SUD (McLellan, 2017). Further, there has been an increase in polysubstance use, using more than one class of drug at one time, which has an additive effect and is more lethal (Compton et al., 2021; Friedman & Shover, 2022).

Gambling behavior is often characterized by the number of gambling activities played and the frequency of gambling. Combined, these two metrics can be an indicator for problematic gambling. However, measures of gambling behavior in general, and problematic gambling in specific, differ greatly (Huggett et al., 2021), with some studies using only number of activities (Boldero et al., 2010; Kang et al., 2018; Studer et al., 2016) and others using only frequency (Blaszczynski & Nower, 2002; Philander et al., 2022; Tucker et al., 2021). It has been established that gambling frequency may be a risk factor for problem gambling (Welte et al., 2004). Used for diagnostic purposes, gambling disorder was included as a behavioral addiction in the "Substance Use and Related Addictive Disorders" section of the DSM-5 (Petry, 2016). Prevalence of gambling disorder in the US is around or below 2% (Petry, 2016). Rates of comorbid psychiatric disorders like depression, anxiety, and phobias are higher among people with a gambling disorder than non-gamblers (Grant & Chamberlain, 2020). Problem gambling has been linked to negative consequences including financial hardship, unemployment, mental and physical health issues, and deteriorating relationships (Grant & Chamberlain, 2020).

An objective of addiction research is to identify the origins of both substance-based and non-substance-based disorders (Huggett et al., 2021). Substance-based and non-substance-based, or behavioral addictions, have some similarities and differences. The etiologies of both gambling and substance misuse involve complex combinations of genetics, personality traits, neurobiology, psychology, biochemical, and environmental factors (Huggett et al., 2021). Problematic gambling and substance misuse share certain traits including urges/craving, withdrawal, and tolerance, as well as impulsivity and compulsivity (Balodis & Potenza, 2020). Few people with SUDs or behavioral addictions seek treatment (Priester et al., 2016). This may result in more severe adverse legal, employment, financial, or family difficulties. Many of the

treatments for gambling disorder were modeled on SUD treatments including 12-step programs, cognitive behavioral therapy, and pharmacotherapies (Petry, 2016). Examining the prevalence and correlates of one may help identify the commonalities and differences across substance-based and non-substance-based disorders as well as the extent to which specific characteristics overlap, and how to develop future intervention strategies.

The CLA model proposes that people with SUD may possess a specific vulnerability or genetic predisposition to substance misuse (Vanyukov et al., 2012). The CLA model assumes a shared influence of individual and environmental characteristics and considers factors such as substance availability, peer influence, and personality traits (Vanyukov et al., 2012). Problematic gambling behavior may be in part due to a genetic predisposition similar to what is shown in the CLA model and people may possess a common propensity for gambling similar to how they may possess a common liability to SUD (Huggett et al., 2021). Additionally, gambling and substance use share an environmental influence with an availability of alcohol, cigarettes, and other substances in casinos and other gambling settings. There are strong associations between alcohol use disorder, cigarette use, and gambling (Grant & Chamberlain, 2020). These common liabilities for each behavior often present as patterns of co-morbidities and occur simultaneously. What is unknown is whether these patterns extend to other substances. The CLA model suggests there are underlying conditions that make addictions cluster (Vanyukov et al., 2012). As addiction researchers continue to investigate the etiology of SUDs and other disorders, incorporating theory will aid in identifying the specific mechanisms that are similar and different as well as the degree of overlap between features of addiction (Banz et al., 2016). Informed by the CLA model, the aim of this study was to examine whether an association exists between PDMU and gambling in Nevada.

Methods

Study design and participants

Data from the 2020 and 2021 Nevada Behavioral Risk Factor Surveillance System (NV BRFSS) survey were used for this analysis. The BRFSS is an annual cross-sectional telephone survey conducted nationwide that measures health risk behaviors, chronic disease, and use of preventive services. Data are collected by trained interviewers through random-digit dialing of both cell-phones and landlines (Nevada Division of Public and Behavioral Health, 2016). The NV BRFSS collects health information among non-institutionalized adults aged 18 years and older residing in Nevada at the time of data collection. The survey consists of three sections: core questions, optional modules, and state-added questions. In 2020 and 2021 the NV BRFSS included a substance use state-added module and gambling behavior state-added module. The primary variables in this analysis were from the substance use and gambling behavior modules.

Measures

Independent variable: Prescription drug misuse was measured with the following question: *Have you ever taken a prescription drug (such as OxyContin, Percocet, Vicodin, Codeine, Adderall, Ritalin or Xanax) without a doctor's prescription?* (No [ref], Yes).

Dependent variable: Gambling frequency was measured with the following question: *In the past 12 months, how often have you bet money or possessions on any of the following activities? Casino gaming including slot machines and table games; or lottery including scratch tickets pull tabs*

and lotto; sports betting; internet gambling; bingo; or any other type of wagering. Response options were categorical (not at all, < 10 times a year, 1-2 times a month, 1-2 times a week, or > 3 times a week) and recoded into a binary variable as Never/Rarely [ref] (not at all, < 10 times a year) and Occasionally/Frequently (1-2 times a month, 1-2 times a week, or > 3 times a week). A previous paper has dichotomized response options in this way (Tucker et al., 2021).

Demographics: The following demographics were included in the analysis: age (18-24 [ref], 25-34, 35-44, 45-55, 56-64, >65), race/ethnicity (non-Hispanic white [ref], Hispanic, other), sex (Male [ref], female), educational level (college graduate [ref], some college, less than high school), employment status (employed [ref], retired, unemployed), and marital status (married [ref], unmarried).

Covariates: The following covariates were included in the analysis: ever diagnosed with a depressive disorder (No [ref], Yes), current smoker (No [ref], Yes), and binge drinker (males having 5+ drinks on one occasion, females having 4+ drinks on one occasion) (No [ref], Yes).

Analysis

First, descriptive statistics were generated to summarize the sample characteristics. Second, chi-square tests were used to explore the relationships between the dependent variable (gambling frequency) and all other variables. Third, chi-square tests were used to explore the relationships between only the substance use variables (binge drinker, current smoker, PDMU). A correlation matrix was generated to assess potential multicollinearity among the substance use variables (Vatcheva et al., 2016). Fourth, logistic regression was used to examine the association between the independent (PDMU) and dependent variables (gambling frequency). All variables showing significant associations in the chi-square tests in step two of the analysis were included in the fully adjusted model (gender, marital status, education, binge drinker, current smoker). Both the chi-square tests and logistic regression models were weighted to account for the complex sampling design. Odds ratios, adjusted odds ratios, and their corresponding 95% confidence intervals are reported. Statistical significance was set at alpha level 0.05 (p value <0.05). All analyses were completed in RStudio.

Results

Among the final sample (n=2788) respondents were white (73%), employed (49%), male (46%), over 65 years old (38%), married (49%), and had a college degree or higher (37%). Eighteen percent had ever been told they have a depressive disorder, 15% were current smokers, 13% had binge drank in the past 30 days, 14% had ever misused a prescription drug, and 17% reported occasionally/frequently gambling in the past 12 months. See Table 1.

The first chi-square analysis revealed statistically significant negative associations between gambling frequency and gender ($p<0.001$), age ($p<0.016$), marital status ($p<0.005$), education ($p<0.034$), smoking status ($p<0.001$), binge drinking ($p<0.001$), and PDMU ($p<0.001$). See Table 1. The second chi-square analysis (not shown) revealed small (<0.3) but statistically significant correlations between the substance use variables (binge drinker, current smoker, PDMU).

The unadjusted logistic regression analysis revealed a statistically significant association between gambling frequency and PDMU. The unadjusted odds of frequent gambling were 77% higher among those who reported PDMU, compared to those who did not (OR=1.77; 95% CI 1.37-2.29; $p<0.0001$). The adjusted logistic regression

analysis revealed a statistically significant association between gambling frequency and PDMU. The adjusted odds of frequent gambling were 43% higher among those who reported PDMU**,** compared to those who did not, after adjusting for gender, marital status, education, current smoker, and binge drinking (aOR=1.43; 95% CI 1.07-1.89; $p<0.013$).

Discussion

The most interesting finding of this study is that the likelihood of frequent gambling was 43% greater among individuals who reported PDMU. This study characterized associations between gambling frequency and PDMU, adjusting for several demographic and behavioral variables. Similar to previous research, we found significant relationships between gambling frequency and substance use (Huggett et al., 2021).

A strength of this study was in its theory driven inquiry. The current study adds to the literature by extending the CLA model to a behavioral addiction and it extends the link between substance use and gambling to include PDMU. Other behaviors that are increasingly discussed as behavioral addictions include compulsive sexual behaviors, internet gaming, and binge-eating (Balodis & Potenza, 2020). The extent to which the CLA model can also be applied to these and other behavioral addictions is currently unknown, but our findings suggest they may present as patterns of co-morbidities and occur simultaneously with substance-based addictions. Large-scale epidemiological research on a range of behavioral addictions would provide much needed data on their unique and shared features with SUDs. Gambling disorder rarely occurs in isolation so it is essential to consider other co-occurring behavioral or substance-based disorders as opportunities to intervene (Tang et al., 2020).

Whereas our study may be useful in characterizing the associations between gambling frequency and PDMU, the demographic analyses we performed also can inform which populations to target for intervention. We found associations between gambling and four demographic variables: gender, marital status, age, and educational level. The existing literature confirms that males have an increased risk of gambling disorder (Petry, 2016). Targeted intervention campaigns should focus on the most vulnerable groups. Further, substance misuse and gambling frequency are risk factors for SUD and gambling disorder. Our findings may have important implications in preventing the progression of substance misuse and problematic gambling behavior to disordered behavior. As well as for the assessment and treatment of individuals with SUD or gambling disorder. Efforts to address substance misuse should also include gambling education and screening.

Limitations & Future research

This study is not without limitations. First, BRFSS survey data are self-reported which has the risk for recall bias and social desirability bias. The latter is especially relevant for sensitive or controversial questions such as gambling and drug use behaviors (Gnambs & Kaspar, 2015; Sturgis & Kuha, 2022). This may have resulted in an underreporting of these behaviors and lower estimates than the true prevalence. Additionally, this sample had a greater proportion of college graduates than the state of Nevada (Federal Reserve Bank, 2023). This may also contribute to an underreporting of these behaviors and lower estimates than the true prevalence. Second, the variable that measured PDMU included “ever use” of both stimulants and sedatives (Adderall, Ritalin, Oxy, Vicodin) which may

have altered the magnitude of association between PDMU and gambling. Future research should isolate stimulant PDMU and its relationship to gambling. Third, our findings may lack generalizability due to inconsistent variable definitions in the field of gambling research which makes it difficult to compare findings across studies. While gambling frequency has been used in past studies as a proxy measure for gambling behavior (Blaszczynski & Nower, 2002; Philander et al., 2022), some investigators use screening tools to assess for pathological gambling, some use the DSM 5 gambling disorder definition, and others use a single question of self-report. Future research should focus on the best way to operationally define gambling behavior and harmonize that measure across studies. Despite these limitations, this study provides a significant contribution to the literature on the complex intersection of substance-based addictions and behavioral addictions.

Conclusion

In conclusion, this study found a significant association between PDMU and gambling frequency. Both targeted and universal public health measures including screening, health education, and awareness campaigns have the potential to reduce the serious adverse effects associated with both substance misuse and gambling.

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Appendix

Table 1. Participant characteristics, stratified by gambling frequency, n=2788				
	Overall n (%)	Never/ Rarely	Occasionally/ Frequently	p value
	2788	2307 (82.7)	481 (17.3)	
Male	1271 (45.6)	1003 (78.9)	268 (21.1)	<0.001*
Age				0.016*
18-24	180 (6.5)	164 (91.1)	16 (8.9)	
25-34	286 (10.3)	235 (82.2)	51 (17.8)	
35-44	349 (12.5)	298 (85.4)	51 (14.6)	
45-54	415 (14.9)	347 (83.6)	68 (16.4)	
55-64	501 (18.0)	405 (80.8)	96 (19.2)	
65+	1057 (37.9)	858 (81.2)	199 (18.8)	
Race				0.216
White, Non-Hispanic	2030 (72.8)	1683 (82.9)	347 (17.1)	
Hispanic	401 (14.4)	339 (84.5)	62 (15.5)	
Other	357 (12.8)	285 (79.8)	72 (20.2)	
Marital status, Married	1377 (49.4)	1168 (84.8)	209 (15.2)	0.005*
Employment				0.262
Employed	1370 (49.4)	1147 (83.7)	223 (16.3)	
Unemployed	440 (15.9)	364 (82.7)	76 (17.2)	
Retired	964 (34.8)	782 (81.1)	182 (18.9)	
Education				0.034*
High school grad or less	840 (30.2)	684 (81.4)	156 (18.6)	
Some college	909 (32.7)	738 (81.2)	171 (18.8)	
College grad or more	1031 (37.1)	878 (85.2)	153 (14.8)	
Depressive disorder, ever	494 (17.8)	411 (83.2)	83 (16.8)	0.786
Current smoker	403 (14.5)	284 (70.5)	119 (29.5)	<0.001*
Binge drank, past 30	352 (12.8)	266 (75.6)	86 (24.4)	<0.001*
Prescription drug misuse, ever	376 (13.5)	281 (74.7)	95 (25.3)	<0.001*