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Problem Gambling Small Research Grant Outcomes FY2020

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Contents

Summary of Program

The ACPG allocated $32,000 in FY2020 for research in order to encourage scholars to contribute to the field of problem gambling. IGI distributed a call for proposals in October 2019 (see below) for research that explores issues related to problem gambling. We received 27 applications. Applications were blind -reviewed and scored by a committee of four. We selected 7 applicants for an award. Below is a description of each project that was selected and the outcome of each funded project. Many projects were disrupted due to COVID-19 restrictions on conducting research and the shutdown of research sites during the stay-at-home order.

List of Winners:

1. Lori Dwyer, UNLV Graduate Student

Summary of project:

Lori Dwyer was awarded $3,000 to study the relationship between problem gambling and suicide in Nevada. Currently, “there are no studies investigating suicide risk and its correlates in Nevada problem gamblers.” Dwyer’s work will help researchers and treatment providers in Nevada better understand not only the relationship between suicide and gambling severity, but also best practices in managing suicide risk and potential protective factors against suicide.

Outcome:

This project was completed and resulted in academic manuscript “Psychological Correlates of Suicidality among Problem Gamblers in Las Vegas,” with co-author Rory Reid. (see below)

Psychological Correlates of Suicidality among Problem Gamblers in Las Vegas

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Introduction

A number of studies have investigated relationships between problem gambling and suicidality with rates ranging from 20% to 80% depending on how suicidality is measured (suicidal thoughts, intent, previous suicide attempts, etc…), the instruments used, and the populations being studied (Kausch, 2003; Ledgerwood, Steinberg, Wu, & Potenza, 2005; Ledgerwood & Petry, 2004; Petry & Kiluk, 2002; Modhaddam et al, 2015). For example, rates vary across the type of group such as community vs. clinical samples, those with co-occurring problems such as substance use disorders, and vulnerable populations such as veterans or the elderly. Collectively, when compared to the general population, problem gamblers have a higher risk for attempting suicide with one study reporting 3.4 times more likely to attempt suicide (Newman & Thompson, 2003) and another study using more rigorous analysis reporting 2.8 times more likely to attempt suicide (Moghaddam et al., 2015). Interestingly, studies examining point-prevalence rates using epidemiological data have attempted to compare gambling and non-gambling regions have yielded mixed results (Phillips et al, 1997; McCleary et al., 1998; McCleary, 2002; Nichols, Stitt, & Giacopassi, 2004). These studies are predicated upon the assumption that if gamblers are at higher risk for suicide, mortality rates related to suicide should be significantly higher in regions where gambling is accessible. The majority of the aforementioned studies failed to find evidence supporting such a relationship with one study examining 206 cases of suicide in Las Vegas concluding the common assertion between Las Vegas and gambling-related suicide was unsupported by the data (Marfels, 1998). Regardless, suicidality among treatment-seeking problem gamblers in Las Vegas is of interest insofar as the 6 percent prevalence rate of problem gambling in Nevada is more than twice the national average in other jurisdictions (St. John, Dassopoulos, & Bernhard, 2017). Subsequently, the current study examines psychological correlates, substance use, and suicidality in Las Vegas problem gamblers and extends existing research on suicide among problem gamblers to include associations with loneliness, shame, hopelessness, and perceived emotional support. These latter constructs have been neglected in the research on problem gambling and suicide despite their importance in assessing this population for risk of self-harm. We will also examine the relationship between suicidality and financial debt anticipating what other studies have found, namely, suicidality will be associated with higher financial debt. Finally, there is a paucity of research examining the relationship between suicidality and game type (games of skill vs. games of chance) therefore we will explore any associations that may exist among this sample.

Risk Factors for Suicide in Problem Gamblers

Risk factors for suicide among problem gamblers have consistently demonstrated several patterns including being female, gambling severity, substance use disorders, and comorbid psychiatric conditions such as depression, attention-deficit/hyperactivity disorder, and post-traumatic stress disorder (Martins, Tavares, Da Silva Lobo, Galetti, & Gentil, 2004; Moghaddam, Yoon, Dickerson, Kim, & Westermeyer, 2015; Stefanovics, Potenza, Pietrzak, 2017; Penfold, Hatcher, Sullivan, Collins, 2006; Potenza, Steinberg, & Wu, 2005; Retz, Ringling, Retz-Junginger, Vogelgesang, & Rosler, 2016). Some research has also linked greater financial debt among problem gamblers as an additional risk factor for suicide including individuals with a higher number of bankruptcies (Petry & Kiluk, 2002). Moreover, studies examining psychological autopsy data post-suicide for individuals presumed to have a gambling disorder have found associations between gambling-related financial problems and suicide (Blaszczynski & Farrell, 1998; Wong, Chan, Conwell, Conner, & Yip, 2010). A recent study found a mediating relationship where financial problems were associated with increased familial conflict, which was in turn associated with increased suicidality (Carr, Ellis, & Ledgerwood, 2018).

Personality traits and personality disorders have also been linked to higher suicidality among problem gamblers with evidence suggesting Cluster B personality disorders (antisocial, borderline, histrionic, and narcissistic personality disorders) are more prevalent among problem gamblers at risk for suicide (Séguin et al. 2010). This finding has also been noted with the observation that impulsivity is a core characteristic among the Cluster B personality disorders and a strong prognostic feature of a suicidal event (Bishof et al., 2015). Furthermore, trait impulsivity has been linked to greater gambling disorder severity with its associated consequences which might also explain how impulsivity among problem gamblers is linked to a higher suicide risk (Mallorqui-Bague, et al., 2018).

Finally, suicide by game activity has not been extensively studied, however, Petry (2003) reported lower mental distress in gamblers engaging in games of skill which was associated with a lower suicide attempt rate.[1] Further research is needed in this area to determine if game activity is predictive of suicidality among problem gamblers, and if so, what explanation might elucidate such a relationship?

The current study explores psychological correlates of problem gambling and suicide in a patient sample seeking treatment at an outpatient mental health clinic in Las Vegas, Nevada. Specifically, we examine correlates of anxiety, depression, loneliness, hopelessness, shame with problem gambling severity, consequences of problem gambling, and suicide. Alcohol and drug abuse are also considered. We hypothesize life satisfaction and perceived emotional support will constitute protective factors against suicide-risk in our sample of problem gamblers. Finally, we

[1] It should be noted that legal debates around "skill vs chance" are more complex than how these classifications are made for treatment seeking problem gamblers. For the legal debates see Roberts, J., Cohen, P., Graboyes, B., & Rutledge, K. (2018). Roundtable discussion from the experts: Debating skill vs. chance. Gaming Law Review, 22(5), 276-288.

examine gambling-related debt and game activity (games of chance vs. skill) and their relationship to suicide risk.

Methods

Participants and Procedure

Participants included problem gamblers (N=117) who were seeking treatment at an outpatient community agency that works with a variety of mental health issues in Las Vegas, Nevada. Overall, participants include more men (males = 73, females = 44), predominantly Caucasian, and an average age of 46.4 years. More detail information regarding demographic variables is noted in Table 1.

Participants were required to be at least 18 years of age, English speaking, and able to read at an eighth-grade level. No incentives for participation were offered and all participants signed consent at the outset of treatment. We had a 94% rate of consent from those who were asked if their data could be used for research purposes. Consecutive admissions of patients were evaluated through a diagnostic structured interview (*Mini International Neuropsychiatric Interview*) by a doctoral level neuropsychologist with over 10+ years of clinical and research experience. All patients met criteria for gambling disorder. This study was submitted to the Institutional Review Board through the University of Las Vegas Nevada.

Suicide-Risk Classification was assigned if a patient had previously attempted suicide (regardless of intent to die), previously had a plan to commit suicide, or reported "thoughts about killing" themselves in the previous 12-month period. These criteria also assigned all patients who reported they were "Likely or Very Likely" to attempt suicide one day as "At-Risk." After classification, 41% problem gamblers (48/117) were classified At-Risk.

Measures

Mini International Neuropsychiatric Interview (MINI 6.0). The MINI is a structured diagnostic clinical interview used to assess DSM-IV-TR psychopathology along the Axis I domains and includes a module that assesses for adult ADHD. It is widely used, and the psychometric properties have been established and reported in the literature (Sheehan, et al., 1998).

National Opinion Research Center DSM Screen for Gambling Problems (NODS) is a short brief structured interview based on the DSM-IV criteria (Gerstein et al, 1999) and has been demonstrated to be a valid, reliable, and clinically usefulness tool to screen for gambling related disorders (Hodgins, 2004; Wickwire, 2008). Participants who answered positively to five or more items were classified as pathological gamblers.

Suicidal Behaviors Questionnaire – Revised (SBQ). The SBQ is a brief 4-item self-report questionnaire related to prior suicidal thoughts, plans, and attempts. Respondents can select from several specific choice options (e.g. "I have attempted to kill myself and really hoped to die")

based on the previous 12-month period (Osman, Bagge, Gutierrez, Konick, Kooper, & Barrios, 2001). The SBQ was validated on adult psychiatric inpatients and college students. Internal consistency as measured by coefficient alpha for the scale items was high (.87) and Receiver operating characteristics (ROC) analysis suggested a cut-off score of 8 or higher correctly classified individuals at significant risk of suicide (Sensitivity = .80 and Specificity = .91). Logistic regression analysis found evidence to support the SBQ scores as useful risk factors for predicting group membership among those with histories of suicide attempts and those without (Standardized Estimate = .39, SE = .11, $p < .001$; Odds Ratio = 1.47).

Shame Inventory (SI). The current study used Part I of the SI which consists of three items answered on a 5-point Likert scale with items that query frequency, intensity/severity, and negative impact of maladaptive shame in response to a definition of shame. The items show good internal consistency with an alpha coefficient of .80 and a test-retest reliability coefficient of .85 over a one-week time period. The SI inventory has also demonstrated convergent validity with two existing trait-based measures of shame and divergent validity with a measure of guilt. The SI has also successfully discriminated between clinical populations and healthy controls. The items administered in the current sample showed high internal consistency ($\alpha = .91$).

Gambling Consequences Scale (GCS). The GCS is a 15-item self-report questionnaire assessing independent events associated with gambling-related issues. Responses indicate the frequency of various consequences (Has not Happened to Happens Daily/Almost Daily) with higher scores suggesting greater frequency of consequences. The GCS shows excellent internal consistency (.94) and adequate test-retest reliability (.89) among problem and recreational gamblers (Reid, Rosenthal, & Fong, 2015). Scores on the GCS are positively correlated with higher levels of anxiety, depression, stress proneness, time spent gambling, and win-to-loss ratio of money lost (Reid, Rosenthal, & Fong, 2015).

Personal Health Questionnaire (PHQ-4). The PHQ-4 is a brief self-report questionnaire that consists of two subscales, each containing 2 items for depression and anxiety with scores ranging from 0-to-6 points for each subscale. These items were extracted from the larger PHQ-9 (for depression) and GAD-7 (for anxiety). The psychometric properties are well established and the PHQ-4 has been shown to be valid and reliable in both general populations and clinical samples (Kroenke, Spitzer, Williams & Lowe, 2009; Lowe et al., 2010). Scores ≥ 3 on either subscale are considered a positive screen for depression and anxiety respectively.

Alcohol Use Disorders Identification Test (AUDIT). A 10-item questionnaire, the AUDIT was initially developed through a World Health Organization collaboration on early detection of persons with harmful alcohol consumption. (Saunders, et al. 1993). It has gained wide-spread usage in clinical practice and research. The psychometric properties are well established (Allen et al, 1997). The AUDIT consists of 3 dimensions; items 1–3 assess alcohol consumption, items 4–6 assess alcohol dependence, and items 7–10 assess the presence of alcohol-related problems.

Questions 1–8 are scored on a 5-point scale ranging from 0 to 4, and questions 9 and 10 are scored 0, 2 and 4 respectively. As a result, 40 is the highest score that can be obtained from AUDIT.

Drug Use Disorders Identification Test (DUDIT): The 11-item DUDIT yields satisfactory measures of reliability and validity for use as a clinical or research tool. Internal consistency reliability estimates (Cronbach's α) are generally > .90. Most studies also revealed favorable sensitivity (ranging from .85 to 1.00) and specificity (ranging from .75 to .92) in a variety of populations. The scoring of DUDIT is based on two approaches: items 1 to 9 are scored on a five-point Likert scale, while items 10 and 11 are scored on three-point scale. The DUDIT score is calculated by summing the scores on all items, engendering a maximum score of 44 points with a cut-off score of 8. (Berman et al, 2005; Hildebrand, 2015; Voluse et al, 2012).

Perceived Emotional Support Inventory (PESI) is an 8-item unifactor Liker-type scale that uses a 7-point response format with categories fully labeled (1 = Very Strongly Disagree, 2 = Strongly Disagree, 3 = Mildly Disagree, 4 = Neutral, 5 = Mildly Agree, 6 = Strongly Agree, 7 = Very Strongly Agree). Items 3, 4, and 7 are reverse scored prior to summation of all scale items yielding a total PESI score. Scores range from 8 to 56 with higher scores reflecting greater levels of perceived emotional support. The PESI purports to assess whether a respondent has someone with whom (1) vulnerable emotions can be trusted, (2) feelings can be honestly expressed, (3) shared emotions can be empathically validated, and (4) guidance can be sought related to emotional issues and emotional well-being. Sample items include "When I need emotional help I have people I can turn to" and "There is someone trustworthy I can share my emotional experiences with." Normed on several college samples (n = 205; n = 298), the scale demonstrated discriminate validity with the Beck Depression Inventory–II and concurrent validity with the Multidimensional Scale of Perceived Social Support. Reliability analysis of the scale showed high internal consistency (alpha = .93) and test-retest reliability over a 4-week interval (r = .87). Analyses of gender differences for the PESI were non-significant (p = .731). Based on combined norming data of the college samples, the mean score is 46.1 (SD = 8.69). Scores of ~ 33 – 59 fall within an average range (± 1.5 standard deviations from the M = 46.1). Respondents scoring below 33 perceive themselves as lacking significantly less emotional support than average and those scoring above 59 have significantly higher than average perceptions of emotional support.

UCLA Loneliness Scale (UCLA-LS): The 10-item UCLA-LS was revised version of the original 20-item scale that showed superior psychometric properties. The UCLA-LS captures loneliness as a unidimensional construct with the 10-item version showing an adequate goodness of fit when assessed through confirmatory factor analysis (AGFI of .90 and CFI of .95) and high reliability with coefficient alpha ranging from .89 to .94. In a normative sample of adults (N=311) the 10-item version yielded a mean of 19.2 (SD=5.1). Subsequent studies examining the UCLA-LS have replicated these findings (Elphinstone, 2018).

Brief Hopelessness Inventory (BHI): The BHI is a 7-item self-report scale with responses that vary from "Very strongly disagree" to "Very strongly agree." The scale queries items such as "I feel like I have nothing to look forward to", "I feel very little hope about what the future has in store for me" and "I feel an overall sense of despair about where my life is headed." The BHI has been positively correlated with the Beck Hopelessness Scale (BHS) ($r = .71$, $p < .01$) with a mean of 12.9(SD=6.4) in a college sample after students who scored ≥ 9 on the BHS were removed and a 5% trimmed mean was assessed to remove outliers. Clinically significant scores based on 1.5 SD above the mean suggest: Scores of 22-25 = mild, Scores of 25-28 = moderate, and Scores ≥ 29 = severe.

Satisfaction with Life Scale (SWLS). The SWLS is a brief 5-item unidimensional measure of global life satisfaction answered on a 7-point Likert scale ranging from 1= strongly disagree to 7 = strongly agree (Diener, Emmons, Larsen, & Griffin, 1985). It is one of the most widely administered scales in the measurement of life satisfaction (Oishi, 2006) with higher scores reflecting higher levels of satisfaction. A neutral score of 20 has been suggested, with scores above 30 representing high satisfaction and scores less than 9 indicative of extreme dissatisfaction with life (Pavot & Diener, 1993). The items show good internal consistency with an alpha coefficient of .87 and a test-retest reliability coefficient of .82 over a two month period (Diener, Emmons, Larsen, & Griffin, 1985). A number of studies have provided validity for the SWLS with higher scores linked to positive affect and self-esteem (Pavot & Diener, 1993) and lower scores correlated with negative affect, anxiety, depression, and general psychological distress (Blais, Vallerand, Pelletier, & Briere, 1989; Larson, Diener, & Emmonds, 1985; Arrindell, Meeuwesen, & Huyse, 1991).

Data Analysis and Results

Correlation Analysis

As expected, correlations outlined in Table 2 show higher suicide risk was positively correlated with problem gambling symptoms ($r = .27$, $p < .01$), gambling consequences ($r = .34$, $p < .01$), depression ($r = .55$, $p < .01$), anxiety ($r = .37$, $p < .01$), hopelessness ($r = .38$, $p < .01$), loneliness ($r = .41$, $p < .01$), and shame ($r = .43$, $p < .01$). Suicide risk was inversely related to higher levels of life satisfaction ($r = -.25$, $p < .01$) and perceived emotional support ($r = -.25$, $p < .01$). Interestingly, higher levels of suicide risk were correlated with drug abuse ($r = .29$, $p < .01$) but associations with alcohol abuse were unremarkable ($r = .10$, *ns*). This latter finding is consistent with previous reports of drug dependence, but not alcohol dependence, being related to higher suicide risk measured by suicide attempts (Hodgins, Mansley, & Thygesen, 2006; Kausch, 2003).

Suicide Risk and Problem Gambling

As reported in Table 3, suicidal thoughts are common among problem gamblers with 38.5% reporting having suicidal thoughts on two or more occasions in the previous 12-month period prior to entering treatment. Expressing a desire to die is also common with 35.9% of

problem gamblers reporting they have told someone else they wanted to die. Insofar as a previous suicide attempt is the strongest predictor of suicide, it is significant that 7.8% of the patients in this sample reported they had made at least one previous attempt to end their life. Perhaps more disconcerting is that 8.5% of gamblers stated they are "likely" or "very likely" to end their life someday but only 20% of these individuals had previously attempted suicide. Thus, the majority of gamblers who report they are likely to commit suicide at some future point in time have no previous history of suicide attempts. Finally, based on criteria outlined in our procedures for suicide-risk classification, 41% of this sample was assessed as "at-risk." We divided the sample into two groups based on "at-risk" or "non-risk" to explore how these groups of gamblers might differ across our study variables.

Group Comparisons

The overall MANOVA for the study variables revealed significant differences between the two groups (Wilks' $\lambda = .329$, $F(12,104) = 16.91$, $p = .001$). As shown in Table 4, post-hoc univariate tests showed significant differences between the groups on all of the study variables except alcohol use. Apart from scores on suicidal tendencies, the magnitude of these differences was most pronounced for depression, shame, anxiety, hopelessness, and gambling consequences.

Calculations for gambling debt and game type are noted in Table 5. The majority of problem gamblers, regardless of group membership, reported some debt (77.6% of suicidal gamblers and 60.3% of non-suicidal gamblers). However, the distribution of this debt differed by group in categories of higher debt. As shown in Table 5, suicidal gamblers report higher percentages of debt in excess of $25,000 (10.2% vs. 4.4%). This trend continues for debt in excess of $50,000 with 28% of suicidal gamblers reporting such debt compared to only 11.8% of non-suicidal gamblers. Thus, having higher financial debt appears to be associated with being at-risk for suicide.

Group differences based on games of skill verses games of chance were also explored. A game of chance is typically a game where the outcome is strongly or completely influenced by randomization (slot machines, video poker, craps, roulette, video keno). Conversely, a game of skill is one in which the outcome may be determined more by skill, rather than chance (table poker, table blackjack, sports betting). For example, someone who does research on statistics related to a sports event (e.g. tennis match) might have an advantage in being able to predict the outcome with greater odds than someone who lacks such knowledge. However, there are still unknown factors that could influence the outcome therefore even games of skill have elements of chance. As noted previously, one study found players engaged in games of skill exhibited less mental distress. Subsequently, it might be hypothesized they would be less likely to be at risk of suicide. However, as shown in Table 5, the percentages of distribution by group are within 2 percentage points. In other words, the classification of suicide risk based on game type (skill vs chance) does not appear to be supported in our data.

Discussion

A number of interesting findings emerged in this study with some replicating results from other studies on problem gamblers and suicide. Suicidal thoughts were common in 38.5 percent of the sample, and 7.8% had previously attempted suicide. The prevalence of suicidal thoughts in this sample is comparable to what has been observed in other studies of treatment seeking gamblers ranging from 32% to 42% (Ibañez et al., 1992; Schwarz & Lindner, 1992; Specker et al., 1996; Petry & Kiluck, 2003). These studies however, report suicidal attempts ranging from 17% to 31% which is much higher than the 7.8% reported in our sample. A number of factors may have influenced this lower rate including co-occurring substance use disorders, psychopathology, trauma histories, treatment settings, family dynamics, and the level of financial debt or other gambling-related consequences. Our finding that 8.5 percent of the gamblers in our sample stated they are "likely" or "very likely" to end their life someday was surprising, especially given 80 percent of these individuals have no history of a previous suicide attempt. This finding strong supports ongoing assessment of suicidality throughout the treatment process and in any follow-up calls after treatment has ended. This is also supported by data that suggests consequences for problem gambling continue to accrue even after problem gambling behavior has been arrested.

The correlations between our study variables and suicidality emerged in the directions we anticipated. However, it is notable that consequences of problem gambling were more strongly correlated with suicidality than gambling severity as measured by the NODS. This finding makes sense since several items on the NODS measures aspects of gambling addiction such as preoccupation, escapism, chasing losses which typically precede consequences of gambling such as unwanted financial losses, legal problems, or relationship loss.

Not surprisingly, depression and anxiety were positively correlated with suicidality. Our data also provided additional insight about this psychopathology insofar as maladaptive shame, loneliness, and hopelessness (which have all been independently linked to depression and anxiety) were positively linked to suicidality, gambling consequences, and gambling severity. Future studies might focus mediating or moderating relationships between these variables. For example, is loneliness a precipitating risk factor for gambling and shame at perpetuating risk factor (e.g. gamblers feel shame in relation to their behavior, then in turn, gamble more to avoid the discomfort of the shame). The construct of hopelessness is also worthy of additional research insofar as it was linked to suicidality, depression, shame, loneliness, gambling severity and consequences. Indeed, many problem gamblers report continuing to gamble as it offers them "hope" for a big win that will miraculously solve all of their problems. While such irrational thoughts should be challenged, therapy must also focus on ways to instill hope for problem gamblers in the positive changes they will make.

Perceived emotional support was inversely linked to suicidality, loneliness, and depression, providers might focus on ways to cultivate emotional support networks for their patients as a protective factor for suicidality. For example, encouraging patients to participate in

Gamblers Anonymous and helping them to make appropriate disclosures to those who might offer them emotional support would likely be advantageous.

We also found evidence that higher levels of financial debt more prevalent among gamblers at risk for suicide. This has been noted in other studies and serves as a reminder that providers should make inquires about the specific financial losses and debts encountered by problem gamblers. Moreover, providers should pursue interventions that arrest financial bleeding among problem gamblers in order as part of treatment planning.

Our analysis of group differences based on games of skill verses games of chance yielded unremarkable findings suggesting this isn't a relevant marker for suicidality.

Limitations to this study include those common among research using self-report instruments. Inferences about the findings beyond those listed in this study should be made with caution, in part, because this study was cross-sectional in nature and thus causal conclusions cannot be drawn from these data. The sample consisted of Las Vegas residents (not visitors) who sought help at an outpatient treatment clinic. Thus, inferences to problem gamblers in residential treatment programs should also be made with caution.

Conclusions

Suicidality, particularly suicidal thoughts, prior attempts, and completions are significantly more elevated among problem gamblers. A number of comorbid factors increase risk for suicide in this population including co-occurring substance use disorders, depression, anxiety, personality disorders, gambling severity and its associated consequences, and higher financial debt. These findings have been reported in other studies and are supported in our sample of Las Vegas problem gamblers. Providers working with this population should monitor suicidality in their patients at intake and throughout treatment. Finally, continuing education about suicide assessment and risk management for suicide in clinical populations is advisable for problem gambling counselors.

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Table 1. *Sociodemographic Data for Gamblers (n=68) and At-Risk Suicide Gamblers (n=49)*

Demographic Variables	**Gamblers**		**Gamblers At-Risk**		**Total**	
Age (Mean/SD)	49.2 / 14.4		42.4 / 11.5		46.4 / 13.7	
	%	**n**	**%**	**n**	**%**	**n**
Gender						
Male	67.6	46	55.1	27	62.4	73
Female	32.4	22	44.9	22	37.6	44
Race						
Asian/Pacific Islander	10.3	7	14.3	7	12.0	14
Black/ African American	8.8	6	8.2	4	8.5	10
Hispanic / Latino	7.4	5	4.0	2	6.0	7
White / Caucasian	73.5	50	73.5	36	73.5	86
Relationship Status						
Single/Never Married	11.8	8	26.5	13	17.9	21
Married/Partnered	32.4	22	28.6	14	30.8	36
Divorced/Separated	39.7	27	30.6	15	36.0	42
Cohabiting	5.9	4	12.2	6	8.5	10
Widowed	2.9	2	0.0	0	1.7	2
Remarried	7.3	5	2.1	1	5.1	6
Education						
Less than High School	0.0	0	2.0	1	0.8	1
High School / GED	20.6	14	18.4	9	19.7	23
Some College/Univ	28.0	19	38.8	19	32.5	38
Trade School Certificate	4.4	3	2.0	1	3.4	4
2 year Associate	10.3	7	18.4	9	13.7	16
4 year Bachelor's	23.5	16	16.3	8	20.5	24
Master/Doctorate	13.2	9	4.1	2	9.4	11
Annual Income						
Between $0.00 - $14,999	16.2	11	16.3	8	16.2	19
Between $15,000-$24,999	13.2	9	8.2	4	11.1	13
Between $25,001-$34,999	8.8	6	18.4	9	12.8	15
Between $35,001-$49,999	19.1	13	16.3	8	17.9	21
Between $50,000-$74,999	14.8	10	24.5	12	18.8	22
Between $75,000-$99,999	13.2	9	8.2	4	11.1	13
Between $100,000-$149,999	8.8	6	0.0	0	5.1	6
More than $150,000	5.9	4	8.1	4	6.8	8
Employment						
Full-time	61.8	42	73.5	36	66.7	78
Part-time	5.9	4	4.1	2	5.1	6
Unemployed	8.8	6	12.2	6	10.3	12
Student	0.0	0	0.0	0	0.0	0
Retired	20.6	14	2.0	1	12.8	15
Disabled	2.9	2	4.1	2	3.4	4
Other	0.0	0	4.1	2	1.7	2

Table 2. Zero order correlations between primary study variables

		1	2	3	4	5	6	7	8	9	10	11	12
1.	Suicide	—	.27**	.34**	.09	.29**	.43**	.37**	.55**	-.25**	.41**	.38**	-.25**
2.	Gambling Severity	.28**	—	.59**	.14	.15	.47**	.48**	.45**	-.13	.36**	.21*	-.21*
3.	Gambling Consequences	.34**	.59**	—	.21*	.09	.53**	.44**	.42**	-.06	.31**	.31**	-.37**
4.	Alcohol Use	.10	.14	.21*	—	.08	.33**	.26**	.21*	.04	.09	.05	-.14
5.	Drug Use	.29**	.15	.09	.08	—	.19*	.23*	.29**	-.02	.16	-.03	-.04
6.	Shame	.43**	.47**	.53**	.33**	.20*	—	.51**	.56**	-.17	.40**	.41**	-.31**
7.	Anxiety	.37**	.48**	.44**	.26**	.23*	.51**	—	.77**	-.21*	.39**	.28**	-.24**
8.	Depression	.55**	.45**	.42**	.21*	.29**	.56**	.77**	—	-.24*	.46**	.37**	-.35**
9.	Emotional Support	-.25**	-.13	-.06	.04	-.02	-.17	-.21*	-.24*	—	-.63**	-.27**	.24**
10.	Loneliness	.41**	.36**	.31**	.10	.16	.40**	.39**	.46**	-.63**	—	.39**	-.44**
11.	Hopelessness	.38**	.21*	.31**	.05	-.03	.40**	.28**	.37**	-.27**	.39**	—	-.47**
12.	Life Satisfaction	-.25**	-.21*	-.37**	-.14	-.04	-.31**	-.24**	-.35**	.24**	-.44**	-.47**	—

* $p < .05$, ** $p < .01$ Constructs Measured: Suicide (SBQ), Gambling (NODS), Gambling Consequences (GCS), Alcohol Use (AUDIT), Drug Use (DUDIT), Shame (SI), Anxiety (PHQ-4), Depression (PHQ-4), Emotional Support (PESI), Loneliness (UCLA-LS), Hopelessness (BHI), Life Satisfaction (SWLS).

Table 3. Suicide Characteristics of Treatment Seeking Problem Gamblers (N=117)

<u>Suicidal Thoughts</u>	
*Past 12 Month*s	
Never	28.2%
Rarely (1 time)	33.3%
Sometimes (2 times)	17.1%
Often (3-4 times)	7.7%
Very Often (≥ 5 times)	13.7%
<u>Suicide Plans / Attempts</u>	
Have Had a Plan	13.7%
Have Made a Previous Attempt	7.8%
Expressed a Desire to Die	35.9%
<u>Likely to Attempt Someday</u>	
Unlikely, No Chance, Never	91.5%
Likely, Very Likely	8.5%

Table 4. Group Differences for Suicide-Risk and Non-Suicide Risk Problem Gamblers

	Problem Gamblers					
	At-Risk (*n*=48)		Non-Risk (*n*=68)			Effect Size
Variable	Mean	SD	Mean	SD	*F*	η^2
Suicide	10.6	2.9	4.8	1.6	182.19***	0.61
Gambling Severity	8.8	1.5	8.3	1.3	5.27*	0.04
Gambling Consequences	47.1	7.1	41.9	8.4	11.67***	0.09
Alcohol Use Disorders	8.5	9.7	6.3	7.7	1.97^{ns}	0.02
Drug Use Disorders	6.4	11.1	2.4	5.5	6.49**	0.05
Shame	8.2	1.8	6.2	2.5	23.31***	0.17
Anxiety	3.9	1.8	2.7	1.8	11.71***	0.09
Depression	4.3	1.7	2.4	1.5	39.49***	0.26
Emotional Support	35.3	11.8	39.6	8.6	5.20*	0.04
Loneliness	26.7	5.5	24.1	4.7	7.35**	0.06
Hopelessness	33.1	8.4	27.1	9.3	13.23***	0.10
Satisfaction with Life	13.0	5.7	15.9	6.3	6.72**	0.06

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5. Group Comparisons by Gambling Debt and Games of Skill/Chance

	Problem Gamblers	
	At-Risk (*n*=48)	Non-Risk (*n*=68)
Debt/Game Type	Percentage %	Percentage %
No Debt	22.4	39.7
$1 to $5000	16.3	19.1
$5001 to $10,000	14.3	17.6
$10,001 to $25,000	8.2	7.4
$25,001 to $50,000	10.2	4.4
More than $50,000	28.6	11.8
Games of Skill	16.3	17.6
Games of Chance	83.7	82.4

2. Kasra Ghaharian, UNLV Graduate Student

Summary of project:

Kasra Ghaharian was awarded $15,000 to investigate the association between shift work (SW) and problem gambling (PG). The hospitality-based economy in Las Vegas has a disproportionately large SW workforce. “Accordingly, this project will investigate the association between SW and PG in hospitality industry employees and explore whether sleep quality, as well as other pertinent factors, mediate the relationship.”

Outcome:

This project was not fully-funded because of Covid-19 disruptions to the research plan. A small researcher stipend was issued instead, and a paper exploring the literature and outlining the logic and methods of the project was completed : “Shift work and gambling disorder: The mediating role of sleep quality.” (see below)

Title: Shift work and gambling disorder: The mediating role of sleep quality.

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Keywords: Shift workers; Gambling disorder; Sleep quality; Physical activity levels; Occupational health

1. Introduction

Modern day society is becoming increasing reliant on 24-hour services. Over 17% of the United States workforce engage in shift work, defined as work primarily occurring outside of standard daylight hours [1]. This proportion is estimated to be even higher in service-centric industries, such as hospitality and gambling, where staff are required around the clock to accommodate customer demands [2-4]. Troublingly, shift work has been identified as a risk factor for gambling disorder [5-7], yet research supporting this hypothesis is scant and the mechanisms of action unclear. Linkages between gambling disorder and poor health have been acknowledged [8-11], and mounting evidence suggests shift work is associated with an increased risk of many adverse health conditions including obesity, type-II diabetes, cardiovascular disease, insomnia, and depression [12,13]. Despite these numerous health and behavioral issues, shift work is considered necessary for the hospitality and gambling industries. As these and other shift work dependent sectors continue to grow so too does the significance of these effects. The need to understand and manage the health of shift workers is upon us.

Gambling behavior in shift workers is suggested to be influenced by environmental and social characteristics including social pressures from coworkers, limited entertainment options during social time, and shift work enabling secretive behavior [6,7,14-19]. However, these hypotheses are largely speculative and based on limited qualitative data. Sleep quality may help explain this proposed link between shift work and gambling disorder. Disturbed sleep is a well-known consequence of shift work [20-22], and a bi-directional relationship between harmful gambling behavior and poor sleep has been acknowledged [23]. Should an association between shift work and gambling disorder exist, sleep quality could play a central role in explaining the relationship.

Accordingly, this research investigates the association between shift work and gambling disorder in gambling industry employees, and explores whether sleep quality mediates the relationship. The research is highly novel as it fills a much-needed gap in both the gambling addiction and the shift work literature. Furthermore, given the non-substance-related nature of gambling, advancing the understanding of plausible neurobiological pathways

has overarching implications for the broader area of addiction research [24]. Gambling disorder is already a relevant public health concern [24], and many shift work-dependent sectors in the United States have higher projected job growth compared to the national average [1]. Effective public health policy to combat gambling disorder must identify target populations and clear risk factors [25]. This research helps clarify whether shift work is creating an at-risk sub-group for gambling disorder.

2. Literature Review

2.1. Gambling disorder

For the majority of the world's population gambling is a harmless pastime. However, for a small minority gambling can be damaging and result in significant costs to individuals, their families, and society as a whole. Various terms have been used to describe this adverse behavior. The latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V) abandons the term "pathological gambling" and employs the term "gambling disorder" to describe a 'persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress' [26]. Interestingly, it is the only non-substance-related disorder categorized in the *Substance-Related and Addictive Disorders* chapter of the DSM-V. Research suggests that the prevalence of gambling disorder amongst adults in the United States is approximately 1% [27]. Concerningly, higher rates occur in certain subpopulations, indicating some individuals are more vulnerable to develop a problem and/or succumb to the harmful effects [28]. For example, adolescents, the elderly, and minorities appear to show higher prevalence rates and have thus garnered attention from the research community [28]. Study of these and other subgroups is important as it can help elucidate on the possible risk factors and etiology of gambling disorder.

A paucity of research has shaped a belief that shift workers are a vulnerable at-risk subpopulation for gambling disorder. However, further work is necessary to confirm this hypothesis. In fact, there is a stark lack of research that purposely targets the proposed relationship between shift work and gambling behavior. The assumption appears to stem from broader literature that investigates gambling behavior and attitudes amongst gambling venue employees. Exposure theory dominates the rationale for these works. The theory, in the context of gambling venue employees, postulates that accessibility to environmental toxins (e.g. a casino or other gambling venue) increases the likelihood of related diseases (i.e. gambling disorder) [29]. Prior literature has therefore attempted to define workplace characteristics (or toxins) that may play a role in encouraging gambling amongst gambling venue employees. Toxins recurrent in the literature include regular contact with gamblers, pressure from coworkers, managerial influence, job stress, job satisfaction, and repeated exposure to gambling activities, marketing, and promotions [15,31,32]. Shift work is also highlighted as a pertinent factor. Investigators suggest that irregular working patterns limit social opportunities, enable secretive behavior, and compound the already high stress nature of the job [6,15,18,25,33,34]. These factors are echoed in some research exploring gambling behavior and shift workers outside of gambling venue employees, but these reports are not peer reviewed [7,16,35]. Unfortunately, all these hypotheses linking shift work to gambling disorder are largely speculative and lack theoretical underpinnings, mainly due to the primary objectives focusing on holistic environmental factors rather than shift work in isolation.

Evidence supporting the exposure theory is equivocal. Data suggests that some may in fact gamble less with increased accessibility over time [36]. This phenomenon has been termed the adaptation effect, suggesting individuals 'adapt' to the exposure (i.e. gambling) over time and become 'immune' to its harmful effects [37]. Nonetheless, bundling shift work among the many gambling venue toxins related to the exposure theory is parochial. Shift work is vital to the gambling industry but is also a staple in myriad other industries, including the broader hospitality industry, healthcare, law enforcement, and transportation to name but a few. Gambling disorder is an addiction, and while there is a lack of evidence linking any specific type of shift work to gambling disorder, emerging data demonstrate an increased susceptibility to substance-abuse and alcohol-use addiction in this subpopulation [38]. Logically, distinctive features of shift work might play a role in the etiology of gambling disorder. Furthermore, present hypotheses related to shift work as a gambling venue toxin fail to recognize the potential impact of the numerous negative physiological and psychological consequences associated with working irregular hours.

2.2. Shift work

Approximately 29% of the United States workforce undertake schedules outside of traditional working hours [39]. Troublingly, shift work is disproportionately common in the hospitality industry. In both the United States and Europe, workers in the sector are considerably more likely to work atypical hours [40,41]. The proportion may be sizably larger for destinations such as Las Vegas and Macau that feature a mass of gambling venues such as Integrated Resorts. For example, The Venetian Macau boasts more than 3,000 suites and employs approximately 15,000 workers, many in roles that require staff to work shifts outside of standard daylight hours [42]. Additionally, drawing response data from the question, "at what time do you arrive at work?" from the 2018 Census for the Las Vegas area, it can be estimated that almost 1 in 4 people in Las Vegas work outside of typical daylight hours (i.e. starting work in the evening or early hours of the morning) [43].

Adverse health outcomes as a consequence of shift work are mediated by concomitant behavioral mechanisms. Altered light exposure (artificial light during nocturnal hours, darkness during the day), poor nutrition choices, irregular feeding patterns, inadequate sleep, low physical activity levels, as well as a higher propensity to smoke and consume alcohol have been identified as potentially damaging behaviors [44]. These may act individually or synergistically and result in undesirable changes to the circadian rhythm, sleep, and/or body composition of the shift worker. The complex interplay between these behaviors and consequent physical and mental detriments place the shift worker at an increased risk for non-communicable diseases and mental health conditions [39]. More recently, these effects have been postulated to play a role in the development and treatment of substance-use and alcohol-use addictions [38]. However, there is no prior research assessing gambling behavior using validated methods and/or a quantitative design amongst shift-workers. We thus propose the following hypothesis:

H1. There is a positive association between shift work and gambling disorder.

2.3. Sleep

Diurnal rhythmicity is displayed by genes throughout the human body [44]. These 'internal-clocks' are found in various tissues and regulate our physiology and behavior [44,45]. This daily ebb and flow of activity is known as our circadian rhythm. The most familiar daily rhythm in humans is the sleep-wake cycle. When forced to work at the 'wrong' time of day (e.g. night shift), shift workers must attempt to sleep in their circadian phase least conducive for sleeping. Generally, this results in disturbed sleep.

Sleep is vital for optimal physical and mental functioning. A wealth of literature, via reliable and valid measures from a variety of industries across the globe, has established lack of sleep and/or poor sleep quality in shift workers [46-50]. Most recently Booker and colleagues [51] performed an extensive systematic review that included 58 studies confirming the positive association between shift work and poor sleep quality. Disturbed sleep is a chief regulator in the etiology of poor health in shift-workers [39] and could also help explain the linkages with gambling disorder.

The study of sleep in substance-related disorders is extensive, but inquiry with respect to gambling disorder is scarce [52]. Of the limited literature, the emphasis is on treatment-seeking gamblers and do not use validated sleep questionnaires. A cross-sectional study in 2012 recognized this shortcoming and utilized two validated sleep questionnaires in a sample of non-treatment seeking gamblers and found a significant association between problematic sleep and gambling severity [52]. A more recent study, also using validated measures, contributed to this evidence but in a sample of treatment-seeking gamblers [53]. However, the goal of these cross-sectional studies was to understand sleep behavior in current gamblers rather than investigate a causal pathway. Further research is warranted to elucidate the relationship (and its direction) between sleep and gambling behavior.

Sleep deprivation is often cited as a common consequence of problematic gambling behavior. However, theoretical underpinnings in support of a reverse pathway (i.e. sleep deprivation causes gambling disorder) does exist. The adverse effects of poor sleep are well-documented elsewhere and include physiological ailments such as all-cause mortality, obesity, diabetes, hypertension, as well as mental and mood disorders [54-56]. Sleep also appears to impact decision making, with deprivation impairing one's decision making capabilities [57]. In 1998 Harrison and Horne [58] exposed sleep deprived and non-sleep deprived participants to a gambling task. The task was designed to prompt changes in decision making toward a conservative strategy that would return small but consistent returns. Despite being confronted with heavy losses at the beginning of the task, the sleep deprived group purposefully continued to seek out high-risk (zero-win) options, suggesting a lack of concern for negative consequences when confronted with high rewards. Over the past two decades, the study of sleep and risk-taking behavior has continued, and while the majority of studies support a positive association between sleep loss and risk-taking behavior, the underlying mechanisms still remain unclear [59]. The most popular theories involve disruptions to the prefrontal cortex, more specifically the ventromedial prefrontal cortex; the area of the brain implicated in decision making. More interestingly though, evidence points to disparities in risk-taking behavior in sleep deprived individuals depending on how a decision is framed. McKenna et al. [60] found that a single night of sleep deprivation altered the assessment of risk. Notably, sleep deprived participants were risk-seeking for gains, yet were risk-averse for losses. Venkatraman et al. [61] extended this work utilizing neuroimaging techniques with a comparable gambling task. Once again, results illustrated that sleep deprivation caused participants to care less about losses and adopt high-risk behavior in the pursuit of larger gains.

These are important implications with respect to gambling venues, where sleep deprived personnel (i.e. shift workers) are regularly exposed to enticing promotional materials as well as the overall allure of the environment (e.g. casino). Certainly, in these settings, gambling is framed as a chance to gain (i.e. win money). Furthermore, not only may the initial decision to start gambling be compromised, but once activity begins shift workers may be desensitized to losses and favor risky behavior in the pursuit of more gains. Accordingly, we hypothesize that:

H2. Sleep quality mediates the association between shift work on gambling disorder such that:

H2a. When sleep quality decreases, the association is significantly negative.

H2b. When sleep quality increases, the association becomes less significant.

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Modern day society is becoming increasing reliant on 24-hour services. Over 17% of the United States workforce engage in shift work, defined as work primarily occurring outside of standard daylight hours [1]. This proportion is estimated to be even higher in service-centric industries, such as hospitality and gambling, where staff are required around the clock to accommodate customer demands [2-4]. Troublingly, shift work has been identified as a risk factor for gambling disorder [5-7], yet research supporting this hypothesis is scant and the mechanisms of action unclear. Linkages between gambling disorder and poor health have been acknowledged [8-11], and mounting evidence suggests shift work is associated with an increased risk of many adverse health conditions including obesity, type-II diabetes, cardiovascular disease, insomnia, and depression [12,13]. Despite these numerous health and behavioral issues, shift work is considered necessary for the hospitality and gambling industries. As these and other shift work dependent sectors continue to grow so too does the significance of these effects. The need to understand and manage the health of shift workers is upon us.

Gambling behavior in shift workers is suggested to be influenced by environmental and social characteristics including social pressures from coworkers, limited entertainment options during social time, and shift work enabling secretive behavior [6,7,14-19]. However, these hypotheses are largely speculative and based on limited qualitative data. Sleep quality may help explain this proposed link between shift work and gambling disorder. Disturbed sleep is a well-known consequence of shift work [20-22], and a bi-directional relationship between harmful gambling behavior and poor sleep has been acknowledged [23]. Should an association between shift work and gambling disorder exist, sleep quality could play a central role in explaining the relationship.

Accordingly, this research investigates the association between shift work and gambling disorder in gambling industry employees, and explores whether sleep quality mediates the relationship. The research is highly novel as it fills a much-needed gap in both the gambling addiction and the shift work literature. Furthermore, given the non-substance-related nature of gambling, advancing the understanding of plausible neurobiological pathways

has overarching implications for the broader area of addiction research [24]. Gambling disorder is already a relevant public health concern [24], and many shift work-dependent sectors in the United States have higher projected job growth compared to the national average [1]. Effective public health policy to combat gambling disorder must identify target populations and clear risk factors [25]. This research helps clarify whether shift work is creating an at-risk sub-group for gambling disorder.

2. Literature Review

2.1. Gambling disorder

For the majority of the world's population gambling is a harmless pastime. However, for a small minority gambling can be damaging and result in significant costs to individuals, their families, and society as a whole. Various terms have been used to describe this adverse behavior. The latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-V) abandons the term "pathological gambling" and employs the term "gambling disorder" to describe a 'persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress' [26]. Interestingly, it is the only non-substance-related disorder categorized in the *Substance-Related and Addictive Disorders* chapter of the DSM-V. Research suggests that the prevalence of gambling disorder amongst adults in the United States is approximately 1% [27]. Concerningly, higher rates occur in certain subpopulations, indicating some individuals are more vulnerable to develop a problem and/or succumb to the harmful effects [28]. For example, adolescents, the elderly, and minorities appear to show higher prevalence rates and have thus garnered attention from the research community [28]. Study of these and other subgroups is important as it can help elucidate on the possible risk factors and etiology of gambling disorder.

A paucity of research has shaped a belief that shift workers are a vulnerable at-risk subpopulation for gambling disorder. However, further work is necessary to confirm this hypothesis. In fact, there is a stark lack of research that purposely targets the proposed relationship between shift work and gambling behavior. The assumption appears to stem from broader literature that investigates gambling behavior and attitudes amongst gambling venue employees. Exposure theory dominates the rationale for these works. The theory, in the context of gambling venue employees, postulates that accessibility to environmental toxins (e.g. a casino or other gambling venue) increases the likelihood of related diseases (i.e. gambling disorder) [29]. Prior literature has therefore attempted to define workplace characteristics (or toxins) that may play a role in encouraging gambling amongst gambling venue employees. Toxins recurrent in the literature include regular contact with gamblers, pressure from coworkers, managerial influence, job stress, job satisfaction, and repeated exposure to gambling activities, marketing, and promotions [15,31,32]. Shift work is also highlighted as a pertinent factor. Investigators suggest that irregular working patterns limit social opportunities, enable secretive behavior, and compound the already high stress nature of the job [6,15,18,25,33,34]. These factors are echoed in some research exploring gambling behavior and shift workers outside of gambling venue employees, but these reports are not peer reviewed [7,16,35]. Unfortunately, all these hypotheses linking shift work to gambling disorder are largely speculative and lack theoretical underpinnings, mainly due to the primary objectives focusing on holistic environmental factors rather than shift work in isolation.

Evidence supporting the exposure theory is equivocal. Data suggests that some may in fact gamble less with increased accessibility over time [36]. This phenomenon has been termed the adaptation effect, suggesting individuals 'adapt' to the exposure (i.e. gambling) over time and become 'immune' to its harmful effects [37]. Nonetheless, bundling shift work among the many gambling venue toxins related to the exposure theory is parochial. Shift work is vital to the gambling industry but is also a staple in myriad other industries, including the broader hospitality industry, healthcare, law enforcement, and transportation to name but a few. Gambling disorder is an addiction, and while there is a lack of evidence linking any specific type of shift work to gambling disorder, emerging data demonstrate an increased susceptibility to substance-abuse and alcohol-use addiction in this subpopulation [38]. Logically, distinctive features of shift work might play a role in the etiology of gambling disorder. Furthermore, present hypotheses related to shift work as a gambling venue toxin fail to recognize the potential impact of the numerous negative physiological and psychological consequences associated with working irregular hours.

2.2. Shift work

Approximately 29% of the United States workforce undertake schedules outside of traditional working hours [39]. Troublingly, shift work is disproportionately common in the hospitality industry. In both the United States and Europe, workers in the sector are considerably more likely to work atypical hours [40,41]. The proportion may be sizably larger for destinations such as Las Vegas and Macau that feature a mass of gambling venues such as Integrated Resorts. For example, The Venetian Macau boasts more than 3,000 suites and employs approximately 15,000 workers, many in roles that require staff to work shifts outside of standard daylight hours [42]. Additionally, drawing response data from the question, "at what time do you arrive at work?" from the 2018 Census for the Las Vegas area, it can be estimated that almost 1 in 4 people in Las Vegas work outside of typical daylight hours (i.e. starting work in the evening or early hours of the morning) [43].

Adverse health outcomes as a consequence of shift work are mediated by concomitant behavioral mechanisms. Altered light exposure (artificial light during nocturnal hours, darkness during the day), poor nutrition choices, irregular feeding patterns, inadequate sleep, low physical activity levels, as well as a higher propensity to smoke and consume alcohol have been identified as potentially damaging behaviors [44]. These may act individually or synergistically and result in undesirable changes to the circadian rhythm, sleep, and/or body composition of the shift worker. The complex interplay between these behaviors and consequent physical and mental detriments place the shift worker at an increased risk for non-communicable diseases and mental health conditions [39]. More recently, these effects have been postulated to play a role in the development and treatment of substance-use and alcohol-use addictions [38]. However, there is no prior research assessing gambling behavior using validated methods and/or a quantitative design amongst shift-workers. We thus propose the following hypothesis:

H1. There is a positive association between shift work and gambling disorder.

2.3. Sleep

Diurnal rhythmicity is displayed by genes throughout the human body [44]. These 'internal-clocks' are found in various tissues and regulate our physiology and behavior [44,45]. This daily ebb and flow of activity is known as our circadian rhythm. The most familiar daily rhythm in humans is the sleep-wake cycle. When forced to work at the 'wrong' time of day (e.g. night shift), shift workers must attempt to sleep in their circadian phase least conducive for sleeping. Generally, this results in disturbed sleep.

Sleep is vital for optimal physical and mental functioning. A wealth of literature, via reliable and valid measures from a variety of industries across the globe, has established lack of sleep and/or poor sleep quality in shift workers [46-50]. Most recently Booker and colleagues [51] performed an extensive systematic review that included 58 studies confirming the positive association between shift work and poor sleep quality. Disturbed sleep is a chief regulator in the etiology of poor health in shift-workers [39] and could also help explain the linkages with gambling disorder.

The study of sleep in substance-related disorders is extensive, but inquiry with respect to gambling disorder is scarce [52]. Of the limited literature, the emphasis is on treatment-seeking gamblers and do not use validated sleep questionnaires. A cross-sectional study in 2012 recognized this shortcoming and utilized two validated sleep questionnaires in a sample of non-treatment seeking gamblers and found a significant association between problematic sleep and gambling severity [52]. A more recent study, also using validated measures, contributed to this evidence but in a sample of treatment-seeking gamblers [53]. However, the goal of these cross-sectional studies was to understand sleep behavior in current gamblers rather than investigate a causal pathway. Further research is warranted to elucidate the relationship (and its direction) between sleep and gambling behavior.

Sleep deprivation is often cited as a common consequence of problematic gambling behavior. However, theoretical underpinnings in support of a reverse pathway (i.e. sleep deprivation causes gambling disorder) does exist. The adverse effects of poor sleep are well-documented elsewhere and include physiological ailments such as all-cause mortality, obesity, diabetes, hypertension, as well as mental and mood disorders [54-56]. Sleep also appears to impact decision making, with deprivation impairing one's decision making capabilities [57]. In 1998 Harrison and Horne [58] exposed sleep deprived and non-sleep deprived participants to a gambling task. The task was designed to prompt changes in decision making toward a conservative strategy that would return small but consistent returns. Despite being confronted with heavy losses at the beginning of the task, the sleep deprived group purposefully continued to seek out high-risk (zero-win) options, suggesting a lack of concern for negative consequences when confronted with high rewards. Over the past two decades, the study of sleep and risk-taking behavior has continued, and while the majority of studies support a positive association between sleep loss and risk-taking behavior, the underlying mechanisms still remain unclear [59]. The most popular theories involve disruptions to the prefrontal cortex, more specifically the ventromedial prefrontal cortex; the area of the brain implicated in decision making. More interestingly though, evidence points to disparities in risk-taking behavior in sleep deprived individuals depending on how a decision is framed. McKenna et al. [60] found that a single night of sleep deprivation altered the assessment of risk. Notably, sleep deprived participants were risk-seeking for gains, yet were risk-averse for losses. Venkatraman et al. [61] extended this work utilizing neuroimaging techniques with a comparable gambling task. Once again, results illustrated that sleep deprivation caused participants to care less about losses and adopt high-risk behavior in the pursuit of larger gains.

These are important implications with respect to gambling venues, where sleep deprived personnel (i.e. shift workers) are regularly exposed to enticing promotional materials as well as the overall allure of the environment (e.g. casino). Certainly, in these settings, gambling is framed as a chance to gain (i.e. win money). Furthermore, not only may the initial decision to start gambling be compromised, but once activity begins shift workers may be desensitized to losses and favor risky behavior in the pursuit of more gains. Accordingly, we hypothesize that:

H2. Sleep quality mediates the association between shift work on gambling disorder such that:

H2a. When sleep quality decreases, the association is significantly negative.

H2b. When sleep quality increases, the association becomes less significant.

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3. Yang Jiao, UNLV Graduate Student

Summary of project:

Yang Jiao was awarded $3,000 to study early identification of high-risk internet gamblers by applying computational psychology deep learning methods. “The proposed research aims to significantly improve the prediction accuracy of high-risk Internet gamblers.” Jiao’s work contributes to scholarship on both addiction prevention and the fast-growing worldwide Internet gambling industry.

Outcome:

This project was completed and resulted in academic manuscript “Detection of Problem Gambling with Less Features Using Machine Learning Methods” with co-authors (see below).

Detection of Problem Gambling with Less Features Using Machine Learning Methods

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Abstract

Analytic features in gambling study are performed based on the amount of data monitoring on user daily actions. While performing the detection of problem gambling, existing datasets provide relatively rich analytic features for building machine learning based model. However, considering the complexity and cost of collecting the analytic features in real applications, conducting precise detection with less features will tremendously reduce the cost of data collection. In this study, we propose a deep neural networks *PGN4* that performs well when using limited analytic features. Through the experiment on two datasets, we discover that PGN4 only experiences a mere performance drop when cutting 102 features to 5 features. Besides, we find the commonality within the top 5 features from two datasets.

1. Introduction

While the Internet gambling (also called online gambling) has grown dramatically during the past two decades, the issue of problem gambling has attracted massive attention from the community of gambling research because of the significant negative impact it causes from the perspectives of individual and public health (Deng et al., 2018). To detect problem gambling, online gambling behaviors which inherently link to individual accounts are monitored and recorded over time (Griffiths, 2012). These behavioral datasets are transformed into analytic datasets and features which

Table 1 Machine learning approaches for addiction research

Category	Method	Description	Ref.
Supervised learning	Regression	Regression models which include logistic regression, and multiple types of penalized regression (Regis, Lasso, Elastic Net), optimize several parameters when training	Acion et al. (2017) Soussia and Rekik (2018) Rish et al. (2016)
	Support Vector Machine (SVM)	SVM is a discriminative classifier that determines the separating hyperplane between data classes. While training, SVM maximizes the distance between data and the hyperplane to optimize the classification.	Soussia and Rekik (2018) Rish et al. (2016)
	Trees	Demonstrating an advantage on visualizing a decision making process, decision trees build tree-like graphs to separate data. CHAID analyzes the relation between features in decision tree.	Braverman et al. (2013) Rish et al. (2016) Rho et al. (2016)
	Random Forests (RF)	Considering a single tree may not be sufficient, random forests implement multiple decision trees to perform classification.	Soussia and Rekik (2018) Rish et al. (2016)
	Naive Bayes	Naïve Bayes is a generative model that assumes all features are independent.	Rish et al. (2016)
	Boosting	Based on a similar idea as RF, boosting methods compose multiple types of classifier to improve the performance.	-
	Discriminant analysis	Discriminant analysis finds a linear combination of features that separates two or more classes.	Gray et al. (2012) Rish et al. (2016)
	Neural Networks	Neural networks are a set of algorithms that implement layers of neurons to contain weights and achieve non-linear transformation.	Acion et al. (2017) Soussia and Rekik (2018)
	Deep Neural Networks	Deep Neural Networks stack the convolutional layers to distill high-level and abstract features.	-
Unsupervised learning	K-means	K-means is a non-parameterized algorithm that automatically clusters data into N groups.	Braverman & Shaffer (2012) Gray et al. (2015)
Reinforced learning	Q-learning	Q-learning is a reinforcement learning algorithm that seeks to find the best action to take given the current state without a policy.	Baker et al. (2020)

conclude the user behaviors into information such as betting amount, betting frequency, frequent games, account actions, etc.

However, analytic features require massive user data monitoring and therefore costly to obtain. In real applications, we also find that the available analytic features vary tremendously between datasets (Gray et al., 2012, Braverman et al., 2013, Braverman & Shaffer, 2012). To accommodate small datasets and reduce the cost of feature obtaining, we propose to study problem gambling detection with less or limited features using machine learning approaches.

In the last decades, machine learning methods have dominated the dataset analysis for addiction research, including problem gambling or high-risk gambler detection (Mak et al., 2019). Supervised, unsupervised, and reinforcement learning are three categories of machine learning approaches. As the most commonly applied machine learning type, supervised learning employs raw data and annotated ground truth to train classifiers (or regressors). It shows good promise on the quality and speed of convergence. Unsupervised learning avoids the labor cost of annotation and draw inferences from datasets consisting of input data without labeled responses. Reinforcement learning aims to optimize an agent to take action to respond to the current state. Table 1 presents a technique taxonomy for machine learning approaches on addiction research.

If we consider the raw analytic features as low-level features, one noticeable drawback of the aforementioned machine learning approaches is that they focus on low-level or the combination of low-level features and ignore the possibility of continuous combining low-level features into abstract (high-level) features. As a subfield of machine learning, deep neural networks classifiers (LeCun et al., 2015) harness multi-layered neural networks to automatically convert data into abstract representations via adjusting their weights. Other than demonstrating power in language and image processing, one dimension deep neural networks as 1-D CNN has been widely applied to time series data analysis (Kiranyaz et al., 2019), for example, signal analysis. However, 1-D CNN has rarely been applied to analytic data.

To obtain a rich feature space, 1-D CNN can combine low-level features from data within a local time frame into abstract features. The enriched abstract feature space will benefit the application with limited features. Therefore, referring to the concept of deep neural networks, the hypothesis is that 1-D CNN will extract abstract features from raw analytic features and will boost the performance of problem gambling detection with limited features.

There are two aspects of performance boosting: (1) the overall performance with full features, and (2) the overall performance with limited features. Considering the cost and complexity of collecting rich analytic features in real applications, the focus of this work is to study the approach that will boost the overall performance with limited features.

2. Method

Deep neural network classifiers are implemented by stacking varying types of layers by restrictive rules. Major layers in deep neural network classifier are listed below.

- Convolutional layer: As one of the major components in deep neural network classifier, convolutional layer distills abstract features with multiple sliding filters with weights which are optimized during training. To keep the output size, zeroes are commonly padded around the sample.

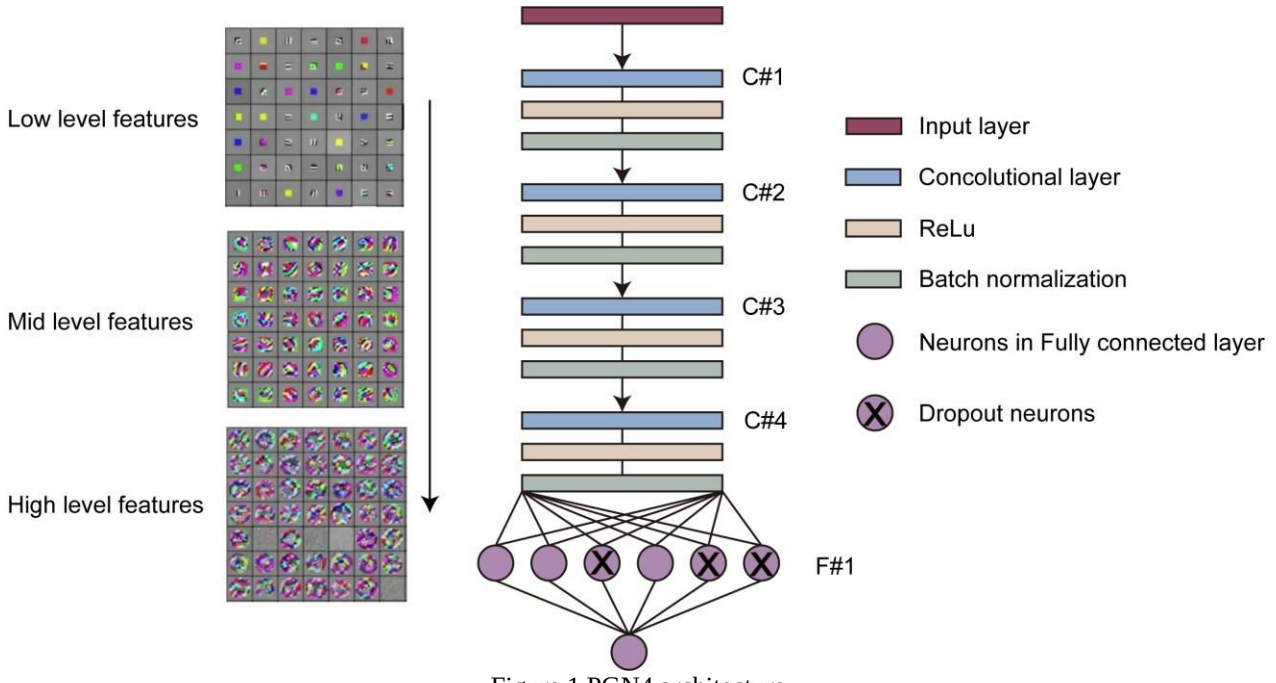

Figure 1 PGN4 architecture

Table 2 Parameters of layers in PGN4

Layers	Parameters
1D Convolutional layer C#1	filter size=3; filter channel=16; stride=1; padding=same
1D Convolutional layer C#2	filter size=3; filter channel=16; stride=2; padding=same
1D Convolutional layer C#3	filter size=3; filter channel=32; stride=1; padding=same
1D Convolutional layer C#4	filter size=3; filter channel=32; stride=2; padding=same
Fully connected layerF #1	128 neurons

- Pooling layer: Pooling layer operates on each feature map independently and aggressively reduces the spatial size of the abstract features, which consequently reduces the computational cost. Max pooling is the most popular pooling function.
- Fully connected layer: To transfer abstract feature maps into a classification score, a fully connected layer flattens the feature maps into a vector of neurons to perform a nonlinear transformation.
- Activation layer: To avoid gradient exploding, activation layer overlaps a nonlinear transformation on the output of the previous layer to map the output into a restricted range. Some common functions are ReLu, and Leak ReLu.
- Batch normalization layer: This layer aims to accelerate the training and against overfitting by normalizing a layer input into a restricted range.
- Dropout layer: Dropout layer randomly mutes some neurons to force robust learning.

Typically, several (one to three) convolutional layers are connected sequentially to perform abstract feature extraction. An activation layer and a batch normalization layer follow a convolutional layer to constrain the convolutional output. A pooling layer performs to reduce the output size.

The depth of the 1-D CNN depends on the raw feature vector size and the data size. Deeper networks have more weight parameters to train, and consequently, require exponentially increased data. Considering the existing behavioral datasets for online gambling, we implement a four-convolutional-layer CNN, namely *Problem Gambling Net 4* or *PGN4*. In PGN4, the convolutional layers with stride size 2 replace pooling layers to reduce the feature map spatial size. Figure 1 shows the PGN4 architecture and the progressive distilling of abstract features. The parameter design for layers in PGN4 is shown in Table 2.

2.1 Feature selection

To boost the detection performance with limited features, a feature selection is conducted based on feature correlation analysis. Through the selection, we evaluate the PGN4 with 5, 10, 20, 50, and full features. Because PGN4 distills abstract features by sliding filters, the arrangement of the raw feature vector will make a difference in abstract features and ultimately impact the detection performance. Via Algorithm 1, we arrange the most correlated features adjacently.

Algorithm 1

Input: Behavioral features vector f, Number of feature selections N, problem gambler flags FL

Output: Rearranged behavioral features f'

1: for $f_i \; in \; f$

2: Compute the correlation between features and flags

$$C(i) = \text{corrcoef}(f_i, FL)$$

3: for $f_j \; in \; f$

Table 3 Reason of the RG Program flags

Reason	Proportion
Account closure/reopening due to problem gambling.	40%-45%
The user reports a problem.	14%-16%
The user requests a limit change.	15%-22%
The user requests to block one or multiple but not all games due to problem gambling	13%-15%
The user requests a higher personal deposit limit.	4%-5%
The user heavily complains about fair play.	2%
A third party contacts RG program to block a user account.	0%-1%
The user cancels an out-payment after requesting it.	0%-1%
The user requests to block an in-payment method.	0%-1%
The user is under age.	0%-1%
Others or unclassified	0%-1%

4: Compute the correlation matrix between features $C_f(i,j) = \text{corrcoef}(f_i, f_j)$
5: end
6: end
7: sort all C, $C_f(i)$ in descending order as C', C_f'
8: //The bow of candidate features are the top //correlated features with flags $f_b = C'(1:N)$
9: for $n = 1:N, m = 1:N$
10: if $f_b(m)$ $not\ in$ f'
11: $f'(n) = f_b(m)$
//We assign a most correlated feature adjacent
if $C_f'(f'(n), 1)$ $not\ in$ f'
12: $f'(n+1) = C_f'(f'(n), 1)$
13: end
14: end
15: until rearranged all candidate features in f_b into f'

2.2 Training

The PGN4 is trained with, Adam optimizer and learning rate $2x10^{-4}$ in 20 epochs. Adam optimizer

Table 4 Performance comparison on two datasets. Best performances are bold. Acc: Accuracy

Feature	Approach	Dataset A				Dataset B			
		Acc	**F1 Score**	**ROC AUC**	**PR AUC**	**Acc**	**F1 Score**	**ROC AUC**	**PR AUC**
Full	PGN4	70.5%	64.3%	74.6%	76.7%	**80.8%**	**82.3%**	**90.2%**	89.5%
	SVM	61.3%	70.6%	63.2%	53.4%	66.0%	74.5%	74.2%	53.5%
	DT	61.8%	62.0%	61.1%	71.7%	72.2%	72.6%	71.5%	79.6%
	RF	66.0%	63.3%	71.9%	71.8%	77.5%	76.3%	84.5%	85.5%
	Ada	70.2%	67.9%	**77.1%**	**78.5%**	78.8%	77.9%	85.2%	**87.3%**
	NN	**72.3%**	**71.9%**	74.1%	77.9%	68.0%	75.2%	88.8%	89.5%
50	PGN4	69.8%	62.1%	74.7%	76.5%	-	-	-	-
	SVM	60.0%	**70.3%**	59.3%	49.8%	-	-	-	-
	DT	60.7%	62.1%	60.7%	71.5%	-	-	-	-
	RF	67.2%	62.5%	72.1%	72.3%	-	-	-	-
	Ada	69.4%	68.6%	**76.6%**	**78.3%**	-	-	-	-
	NN	**72.4%**	70.0%	76.3%	77.8%	-	-	-	-
20	PGN4	**69.0%**	62.4%	73.2%	75.6%	80.3%	77.8%	**90.2%**	**90.1%**
	SVM	60.8%	**70.1%**	63.2%	54.1%	64.8%	73.9%	74.2%	53.2%
	DT	60.7%	60.5%	60.3%	70.6%	71.9%	72.5%	71.1%	79.3%
	RF	66.9%	61.4%	69.3%	70.1%	79.1%	78.0%	84.8%	85.7%
	Ada	68.1%	65.7%	**74.1%**	**76.9%**	78.7%	78.0%	85.6%	87.8%
	NN	68.1%	67.9%	71.7%	75.4%	**81.7%**	**82.5%**	89.4%	90.0%
10	PGN4	**67.9%**	65.7%	73.9%	74.8%	**80.5%**	78.6%	**88.0%**	**88.0%**
	SVM	66.7%	**66.7%**	69.3%	64.6%	65.7%	72.7%	69.2%	56.9%
	DT	62.1%	58.7%	59.6%	69.2%	69.3%	69.9%	69.0%	77.8%
	RF	66.7%	63.5%	64.9%	66.2%	75.0%	73.6%	79.3%	81.4%
	Ada	67.1%	66.3%	71.6%	72.4%	75.1%	73.1%	81.5%	84.9%
	NN	66.8%	65.5%	**74.1%**	**75.0%**	75.6%	**79.5%**	87.2%	86.6%
5	PGN4	**68.8%**	**67.8%**	**74.1%**	**75.0%**	**79.2%**	**79.6%**	**87.9%**	**87.8%**
	SVM	67.5%	65.9%	68.0%	66.5%	74.2%	73.7%	75.6%	73.8%
	DT	61.3%	55.8%	58.0%	68.0%	66.8%	65.4%	64.5%	74.1%
	RF	66.2%	62.6%	64.6%	66.4%	74.2%	72.0%	76.6%	79.1%
	Ada	66.3%	65.7%	69.6%	72.0%	74.9%	73.6%	80.6%	84.2%
	NN	67.4%	67.3%	74.0%	74.4%	75.0%	79.1%	86.4%	86.1%

(Kingma & Ba, 2014) is a state-of-the-art model optimizer which calculates an exponential moving average of the gradient and the squared gradient from the training loss of a minibatch of samples, and the parameters beta1 and beta2 control the decay rates of these moving averages. The loss function used to compute the training loss is binary cross-entropy.

3. Performance evaluation

In this works, we collect two public datasets to evaluate the performance of the proposed PGN4. Both datasets include multiple modalities of online gambling such as live action sports gambling, fix-odds sporting betting, casino, poker, and games like backgammon. Excluding date and categorical features, Dataset A (Braverman et al., 2013) contains 102 numerical behavioral features of 4,056 users, and Dataset B (Gray et al., 2012) has 27 numerical behavioral features of 4,132 users, as 25% of data are randomly select for validation. In both datasets, the user behavioral data associate with the Internet betting service provider *bwin.party*, and the flags of problem gamblers are provided by the *Responsible Gambling* (RG) program. The RG program flags a user based on multiple reasons, as shown in Table 3.

3.1 Evaluation metrics

To comprehensively evaluate the performance of PGN4, we apply 4 evaluation metrics including accuracy, F1 score, Precision-Recall (PR) curve, and Receiver operating characteristic (ROC) curve because they perform fair evaluation for either balanced or imbalanced data considering both positives and negatives. The area-under-curve (AUC) represents the overall performance of a classifier in the PR curve and ROC curve evaluation.

3.2 Performance comparison

Table 4 lists the performance metrics of PGN4 and five methods in comparison. According to the result, when performing full features on problem gambling detection, PGN4 is not always the best classifier because the feature space is abundant with full analytic features. As such the rich abstract features are not playing a vital role in this case.

With less and limited analytic features, PGN4 demonstrates robustness and efficiency on problem gambling detection. Selecting 5 from 102 features on Dataset A, PGN4 only experiences a 1.7% drop on accuracy and a 0.5% drop on ROC AUC, while Adaboosting drops 7.5% on ROC AUC. Similarly, on Dataset B, applying PGN4 on problem gambling detection with 5 over 27 behavioral features leads to a mere performance drop.

Compared PGN4, the other methods although either have a lower overall performance or have a larger performance dropping from full to limited features, they all confirm the feasibility of predicting problem gambling with few features according to the results in Table 4.

Based on the performance of PGN4, we summarize the top 5 features that lead a compatible detection with full features, as shown in Table 5. Particularly, we discover that live action plays an irreplaceable position in problem gambling detection.

4. Discussion

With limited features available, PGN4 is dominant the problem gambling detection compared to other machine learning approaches. This is attributed to the fact that the abstract features distilled by PGN4 from the low-level analytic features significantly enrich the feature space. However, model variation, which results in a tiny

Table 5 Top 5 features of Dataset A and B

Dataset	Feature name	Feature discription	Correlation coefficent
Dataset A	NumberofGames31days	Number of games during the first 31 days since the first deposit date	0.2994
	totalactivedays_31days	Total active days in 31 days since the first deposit date	0.2916
	p2totalactivedays_31days	Total active days in 31 days since the first deposit date for live action	0.2835
	playedLA	Played live action odds at least 3 times	0.2578
	p2SDBets31days	Variability of number of bets per day in live action in 31 days since the first deposit date	0.2389
Dataset B	bettingdays_liveaction_sqrt	Sum of active betting days: live action: square root transformed	0.4792
	duration_liveaction_sqrt	Duration of betting days: live action: square root transformed	0.4714
	bets_per_day_liveaction_sqrt	Bets per betting day: live action: square root transformed	0.4191
	sum_bets_liveaction_sqrt	Sum of bets: live action: square root transformed	0.4133
	euros_per_bet_liveaction_sqrt	Euros per bet: live action: square root transformed	0.3724

scale variation of model performance in every training, is a drawback of PGN4 and all neural network models. The reason is that the randomly initialized neuron weights may lead to a various global minimum during training. Two possible solutions may address this drawback. (1) Increasing the data volume; (2) Increasing the size of minibatch in training.

5. Conclusion

In this work, we propose to use 1-D deep neural networks on problem gambling detection to boost the performance with full and limited features. We present a four-convolutional-layer network *PGN4* which is designed based on the available feature size and date volume. Tested on two datasets, PGN4 demonstrates a performance boosting in limited feature space. With only 5 features, PGN4 has the best performance and sustains the detection accuracy and ROC AUC compared with when full features available. Besides, we draw another conclusion that the common top 5 features of two datasets focus on *overall active days*, *overall number of games*, and *live action activities*.

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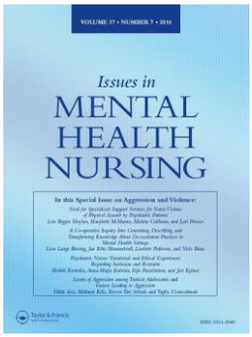
4. Anthony King, UNLV Graduate Student

Summary of project:

Anthony King was awarded $3,000 to study the association between problematic video gaming and gambling. King's study will focus on student and non-student populations of emerging adults ages 18-25 to investigate factors related to internet gaming disorder, asking why it is that certain gamers have a greater likelihood to develop problem gambling behaviors. "Implications from this study will increase public and clinical awareness of gambling models within video games marketed to vulnerable, and often underage populations."

Outcome:

This project was completed and resulted in published journal article "Risk Factors of Problem Gaming and Gambling in US Emerging Adult Non-Students: The Role of Loot Boxes, Microtransactions, and Risk-Taking" by Anthony King , Gloria Wong-Padoongpatt , Aldo Barrita , Danny Tran Phung and Ting Tong in *Journal of Mental Health Nursing*. (see below)



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Risk Factors of Problem Gaming and Gambling in US Emerging Adult Non-Students: The Role of Loot Boxes, Microtransactions, and Risk-Taking

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Risk Factors of Problem Gaming and Gambling in US Emerging Adult Non-Students: The Role of Loot Boxes, Microtransactions, and Risk-Taking

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ABSTRACT

Video gaming and gambling have increasingly converged with one another (e.g., social casino games). For emerging adults (18–25 years old), who are already at an elevated risk for addictive disorders, this overlap in these activities may increase the likelihood of problematic involvement. At the moment, Internet gaming disorder (IGD) is being considered as a future medical diagnosis by the American Psychiatric Association. Therefore, the purpose of this study was to examine the potential comorbidity between IGD and gambling disorder (GD) in emerging adults, as well as explore if problematic engagement in gaming and gambling may be explained by recent trends in video game microtransactions (e.g., loot boxes) and risk-taking behaviors. An online survey was completed by 300 emerging adult non-students (M_{age} ¼ 22.79, 49% male) from across the United States. The results revealed that compared to non-gamers, problematic gamers were 6.45 times more likely to problem gamble and compared to non-gamblers, problem gamblers were 5.62 times more likely to problem game. Microtransactions were the major mechanism for the relationship between IGD and GD. Participants with higher severity levels of either disorder demonstrated a greater likelihood of purchasing microtransactions, in addition to displaying significantly less aversion towards several domains of risk-taking. These findings suggest that emerging adults with probable IGD or GD may share common risk factors and patterns of behavior that transdiagnostic treatment approaches may better serve than syndrome-specific models.

> Needing extremes, the addict leaps from one behavior to another. —Gabor Mate, 2010, p. 229

Addictive disorders remain a significant public health concern for emerging adults (18–25 years old; SAMHSA, 2019). Yet, despite the extensive research for substance use disorders (SUDs) related to emerging adulthood, many plausible behavioral addictions (e.g., Internet use, sex, shopping) have received relatively less attention until recent years (Yau & Potenza, 2015). As the research on addictions expands, the *Diagnostic and Statistical Manual of Mental Disorders–5th Edition* (DSM-5; APA, 2013) has acknowledged the shared features involved in addictive disorders (e.g., loss of control, tolerance, withdrawal) through the similarities in diagnostic criteria. For emerging adults, the idea that different addictions have a common underlying pattern may be especially pertinent to the treatment of pathological video gaming and gambling (recognized in the DSM-5 as Internet gaming disorder [IGD] and gambling disorder [GD], respectively).

Although research on the behavioral associations between IGD and GD has been limited (Stockdale & Coyne, 2018), as well as mixed (Macey et al., 2020), the crossover of the (video) gaming and gambling industries since the early 2000s has immensely elevated the commonalities observed between these behaviors (see Abarbanel, 2018; King & Delfabbro, 2020; King et al., 2015; Teichert et al., 2017). In addition to these industries becoming increasingly harder to distinguish from one another (e.g., social casino games), so have the individuals who engage in gaming and gambling (Sanders & Williams, 2019). McBride and Derevensky (2017) surveyed 1,276 students (ages 16–24) and found that gamblers (94.1%), compared to non-gamblers, played video games more often and gamers (54.6%), compared to non-gamers, gambled more often. Nevertheless, other studies (e.g., Forrest et al., 2016; Macey & Hamari, 2019) have found less of a connection between gaming and gambling behaviors, indicating the need for subsequent research in this area. Regardless of the contradictory findings, both gaming and gambling activities heavily rely on variable reinforcement schedules (i.e., where a response is reinforced after an unpredictable number of responses; e.g., scratch-off tickets), which may contribute to a greater propensity for these behaviors to overlap (McBride & Derevensky, 2017).

For the last three decades, 18 to 25-year-olds have consistently maintained the highest prevalence rates of GD, relative to other age groups (Grande-Gosende et al., 2020; Nowak, 2018; Nowak & Aloe, 2014). While lifetime prevalence rates of GD in the United States (US) general population are estimated between 0.4%–1.0% (APA, 2013), current rates for probable GD amongst emerging adults estimate upwards of 10.0% (Marchica et al., 2020). Furthermore,

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emerging adults represent the largest segment of the video game consumer market (Statistica, 2019) and also use digital media more than other activities (Coyne et al., 2013), making them a particularly vulnerable group for IGD (Russell & Johnson, 2017). One recent study surveying US emerging adults (n ¼205) from different universities reported an IGD rate of approximately 7.0% (Stockdale & Coyne, 2018). However, few other IGD studies have focused on this age group in the US (especially for non-students; McBride & Derevensky, 2017) or IGD's potential comorbidity with GD (Stockdale & Coyne, 2018), highlighting a significant gap in the literature on this topic.

Presently, GD is the only medically-sanctioned behavioral addiction of the DSM-5 (APA, 2013). Despite IGD's inclusion in the manual, it was placed in Section III as a condition warranting further evidence, partially due to inconsistencies in defining problematic video game behaviors (APA, 2013; Petry et al., 2015). However, the authors did recognize that IGD represents a legitimate public health issue and may eventually qualify as a medical diagnosis in future editions (APA, 2013). Notably, the core distinction separating a diagnosis of IGD from online forms of GD all relates back to a single factor: money. Instead of financial risk, IGD is most often viewed as causing harm through excessive time investment (King & Delfabbro, 2019). However, in the years since the DSM-5 (APA, 2013) was published, drastic changes in the monetization methods of video games has brought this financial distinction between these disorders back into question. Therefore, this study will examine how escalating financial components involved in modern video gaming mediate IGD severity and its possible relationship to gambling engagement and GD severity.

Money in video games

In the world of video gaming, microtransactions (i.e., typically small, in-game purchases for virtual items or perks) were first incorporated by independent game designers as a means to compete with larger, well-established corporate developers (Tomic, 2018). The strategy was simple: instead of a player making one large purchase to play a game, publishers would allow the basic game to be downloaded for free, with an infinite supply of microtransactions available for a few dollars at a time to enhance the overall gameplay experience. To put it mildly, this sales tactic worked and has reshaped the way video games are sold in the present-day marketplace (Zendle, Ballou, et al., 2019). In 2019, "free-to-play" games (e.g., *Fortnite*, *Candy Crush Saga, Pokemon GO*), which earn the vast majority (if not all) of their money through microtransactions, generated over $87 billion (USD) in revenue, representing approximately $4 out of every $5 made in the entire digital game market (Nielsen Superdata Research, 2020).

One of the most popular, as well as controversial, forms of microtransactions is known as a loot box, which is an umbrella term applied to a purchasable virtual container within most popular video games (Zendle et al., 2020) and as the industry describes them "are like locked treasure chests that contain an array of virtual items that can be used in the game once unlocked" (Vance, 2019, n.p.). Since loot boxes require zero skill to open, distribute randomized rewards that remain unseen until purchased, and are available in unlimited quantities, critics of these game features have argued these mechanics represent a unique form of unregulated gambling (Drummond & Sauer, 2018; King & Delfabbro, 2019). However, while the legality of randomized microtransactions may be debatable (Abarbanel, 2018), previous research on this topic suggests that higher spending rates on loot boxes is positively associated with problematic gaming and gambling engagement (Brooks & Clark, 2019; Kristiansen & Severin, 2020; Li et al., 2019; Zendle & Cairns, 2019a, 2019b; Zendle, Meyer, et al., 2019). Although, it is important to note that a causal direction has not been determined between these behaviors.

Beyond loot box features, non-randomized microtransactions available in social casino games (SCGs; i.e., video games that imitate real financial gambling, often with a strong social component) may also resemble gambling wagers and in turn, carry a legitimate financial risk. Several social networking sites (e.g., Facebook) and non-gambling mobile games (e.g., *Words With Friends*) heavily advertise for SCGs, often glamorizing gambling behaviors in marketing that appears to target younger demographics (Abarbanel et al., 2017). Although SCGs are considered "free-to-play," users are continually prompted to spend money on microtransactions for additional game credits, virtual gifts for other players, and extra in-game functions (Kim et al., 2017). Despite players being unable to win money in these games, several news reports have depicted the addictive nature of these gambling simulations and the devastating financial impact that vulnerable users may experience. For instance, one US woman spent her life-savings of $400,000 (USD) on the SCG *Big Fish Casino* (Halverson, 2019).

A study by Kim et al. (2015) examined US adults (n ¼ 409) who had never gambled before, but played SCGs and found that 26.0% of the sample became gamblers after playing. Similar findings were reported by Gainsbury et al. (2016) for Australian adults (n¼621), with 19.4% of participants becoming gamblers after first playing SCGs. In both studies, higher rates of microtransaction spending predicted future gambling engagement (Gainsbury et al., 2016; Kim et al., 2015), but causality is difficult to determine in these relationships. Although it does appear feasible that SCGs may elevate gambling involvement (Abarbanel & Rahman, 2015; Derevensky & Gainsbury, 2016) by potentially increasing players' confidence for real gambling situations, which may lead to riskier patterns of engagement (Armstrong et al., 2018; Bednarz et al., 2013; Kim et al., 2017; King et al., 2014).

Risk-taking in gaming and gambling

Risk-taking behaviors are frequent predictors of addictive disorders (e.g., Balogh et al., 2013; Kreek et al., 2005), in addition to being generally associated with emerging adulthood (Arnett, 2000; Worthy et al., 2010). A study by Liu

Table 1. Participant Demographic Characteristics.

Demographics	Non-Students (*n* ¼ 263)
Median age (SD)	22.79 (2.00)
Gender (% Male)	49.00%
Ethnicity/Race:	
Asian	5.20%
Black	21.30
Latinx	10.50
White	64.80
Other	4.50
Education:	
HS diploma or less	50.20%
Some college	16.70
Associate's/Bachelor's	28.60
Master's or higher	2.70
Other	1.80
Place of birth:	
USA	94.30%
Other	5.70
Yearly income:	
$0.00–$39,999	67.20%
$40,000–$79,999	26.10
$80,000 or more	6.60
Yearly P/G income:	
$0.00–$39,999	41.40%
$40,000–$79,999	36.40
$80,000 or more	22.10

Note. Participants were able to select more than one ethnicity/race, therefore the total percentage exceeds 100. HS ¼ High School; P/G ¼ Parental/Guardian.

et al. (2017) investigated how risky decision-making may be exhibited in the brains of college students (*n* ¼ 41) with IGD. The results revealed that compared to the healthy control participants, IGD participants had less activation within brain regions involved in risk evaluation (i.e., dorsolateral prefrontal cortex & inferior parietal lobule) and greater responses in the brain reward system when experiencing rewards. These findings are consistent with other studies (Dong & Potenza, 2016; Wang et al., 2017) and support a neurobiological basis for hypersensitivity toward external rewards in individuals with IGD, as well as greater impairments in decision-making related to risk and impulse control (Liu et al., 2017).

Similar patterns of heightened reward sensitivity and risky decision-making have been found in the brains of individuals with GD (e.g., Clark & Dagher, 2014; Limbrick-Oldfield et al., 2020; Wilson & Vassileva, 2018). A study by Fauth-Bühler and Mann (2017) reviewed the available neurobiological data between IGD and GD and found a common pattern of increased cognitive, emotional, and physiological reactivity to gaming and gambling cues, respectively, and less aversion to monetary losses. While financial risk-taking for problematic gambling in US emerging adults has received some attention by researchers (Wong et al., 2013), no research exists (to the best of our knowledge) on this risk factor for non-students within the same population meeting the IGD diagnostic criteria. Non-students may not only be more reflective of the general population (Hanel & Vione, 2016), but they may also be at an elevated risk for developing addiction (McBride & Derevensky, 2017). As video game designs increasingly converge with gambling mechanics and incorporate more ways for players to spend money via microtransactions, deficits in evaluating different domains of risk (e.g., financial, health/safety, social) for individuals with IGD may have severe financial, physiological, and psychological implications associated with them.

Present study

The aim of this study is to empirically evaluate the possible co-occurrence of problematic gaming and gambling behaviors in a nationwide sample of US emerging adult non-students, in addition to investigating the role microtransactions have in this relationship. For both behaviors, two different levels of involvement will be investigated: (a) engagement (i.e., gambled or never gambled; gamed or never gamed) and (b) problems (i.e., reporting diagnostic criteria of IGD or GD). Based on previous findings, we will explore risk-taking behaviors at different levels that could be connected to problem gaming and gambling, in order to identify any possible groups or characteristics that may indicate a greater vulnerability to the development of these disorders. The hypotheses for this study are as follows:

(H1) Problematic gaming and gambling involvement will have a positive relationship in emerging adults.

(H2) Microtransactions will mediate the relationship between problematic gaming and gambling involvement.

(H3) Risk-taking will be a predictor for emerging adults that engage in gaming or gambling, especially for individuals with problematic levels of involvement.

Methods

Participants and procedure

An online survey was developed to assess the following variables: (a) problematic video gaming, (b) problematic gambling, (c) microtransaction engagement, (d) risk-taking, and (e) relevant covariates (i.e., age, education, ethnicity/race, gender, socioeconomic status [SES], place of birth, & well-being). The inclusion criteria for participation were: (1) consenting to the study, (2) being 18 to 25 years old, (3) being a non-student, (4) living in the US, and (5) understanding written English. Prospective participants unable to meet all these criteria were excluded from the sample. The survey was administered using the following order: consent, demographics, initial screener, IGD assessment, risk-factors scales, microtransaction engagement scale, and a GD assessment. Gambling engagement was measured last to reduce participant awareness of the study's main associative examination. Data for this study were collected during a 2-week period in January 2020.

A total of 300 participants were recruited by the online survey and data services company Qualtrics™ (see Table 1 for demographic characteristics). The company obtained the sample through an email list containing a pre-arranged pool of respondents that had previously consented to participate in survey-taking for various types of general market research. We instructed the Qualtrics™ data-collection team to acquire data from an equal ratio of male and female

Table 2. Adapted RLI and Bivariate Correlations of IGD and GD Assessments.

Scale Items:	Percent "Agree" (n ¼ 157)	Problematic Gaming	Problematic Gambling
(1) I feel obligated to purchase microtransactions and/or loot boxes when I encounter them.	24.3%	.447	.436
(2) The amount of microtransactions and/or loot boxes I purchased has increased since I first started.	35.0	.239	.118
(3) I find it harder to not purchase microtransactions and/or loot boxes as time goes on.	37.1	.216	.254
(4) These microtransactions and/or loot boxes feel like more than a pasttime such as they provide excitement or an escape from unwanted feelings.	28.6	.407	.248
(5) I often spend money on microtransactions and/or loot boxes on impulse.	35.7	.300	.216
(6) My microtransactions and/or loot box use has caused me problems[a]	31.4	.375	.296
(7) Opening microtransactions and/or loot boxes are exciting.[a]	57.1	.121	.166
(8) I buy microtransactions and/or loot boxes with the hope of receiving valuable items to sell.[a]	26.4	.357	.298
(9) I believe obtaining items from microtransactions and/or loot boxes is an effective way way to generate money.[a]	32.9	.331	.223
(10) I most enjoy games that rely heavily on randomization to determine rewards.[a]	36.4	.188	.192
(11) Please estimate your monthly spending on microtransactions and/or loot boxes in dollars.[a]	4.11 (1.81)	.455	.471

Note. Items 1–10 used a 5-point Likert-scale ("Strongly Disagree"–"Strongly Agree"). Item 11 requested a dollar value (USD) based on ordinal choice options: scored 0 ("$0.00"), 1 ("$0.01–$0.99"), 2 ("$1.00–$9.99), 3 ("$10.00–$19.99"), 4 ("$20.00–$29.99"), 5 ("$30.00–$39.99"), 6 ("$40.00–$49.99"), 7 ("$50.00–$99.99"), 8 ("$100.00–$199.99"), and 9 ("$200.00 or more"). For Item 11, the mean is presented with the standard deviation inside parentheses. Agreement responses are shown for participants reporting playing a video game with microtransactions and/or loot boxes at least once (n¼157). Bivariate correlations include the entire sample (n ½263). Bold values indicate statistical significance. IGD¼Internet ¼gaming disorder; GD gambling disorder.

[a]Scale items from original Brooks and Clark (2019) RLI measure.

$p < .05$.

$p < .01$.

participants, but did not restrict individuals identifying as non-binary genders to participate in the study. The full sur- vey appeared under the title of *Cognition and Behaviors of Internet Use*, with no prior indicators given to potential respondents regarding the study investigating video gaming and gambling behaviors. The entire survey took approximately 30 minutes on average to complete and since each item required a response, there were no missing values. However, most demographic questions did provide a "prefer not to answer" or "decline/refuse to answer" option. Upon completion, participants were compensated $6.00 (USD) for their time directly through the Qualtrics™ market research team.

To increase internal validity, six discreet attention checks were included in the survey. For example, one attention check asked participants to type the title or titles of video games they play and instructed individuals who do not game to type "none." Participants failing any of the attention checks (i.e., providing irrelevant responses) or with an abnormal completion time (<10 minutes) were removed from the sample. The final sample size for this study was 263 participants (M_{age} ¼ 22.79, SD ¼ 2.00, 49% male).

Measures

Video gaming

Video game engagement was determined by asking participants to estimate their average daily time spent playing video games and participants reporting more than 0 hours of daily gameplay were considered gamers. The clinical assessment tool (C-VAT 2.0; van Rooij et al., 2017) for IGD was used to assess the proposed DSM-5 (APA, 2013) diagnostic criteria. This instrument measures IGD severity of participant behaviors that occurred within the most recent 12 months (e.g., "Did you unsuccessfully try to spend less time on video games?"; "Did you neglect your own health because of video gaming?"). There are a total of 11 items scored on this assessment with all items scored 0 ("no") or 1 ("yes"); higher scores indicate more severe forms of IGD. In accordance with the DSM-5 (APA, 2013) diagnostic threshold, we classified participants into three levels: no problems (score of 0–1), at-risk gamer (score of 2–4), and probable problematic gamer (score of 5–11). The C-VAT 2.0 has displayed effective psychometric sensitivity in distinguishing IGD in younger clinical populations (van Rooij et al., 2017) In the study's final sample, internal consistency was 0.86 for the C-VAT 2.0 assessment.

Gambling

Gambling engagement was determined by asking participants if they had gambled at least once in their lifetime and participants with at least one gambling experience were considered gamblers. The South Oaks Gambling Screen: Revised for Adolescents (SOGS-RA; Winters et al., 1993) was used to assess problem gambling behaviors of emerging adults that occurred within the most recent 12 months. There are a total of 12 items scored on this assessment. Item 1 (i.e., "How often have you gone back another day to try to win back the money you lost?") is scored 1 if "every time" or "most of the time" is selected and scored 0 for the other two options (i.e., "some of the time" or "never"). The remaining items are scored 0 ("no") to 1 ("yes"). As specified by Winters et al. (1995), once a total score is calculated, respondents are classified in one of the following three levels: no problems (score of 0–1), at-risk gambler (score of 2–3), and probable problematic gambler (score of 4–12). This scale has been shown to perform similarly, if not better, than other common problem gambling screeners used on individuals in late adolescence and early adulthood (i.e., 16–20 years old; Derevensky & Gupta, 2000). In the study's final sample, internal consistency was 0.90 for the SOGS-RA measure.

Table 3. Correlational Matrix between IGD, GD, MT Engagement, Risk-Taking, and Covariates.

Variable	1	2	3	4	5	6	7	8	9	10	11
1. IGD Severity	–										
2. MT Engagement	.531	–									
3. GD Severity	.375	.460	–								
4. Risk-Taking	.268	.312	.417	–							
5. Age	.021	.017	.096	.066	–						
6. Education	.032	.048	.067	.075	.332	–					
7. Ethnicity/Race	.065	.034	.024	.048	.032	.032	–				
8. Gender	.245	.246	.254	.256	.044	.051	.156	–			
9. Place of Birth	.046	.062	.020	.048	.048	.044	.167	.021	–		
10. SES	.102	.268	.266	.097	.038	.390	.108	.193	.006	–	
11. Well-Being	.017	.107	.065	.117	.051	.036	.124	.044	.061	.034	–

Note. Bold values indicate statistical significance. IGD ¼Internet Gaming Disorder; MT ¼Microtransaction; GD ¼Gambling Disorder; SES ¼Socioeconomic Status. $p < .01$.

Microtransaction attitudes and behaviors

A partial adaptation of the Risky Loot Box Index (RLI; Brooks & Clark, 2019) was used to assess loot box engagement, as well as other microtransaction-related behaviors and attitudes. We included 6 items from the original RLI scale (see Table 2; e.g., "My microtransactions and/or loot box use has caused me problems") for a total of 11 items on this scale. Since previous research has indicated that other purchase options in video games may also be potentially problematic (e.g., Gainsbury et al., 2016; Kim et al., 2015), the wording of each item was adjusted to apply to all in-game microtransactions, instead of referring strictly to loot boxes. Definitions for microtransactions and loot boxes were provided to participants prior to answering these items.

Items that were not in the original RLI measure were related to the topics of obligation, tolerance, escapism, and impulsivity as they apply to in-game purchases (e.g., "I often spend money on microtransactions and/or loot boxes on impulse"). Items 1–10 used a 5-point Likert-scale ("Strongly Disagree"–"Strongly Agree"). Item 11 requested a dollar value (USD) for participants' estimated monthly spending on microtransactions based on ordinal choice options: scored 0 ("$0.00"), 1 ("$0.01–$0.99"), 2 ("$1.00–$9.99), 3 ("$10.00–$19.99"), 4 ("$20.00–$29.99"), 5 ("$30.00–$39.99"), 6 ("$40.00–$49.99"), 7 ("$50.00–$99.99"), 8 ("$100.00–$199.99"), and 9 ("$200.00 or more"). Item 11 also allowed participants to report specific dollar values exceeding $200.00 in an open text-entry box. In the study's final sample, internal consistency was 0.83 for our modified version of the RLI.

Risk-taking

The Domain-Specific Risk-Taking scale (DOSPERT; Blais & Weber, 2006) was used to measure the likelihood of a participant's engagement in risky behaviors or activities related to six domains of life: ethical, financial gambling, financial investment, health and safety, recreational, and social. Previous research on risk-taking has indicated these domains to be distinct from one another and that individuals who engage in one domain, may not necessarily engage in others (Markiewicz & Weber, 2013; Zimerman et al., 2014). There are a total of 30 items in this measure (e.g., "Investing 5% of your annual income in a very speculative stock"; "Betting a day's income on the outcome of a sporting event"), all of which are scored on a 7-point Likert scale ranging from 1 ("Extremely Likely") to 7 ("Extremely Unlikely"). This scale has been extensively used to assess risk-related behaviors and has displayed good consistency across diverse populations and age groups (Shou & Olney, 2020). In the study's final sample, internal consistency was 0.89 for the DOSPERT scale.

Covariates

Based on previous research (Chan et al., 2015; Henkel & Zemlin, 2016; Jun et al., 2019; Penelo et al., 2012; Rinker et al., 2016; Stockdale & Coyne, 2018; Wong et al., 2013), we included seven covariates in our study that have been found to interact with both gaming and gambling behaviors. Gender was assessed by asking participants to self-identify as male, female, or other unlisted genders, which included an open text-entry box. Since we specifically controlled for a sample of emerging adults, age was self-reported as an open-ended question. Education was assessed using a mul- tiple-choice question with ordinal levels ("less than high school"–"PhD/MD/JD"). Place of birth was reported from "born in the US" or "born elsewhere." Although the links between IGD and immigration-status are not well under- stood, higher rates of problematic gambling have been observed in migrant groups (Henkel & Zemlin, 2016).

Furthermore, participants were asked to self-identify all ethnic and racial groups they belong to, with an open-text entry box provided to report any unlisted groups. For assessing well-being, we used the World Health Organization (WHO) Well-Being Index (WHO-5; WHO, 1998), which is a widely-used measure that has demonstrated excellent reliability and sensitivity in both clinical and general populations around the world (Topp et al., 2015). Lastly, participant SES scores were calculated using both subjective and objective measures of SES. Subjective social status (SSS) was measured at national and community levels using the MacArthur SSS Ladder subscales (MSSSL; Adler et al., 2000). SSS responses were then added to objective SES measures (i.e., personal yearly income & combined parental/guardian income) to compute an overall SES score. Compared to standard income questions, there is evidence to suggest that SSS may more accurately capture social disadvantages (Garza et al., 2017), as well as better predict health and well-being (Singh-Manoux et al., 2005). In the study's final sample, internal consistency was 0.31, 0.81, and

Table 4. Multinomial Logistic Regression of Gaming and Gambling Involvement.

Engagement	Predictors	*B*	*Z*-Test	*p*	OR	95% CI
Gambler[a]						
	Gamer[b]	0.25	0.55	0.59	1.28	[0.53, 3.11]
	P. Gamer[b]	0.28	0.45	0.65	0.75	[0.22, 2.56]
P. Gambler[a]						
	Gamer[b]	0.49	0.74	0.46	1.64	[0.44, 6.08]
	P. Gamer[b]	1.86	2.73	0.01	6.45	[1.69, 24.54]
Gamer[b]						
	Gambler[a]	0.10	0.22	0.83	1.11	[0.45, 2.67]
	P. Gambler[a]	0.30	0.45	0.65	1.35	[0.37, 4.95]
P. Gamer[b]						
	Gambler[a]	0.42	0.69	0.49	0.66	[0.20, 2.17]
	P. Gambler[a]	1.73	2.57	0.01	5.62	[1.51, 20.98]

Note. Multinomial logistic regressions showing the influence of gaming or gambling involvement (including problematic) as risk factors for one another (controlling for age, education, ethnicity/race, gender, place of birth, SES, and well-being). Bold values indicate statistical significance. P. ¼ ¼Problematic; OR Odds Ratio; CI¼Confidence Interval.
[a] Compared with non-Gamblers.
[b]Compared with non-Gamers.
Pseudo R^2(Gambler Model) ¼ 0.21.
Pseudo R^2(Gamer Model) ¼ 0.22.
Log Likelihood (1) ¼ 194.60.
Log Likelihood (2) ¼ 211.10.

0.70 for the WHO-5, MSSSL, and the total SES measures, respectively.

Data analysis and preliminary analysis

We conducted descriptive statistics (see Table 1) and bivariate correlational analyses (see Table 3) to evaluate the relationships between variables in our sample. A combination of regression, mediation analysis, and multinomial logistic regressions were performed to test our first (H1) and second hypotheses (H2). Finally, eight binomial logistic regression analyses were conducted to test the third hypothesis (H3). The entire study analysis was performed using SPSS v25 (IBM Corp, 2017).

Results

IGD, GD, and microtransaction frequencies

Gaming frequencies

As measured by the C-VAT 2.0 screening tool (van Rooij et al., 2017), 23.6% of the total participants exceeded the diagnostic threshold for IGD. The most frequent IGD criterion reported by the sample was using video games as a way to avoid or escape problems (40.3%). The other most frequent symptoms reported were preoccupation (34.2%) and intense craving (29.7%) to play video games. The average daily gameplay of the sample was 3.00 hours (SD ¼ 4.30), with 45.0% of participants reporting at least 1 hour or more of daily video gameplay and 28.3% reporting 4 or more hours. There was a significant positive association between the reported hours spent playing video games and microtransaction spending (r ¼ .31, $p < .01$). The amount of video gameplay was also positively related to both IGD (r ¼ .51, $p < .01$) and GD severity (r ¼ .21, $p < .01$).

Gambling frequencies

For gambling behaviors, 38.4% (n ¼401) of the sample reported they had gambled at least once in their lifetime and 18.6% indicated they still engage in gambling activities. According to the SOGS-RA measure, 14.4% of the sample was classified as probable problematic gamblers by reporting four or more symptoms of GD and 4.2% were considered at-risk gamblers with two to three symptoms reported. Based only on participants with previous gambling experi- ence, the most common symptom reported was experiencing negative thoughts or feelings about the amount of money they bet (39.6%), followed by gambling more than they had planned to (34.7%). Moreover, the most common types of gambling engagement reported were slot machines (60.4%) and scratch tickets (63.4%), followed by betting on games of personal skill (50.5%; e.g., bowling, golf, or pool), and engaging in sports betting activities (52.5%).

Microtransaction frequencies

See Table 2 for microtransaction engagement frequencies and exploratory analysis for both problematic gaming and gambling in the sample. Out of the participants who reported playing a video game with microtransactions at least once in their lifetime (n ¼157), 55.4% indicated they spend money on these in-game purchase options each month (M ¼411, SD 1.¾1); 6.4% of these microtransac- tion-game players reported previously spending over $100.00 (USD) on a single video game title, with two participants reporting expenditures of $1,000.00 and $2,000.00 (USD). According to our adaptation of the RLI scale (Brooks & Clark, 2019), approximately one-third of the gamers in the sample reported experiencing problems related to microtransactions (31.4%), in addition to having intensifying urges to purchase microtransactions as time went on (37.1%). Furthermore, feeling obligated to purchase microtransactions (item 1), as well as monthly microtransaction spending rates (item 11), had the strongest, direct associations with both IGD and GD severity (see Table 2).

Are IGD and GD related?

We examined the relationship between IGD and GD using two multinomial logistic regressions to test our first hypothesis (H1; see Table 4). We controlled for age, education, ethnicity/race, gender, place of birth, SES, and well-being. We checked for multicollinearity and found no major correlations ($r < 0.70$) across our independent variables. All other assumptions (e.g., multivariate normality, no outliers) were met for this analysis. Therefore, we set our level of significance at an alpha of 0.05. The results revealed that relative to non-gamblers, problem gamblers were 5.62 times more likely to problem game (p¼.01, 95% CI [1.51, 20.98]). Similarly, we found that relative to non-gamers, problem gamers were 6.45 times more likely to problem gamble (p ¼01, 95% CI [1.69, 24.54]). Both models show strong fitness with pseudo R^2 of 0.22 and 0.21, respectively (McFadden). These findings

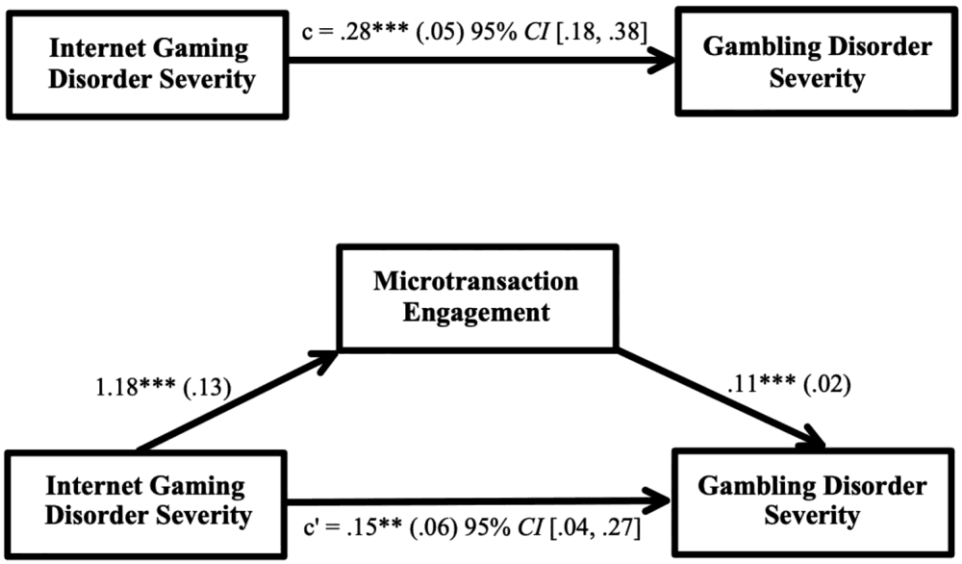

Figure 1. Mediation Analysis of IGD and GD with Microtransaction Mediator. *Note.* Mediation analysis for the effect of Internet gaming disorder severity via microtransaction engagement on gambling disorder severity (controlling for age, education, ethnicity/race, gender, place of birth, SES, and well-being). Unstandardized coefficients are reported with standard errors inside parentheses. $p < .05$. $p < .01$. $p < .001$.

Table 5. Binomial Logistic Regression of Risk-Taking as Risk Factor.

	Gaming					Problematic Gaming				
Predictors	*B*	OR	95% CI		*p*	*B*	OR	95% CI		*p*
Age	0.13	1.13	[0.95, 1.35]		0.16	0.01	0.99	[0.73, 1.35]		0.96
Education	0.40	0.67	[0.54, 0.82]		0.00	0.04	1.04	[0.75, 1.43]		0.82
Ethnicity/Race	0.13	1.14	[0.94, 1.37]		0.19	0.19	1.21	[0.91, 1.60]		0.19
Gender[a]	1.96	7.01	[3.35, 14.92]		0.00	0.16	1.18	[0.38, 3.67]		0.78
Place of Birth	0.90	2.45	[0.47, 12.83]		0.29	20.86	11.52	[0.00, 22.12]		0.99
SES	0.04	1.04	[0.98, 1.10]		0.24	0.06	1.06	[0.98, 1.16]		0.17
Well-Being	0.05	1.05	[0.97, 1.14]		0.25	0.01	0.99	[0.85, 1.14]		0.84
Risk-Taking	0.01	1.01	[1.00, 1.03]		0.08	0.03	1.03	[1.01, 1.05]		0.00
Summary Statistics (block)			v^2	*df*	*p*			v^2	*df*	*p*
Likelihood Ratio Test			63.35	8	0.00			20.63	8	0.01
Hosmer and Lemeshow			5.49	8	0.70			9.61	8	0.29

	Gaming					Problematic Gambling				
Predictors	*B*	OR	95% CI		*p*	*B*	OR	95% CI		*p*
Age	0.18	1.19	[0.02, 1.39]		0.03	0.17	1.19	[0.91, 1.54]		0.20
Education	0.07	0.93	[0.78, 1.11]		0.41	0.14	0.87	[0.66, 1.14]		0.30
Ethnicity/Race	0.08	0.93	[0.79, 1.08]		0.00	0.17	1.18	[0.92, 1.51]		0.19
Gender[a]	0.77	2.16	[1.21, 3.85]		0.01	0.22	1.24	[0.46, 3.34]		0.67
Place of Birth	0.79	0.46	[0.13, 1.65]		0.23	1.13	3.11	[0.21, 46.40]		0.41
SES	0.09	1.09	[1.04, 1.15]		0.00	0.07	1.08	[1.00, 1.17]		0.07
Well-Being	0.03	1.03	[0.95, 1.10]		0.50	0.03	0.97	[0.85, 1.11]		0.65
Risk-Taking	0.03	1.03	[1.01, 1.04]		0.00	0.03	1.03	[1.01, 1.05]		0.00
Summary Statistics (block)			v^2	*df*	*p*			v^2	*df*	*p*
Likelihood Ratio Test			57.52	8	0.00			21.75	8	0.01
Hosmer and Lemeshow			9.17	8	0.32			4.20	8	0.84

Note. Binomial logistic regression analyses showing the influence of risk-taking as a risk factor (controlling for age, education, ethnicity/race, gender, place of ¼birth, SES, and well-being). Bold values indicate statistical significance. OR Odds Ratio; CI¼Confidence Interval.
[a] Compared to Female.
Nagelkerke R^2 (Gaming) ¼ 31.4% variance.
Nagelkerke R^2 (Problematic Gaming) ¼ 29.1% variance.
Nagelkerke R^2 (Gambling) ¼ 26.7% variance.
Nagelkerke R^2 (Problematic Gaming) ¼ 25.8% variance.

indicate a strong mutual association between IGD and GD, which supports our main hypothesis (H1).

Do microtransactions mediate the relationship?

We tested whether microtransaction engagement mediated the relationship between emerging adult severity levels of IGD and GD. The model was tested using the bootstrapping method for simple mediation (Preacher & Hayes, 2008). For the analysis, we used PROCESS v3.4 (Hayes, 2013, 2015) bootstrapping procedure in SPSS v25 (IBM Corp, 2017) and ran Model 4 using 10,000 resamples (with replacement). The total effect of severity levels of IGD on severity levels of GD

Table 6. Binomial Logistic Regression of Risk-Taking Domains as Risk Factors.

	Gaming				Problematic Gaming			
Predictors	*B*	OR	95% CI	*p*	*B*	OR	95% CI	*p*
Ethical	0.03	1.03	[0.96, 1.11]	0.41	0.02	0.98	[0.89, 1.09]	0.75
F. Gambling	0.01	0.99	[0.87, 1.12]	0.83	0.28	1.32	[1.06, 1.65]	0.01
F. Investment	0.06	0.94	[0.86, 1.03]	0.20	0.03	0.97	[0.82, 1.16]	0.77
Health/Safety	0.01	1.00	[0.95, 1.07]	0.85	0.03	1.03	[0.92, 1.15]	0.62
Recreational	0.05	1.05	[0.99, 1.12]	0.09	0.04	1.04	[0.95, 1.14]	0.39
Social	0.00	1.00	[0.95, 1.06]	0.98	0.07	0.93	[0.85, 1.02]	0.14
Summary Statistics (block)		v^2	*df*	*p*		v^2	*df*	*p*
Likelihood Ratio Test		67.16	13	0.00		34.33	13	0.00
Hosmer and Lemeshow		10.79	8	0.21		3.40	8	0.91

	Gaming				Problematic Gambling			
Predictors	*B*	OR	95% CI	*p*	*B*	OR	95% CI	*p*
Ethical	0.03	1.03	[0.97, 1.10]	0.28	0.01	0.99	[0.91, 1.09]	0.85
F. Gambling	0.05	1.05	[0.94, 1.17]	0.39	0.26	1.30	[1.09, 1.55]	0.00
F. Investment	0.20	0.83	[0.75, 0.91]	0.00	0.00	1.00	[0.85, 1.17]	0.99
Health/Safety	0.07	1.07	[1.01, 1.13]	0.02	0.04	1.04	[0.95, 1.14]	0.35
Recreational	0.06	1.06	[1.01, 1.12]	0.02	0.01	1.01	[0.93, 1.10]	0.78
Social	0.07	1.07	[1.01, 1.14]	0.02	0.06	0.94	[0.86, 1.02]	0.15
Summary Statistics (block)		v^2	*df*	*p*		v^2	*df*	*p*
Likelihood Ratio Test		86.82	13	0.00		38.91	13	0.00
Hosmer and Lemeshow		3.74	8	0.88		5.59	8	0.69

Note. Binomial logistic regression showing the risk factors for each domain of risk-taking (controlling for age, education, ethnicity/race, gender, place of birth, SES, and well-being). Bold values indicate statistical significance. F. ¼ Financial; OR ¼ Odds Ratio; CI ¼ Confidence Interval.
Nagelkerke R^2 (Gaming) ¼ 33.1% variance.
Nagelkerke R^2 (Problematic Gaming) ¼ 44.8% variance.
Nagelkerke R^2 (Gambling) ¼ 38.2% variance.
Nagelkerke R^2 (Problematic Gaming) ¼ 42.6% variance.

was statistically significant with the microtransaction mediator included in the model (b ¼0.28, 95% CI [0.18, 0.38], $p < .001$). The model's direct effect was also found to be significant (b ¼0.15, 95% CI [0.04, 0.27], $p < .01$), in addition to the indirect effect for microtransaction engagement (b ¼.13, 95% CI [0.06, 0.22], $p < .01$). However, since both the direct and indirect effects of the model remained significant, full mediation did not occur. Thus, these data suggest microtransaction engagement acts as a partial mediator in this IGD and GD relationship (see Figure 1). Overall, the results indicate that participants reporting more problematic video game behaviors (according to IGD diagnostic criteria) were more likely to purchase microtransactions and report more problems associated with gambling (according to the SOGS-RA specifications).

What aspects of risk-taking predicts IGD and GD?

To determine the role risk-taking attitudes play in the involvement of either gaming or gambling (H3), especially at problematic levels, we conducted four different binomial logistic regressions (see Table 5). We controlled for age, education, ethnicity/race, gender, place of birth, SES, and well-being in all of our models. In general, the results indicated that risk-taking was a significant predictor for all levels of involvement except gaming involvement (p¼0.08, 95% CI [1.00, 1.03]). That is, risk-taking was a significant predictor for gambling involvement (p ¼0.00, 95% CI [1.01, 1.04]), problem gaming ($p < 0.01$, 95% CI [1.01, 1.05]), and problem gambling (p ¼ 0.00, 95% CI [1.01, 1.05]). See Table 5 for detailed statistics on the binomial logistic regression analyses.

In an exploratory approach, we conducted four additional binomial logistic regressions to understand which domains of risk-taking are risk factors for the different levels of involvement (see Table 6). Similar to the previous analyses on general risk-taking, results indicated that aspects of risk-taking predicted all of the levels except gaming involvement. Moreover, the health and safety, financial investment, recreational, and social risk-taking domains were all significant individual predictors that increased the odds for gambling involvement ($p < 0.05$; see Table 6). Results also showed that an increase in financial gambling was a significant predictor for both problem gaming (p ¼0.01, 95% CI [1.06, 1.65]) and problem gambling (p¼0.00, 95% CI [1.09, 1.55]). All models were statistically significant (see Table 6).

Discussion

While our sample's IGD prevalence rate (23.6%) was significantly higher than Stockdale and Coyne's (2018) study, which examined US emerging adult students, there are no other available studies (that we are aware of) that measured IGD specifically in US emerging adult non-students. However, our results are within the range of the WHO's general IGD prevalence rate estimates of 0.3% to 27.5% for countries around the world (WHO, 2019). It is possible that being a student may serve as a protective factor against problematic gaming behaviors or that 18 to 25-year-olds living in the US, who are not enrolled in school, are more susceptible to developing IGD. The most frequently reported IGD symptom in the sample (i.e., using video games as an escape or to avoid problems) is consistent with other problem gaming studies (e.g., Blasi et al., 2019; Chen & Chang, 2019). This finding suggests that emerging adults may use video games as a maladaptive coping strategy to alleviate negative emotions (e.g., anxiety), which may have valuable clinical relevance for constructing treatment approaches.

Since our results displayed that problematic engagement in either gaming or gambling represents a major risk factor for problematic engagement in the other behavior, psychiatric nurses may improve their clinical efficacy by selecting transdiagnostic treatment approaches (e.g., Acceptance & Commitment Therapy; see Gordon & Borushok, 2017) that target the underlying reasons why emerging adults with IGD and/or GD may select these addiction-based coping styles in the first place. Although syndrome-specific treatment models may still be useful for some patients, these models direct less attention toward preparing individuals with IGD and/or GD on how to resist substituting one addiction for another (Kim & Hodgins, 2018). With the apparent comorbidity of not only IGD and GD (Mills et al., 2020), but also addiction and mental health disorders (APA, 2013; Cleary & Thomas, 2017; Kerber et al., 2008; Kim et al., 2020; Loo et al., 2019; SAMHSA, 2019), it is important for nurses to educate addiction-prone emerging adults on how to recognize their own personal indicators of when their behavior may be transitioning toward another type of maladaptive coping. Once

patients learn how to notice these warning signs, they will have an enhanced capacity to modify their future actions and resist previous behavioral triggers and patterns (Gordon & Borushok, 2017). Moreover, nursing care plans should encourage patients with IGD and/or GD to explore realistic, healthier alternatives (e.g., exercising, joining a support group, trying a new hobby) for handling common stressors relevant to their circumstances. While stopping problematic behaviors is fundamental to effective addiction treatment, it is equally vital for nurses to guide clinical patients toward more functional lifestyle options.

In relation to lifetime gambling engagement, our sample had lower rates of previous gambling experience (38.4%) than other studies for US emerging adults (e.g., Welte et al., 2011; Wong et al., 2013). Despite these lower levels of gambling in the sample though, when participants did engage in gambling, they experienced symptomatology of GD at higher than average rates (14.4% of participants reported 4 symptoms of GD). The sample also differed from previous research in that there were more probable problematic gamblers (14.4%) than at-risk gamblers (4.2%). The "probable problematic" nomenclature in this instance refers to individuals who may likely classify as pathological gamblers, but cannot be diagnosed as such without direct consultation with a medical professional. Whereas, "at-risk" implies subthreshold diagnostic levels of GD. The higher rates of probable problematic gamblers than at-risk gamblers in our study may be attributed to the way in which GD severity was measured across different studies, lower levels of lifetime gambling engagement in our sample, or the specifications of Winters et al. (1995) for the different classification levels.

Regarding the sample's microtransaction engagement, our results suggest there is a significant financial component involved in video games via these in-game expenditures that may help explain problematic engagement in gaming and gambling for US emerging adults. For example, 31.4% of players indicated microtransactions had caused them problems and two participants reported microtransaction spending in the thousands of dollars for one video game. These findings highlight the need for mental health professionals to reconsider the current monetary distinction that separates IGD from GD in the DSM-5 (APA, 2013). After all, GD is not based on a specific dollar amount spent, but the negative consequences that may arise from a monetary loss. Emerging adulthood is already considered an unstable financial period (Terriquez & Gurantz, 2015) and with access to online gaming and gambling rapidly expanding (King & Delfabbro, 2016), there will be more opportunities for vulnerable individuals to experience financial losses. Unfortunately, these losses may prevent some emerging adults with IGD and/or GD from receiving medical treatment (Kerber et al., 2008), which may ultimately be detrimental to their long-term mental health and well-being. Psychiatric nurses are in a unique position to raise clinical and public awareness about the commonalities between IGD and GD, in addition to the possible treatment barriers that young adults suffering from these disorders may encounter when seeking care.

Overall, our results reflect the comorbid nature of disordered video gaming and gambling among emerging adults and support the claim that IGD should qualify as a medical diagnosis (APA, 2013). The recent incorporation of money in video games does seem to blur the lines of IGD and GD, further merging these addictive disorders. Alarmingly, video games continue to be largely unregulated for customers much younger than the legal gambling ages (King & Delfabbro, 2019). Given the strong overlap between IGD and GD, more research and policy considerations (e.g., age restrictions, independent regulation, spending limits) are needed to address the growing video game industry and the impact of current monetization trends.

Furthermore, results from the mediation analysis support our first (H1) and second (H2) hypotheses because microtransactions partially explained the relationship between severity levels of IGD and GD. Although microtransaction engagement and spending were more closely related to problematic gaming, the connection between in-game purchases and problematic gambling was still significant ($p < .001$). However, since these analyses are correlational, we cannot determine whether higher levels of microtransaction engagement potentially lead to problem gambling later on or if problem gamblers are more likely to spend money on microtransactions when gaming. Regardless of the causal direction though, these results posit there is a comorbid relationship between IGD and GD that microtransactions can explain to a certain extent.

The risk-taking findings from our binomial logistic regressions suggest that emerging adults engage in video games for reasons other than opportunities to take risks. The results partially supported our third hypothesis (H3), as increments in risk-taking behaviors significantly predicted higher odds for gambling engagement, problematic gambling engagement, and problematic gaming engagement. While general gaming engagement was not statistically predicted by risk-taking, we observed a trend toward significance (p ¼0.08). Further analysis displayed that specific domains of risk-taking were the main predictors for these results. Specifically, we found that the domain of financial gambling risk-taking alone was able to predict participants with problem gaming and problem gambling engagement. Once again, underscoring the role money plays in present-day video games and the risk that entails. Additionally, other risk domains (i.e., financial investment, health/safety, recreational, & social) were found to significantly predict only gambling engagement, suggesting these two different types of engagements are distinguished by emerging adults' risk-taking motivations.

Outside of the study's main objectives, other interesting predictors did emerge for gaming and gambling involvement. Lower levels of education were connected to higher rates of gaming engagement, which could be attributed to the fact that approximately half (50.2%) of our sample reported their highest level of education as high school or less; in addition to us controlling for a sample of current

non-students. For gambling engagement, older emerging adults, identifying as White, and with a higher SES had a greater likelihood of being a gambler. Yet, since our sample was primarily White Americans, our results likely do not accurately reflect ethnic or racial differences for engagement. The significance of age related to gambling engagement may also be deceiving since many US states require individuals to be 21 or older in order to legally gamble. However, the most compelling results were associated with gender identity. For both gaming and gambling engagement, males were shown to game seven times more (OR ¼ 7.01, B ¼ 1.96, p ¼ 0.00) and gamble two times more than females (OR ¼ 2.16, B ¼ 0.77, p ¼ 0.01), but these gender differences disappear at problematic levels. These findings are consistent with previous literature for engagement (Wong et al., 2013), yet inconsistent for problematic engagement (APA, 2013). Future research should continue to examine the influential role gender appears to have in these behaviors.

Limitations

The present study has some limitations to consider when evaluating our findings. First, the survey utilized for this research was restricted to a single time-point and relied on self-report measures for data collection. Second, participants were recruited through convenience sampling, self-selected to participate in the study, and were from a non-clinical population. Although sampling from a pre-arranged pool of online survey-takers may have allowed us greater access to the target demographic, it is necessary to note that our results may not generalize to all US emerging adult non-students. It is possible there are certain characteristics of online survey respondents or our specific sample that differ from the general US 18 to 25-year-old, non-student population and were unaccounted for in our analyses. Third, the WHO-5 (WHO, 1998) well-being measure for our sample displayed low internal consistency (α ¼ 0.31). Since each survey question required a response and did not allow participants to skip questions, it is a possibility that this forced-response design may have obscured the identification of problematic questions for our sample within the survey. Therefore, generalizability of our findings should be applied with caution.

Conclusion

This study investigated the possible comorbidity of IGD and GD in US emerging adult non-students, in addition to the role microtransactions and risk-taking have in this relationship. The results demonstrated there is a significant association between problematic involvement in both gaming and gambling: individuals experiencing more severe forms of one disorder were more likely to experience symptoms of the other disorder. These findings contribute to the growing evidence that addictive disorders share more similarities than they do differences, which may have particular relevance for how these conditions are treated in clinical settings and encourage more transdiagnostic treatment approaches for these addictions. Gaming and gambling disorders represent significant mental health issues not only in the US, but around the world. As access to these activities continues to rapidly increase with mobile technology, people vulnerable to problematic involvement will have more opportunities than any previous time in history to participate in these behaviors.

Finally, the near ubiquitous implementation of gambling mechanics into modern video games may represent a substantial threat to the psychological and financial well-being of emerging adults, who are already at an elevated risk for addictive disorders (SAMHSA, 2019). Contrary to the DSM-5 (APA, 2013), our results indicate gamers can experi- ence negative financial consequences from their involvement in video games via microtransactions, which suggests there is a key monetary risk involved in IGD that is not currently acknowledged or well understood by the APA. Beyond spending money in video games, risk-taking behaviors were also significant predictors of problematic involvement for both gamers and gamblers alike in our sample. Future studies may be able to examine this risk factor in greater detail for IGD and GD, as well as elaborate on whether specific game types or microtransactions (i.e., random- or fixed-reward) pose more of a threat than others to vulnerable players. Due to the complex, diverse, and ever-changing nature of video games, many questions in this field still remain unanswered and are greatly needed to further improve the ways in which IGD and GD are treated by nursing professionals.

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5. Dr. Richard Bret Leary, UNR Faculty

Summary of project:

Dr. Richard Bret Leary was awarded $3,000 to study the relationship between “masculinity stress” and problem gambling. Incorporating concepts of “fixed” and “growth” mindsets, Dr. Leary’s research aims to investigate how different types of consumer mindsets in conjunction with varying levels of “masculinity stress” impact American men’s problem gambling outcomes, along with their gambling behaviors more generally.

Outcome:

This project was not completed due to COVID-19 disruptions. Funds were not issued.

6. Dr. Jimmie Manning, UNR Faculty

Summary of project:

Dr. Jimmie Manning was awarded $3,000 to study how problem gambling impacts interpersonal communication in families. Dr. Manning’s research conducts in-depth interviews with adult family members who currently or in the past have lived with a problem gambler. As shown in the study’s preliminary work, “little research has been conducted to determine how families are addressing issues related to problem gambling and its resulting stressors.” Dr. Manning’s research is an attempt to begin filling that gap via exploratory research methods.

Outcome:

The project was only partially completed due to COVID-19 disruptions. Data collection has begun, but it is currently paused until face to face interviews can resume. Partial funds were issued for transcriptions and supplies.

7. Glenn Nowak, UNLV Faculty

Project summary:

Glenn Nowak was awarded $2,500 for the Hospitality Design (HD)-Lab to investigate potential architectural responses to problem gambling. “The proposed study will utilize an on-site intercept survey to measure participants’ sentiments toward casino environments, their perceived health/wellness of those spaces, and their level of support for increased expectations from the architecture of integrated resorts.” Incorporating architectural best practices such as the WELL Building Standard, “It is the hope of the research team to bring greater consideration to the effects the built environment has on recreational gamblers, problem gamblers, and the community at large.”

Outcome:

This project was only partially completed due to COVID-19 disruptions. It is currently paused until intercept surveys can be resumed on casino floors and until a “lunch and learn” can be organized to deliver research findings to architecture professionals. Partial funds were issued for supplies.

Appendix: Call for Proposals and Scoring Rubric

UNLV | INTERNATIONAL GAMING INSTITUTE

RESEARCH FUNDING OPPORTUNITY

UNLV International Gaming Institute is seeking grant proposals from graduate students and faculty studying problem gambling. We encourage submissions from a broad range of fields and topics!

BACKGROUND

The Nevada Department of Health and Human Services has allocated $32,000 to encourage Nevada scholars to contribute to the field of problem gambling by offering research grants. These funds will be awarded on a competitive basis, after applications are reviewed by committee. Multiple small grants of up to $3000 each and a larger grant of up to $15,000 will be awarded.

TOPICS

Submissions are welcomed for any projects that explore issues related to problem gambling. Researchers may analyze existing data or conduct their own original data collection. Special consideration will be given to projects that improve public awareness through dissemination of research findings in public forums.

DETAILS

- Open to graduate students and faculty based in Nevada.
- Graduate students in sociology, psychology, social work, epidemiology, public health, biostatistics, or a similar field are encouraged to apply. Graduate students must have a faculty advisor's approval.
- You will be required to submit a proposal to present your research findings at The Nevada State Conference on Problem Gambling.
    - In the event you are not selected for the Nevada State Conference, you will be asked to present your research at another conference in Nevada (for example: UNLV GPSA Research Forum, UNR GSA Research Symposium, American Association of Behavioral and Social Sciences Conference, discipline-specific regional conferences)
- Research involving human subjects must obtain IRB approval from an academic institution.
- The proposal must include a description of how results will be communicated to the public (for example: social media, blogs, editorials, symposia).
- You must complete the research and submit a preliminary report by June 30, 2020. (You may fulfill the conference presentation requirement in 2021. Final report due by no later than September 30, 2020 and is required in order to be considered for future grants.)
- It is expected that a white paper, conference presentation, and public awareness component will result from each project, though other deliverables (e.g. thesis, dissertation, academic journal publications, or policy advocacy for best practices) are also welcome.
- If you have any questions about eligibility or the application process, email them to andrea.dassopoulos@unlv.edu

TIMELINE

Applications are due November 15. Award recipients will be announced by December 6. A portion of the award will be given at the start of the project, with the rest upon completion. Projects must be completed by June 30, 2020.

UNLV | INTERNATIONAL GAMING INSTITUTE

APPLICATION FOR SEED GRANT ON PROBLEM GAMBLING RESEARCH

Applicants should prepare a brief proposal (up to 1,000 words) addressing the following questions:

1. Name, affiliation, contact information, award amount requested, and budget justification.
2. What research question(s) will your study address?
3. What potential contributions will this study make to the fields of problem gambling treatment, prevention, and/or awareness?
4. What is your proposed study design? (Submissions should emphasize how the project will be executed, including a detailed strategy on any research methodology, timelines, research plan, and deliverables.)
5. How will your research findings be communicated?
6. Human Subjects Research: should any primary research be conducted with human subjects (including both exempt and full review formats), submissions should outline how human subject reviews will be undertaken with an appropriate institutional review board.
7. Anticipated timeline for project, including start and complete dates.
8. How does this research project fit with your academic and career goals?
9. (For graduate students) When submitting your proposal, cc your advisor in the email and include the following statement in the body of the email:
   "My advisor (advisor's name, institutional affiliation, email address) has read this proposal and views this as an appropriate project for me."
10. Submit completed applications as an attached word document to andrea.dassopoulos@unlv.edu no later than 11:59pm PST on November 15, 2019. Proposals will be de-identified and blind-reviewed by a committee of three reviewers.

SCORING RUBRIC for PROPOSALS

PROPOSAL #		TOTAL SCORE:	
	EXEMPLARY (3 pts)	**ADEQUATE (2 pts)**	**NEEDS IMPROVEMENT (1 pt)**	**SCORE**
Research Question	Clearly articulates a research question that can be answered.	States a clear, but untestable research question.	States a vague, untestable research question.	
Project Description and Contributions to Problem Gambling Field	Provides a strong rationale for the project, with evidence-based justification that clearly explains activities and outcomes. Clear contribution to problem gambling field.	Does not adequately introduce the topic with evidence- based justification for the project. Contribution is vaguely described. Reviewers must infer some of the relevance/contribution to problem gambling field.	Does not introduce the topic; no evidence-based justification for the project. The relevance and/or contribution to problem gambling field is not clear/missing.	
Study Design	Project activities fully described in appropriate detail; it is clear how objectives will be accomplished. Describes precise steps to carry out/achieve each objective.	Project activities are described. Reviewers must infer some methodological information.	Fails to describe project activities in detail. It is unclear how objectives will be accomplished	
Dissemination	Outcomes and/or tangible deliverables are thoroughly described. A clear strategy for dissemination is presented that includes non-academic audiences.	A partial explanation of the project outcomes and/or tangible deliverables. Some elements are ambiguous. It is unclear how outcomes and/or deliverables will be disseminated.	Project outcomes and/or tangible deliverables are unclear. Dissemination is not addressed.	
Timeline and Feasibility	Clear timeline that is reasonable for the proposed project.	Timeline that is vague or overly ambitious for the completion of proposed project.	Project is not feasible and/or time specified.	
Notes:				

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