Examining the Gambling Behavior of University Students: A Cross-Sectional Survey Applying the Multi-Theory Model (MTM) of Health Behavior Change in a Single Institution

Sidath Kapukotuwa *, Laurencia Bonsu, Anita Chatterjee, Miguel Fudolig, Manoj Sharma

Posted Date: 12 June 2023

doi: 10.20944/preprints202306.0750.v1

Keywords: behavior; theory; addiction; gambling; college students; university students; young adults; betting; gaming

Article

Examining the Gambling Behavior of University Students: A Cross-Sectional Survey Applying the Multi-Theory Model (MTM) of Health Behavior Change in a Single Institution

Sidath Kapukotuwa [1,*], Laurencia Bonsu [1], Anita Chatterjee [1], Miguel Fudolig [2] and Manoj Sharma [1,3]

[1] Department of Social & Behavioral Health, School of Public Health, University of Nevada, Las Vegas (UNLV), NV 89119; kapukotu@unlv.nevada.edu; bonsul1@unlv.nevada.edu; chatta1@unlv.nevada.edu; manoj.sharma@unlv.edu

[2] Department of Epidemiology and Biostatistics, School of Public Health University of Nevada, Las Vegas (UNLV), NV 89119; miguel.fudolig@unlv.edu

[3] Department of Internal Medicine, Kirk Kerkorian School of Medicine at UNLV, Las Vegas, NV 89106; manoj.sharma@unlv.edu

* Correspondence: kapukotu@unlv.nevada.edu

Abstract: Gambling among college students can start as a pastime activity. However, this pastime can lead to problem gambling and pathological gambling. This cross-sectional study aimed to identify and explain gambling behavior among university students using a novel fourth-generation multi-theory model (MTM) of health behavior change. Data were collected from a sample of 1,474 university students at a large southwestern university in the U.S. between January 2023 and February 2023, utilizing a validated 39-item survey. The statistical analyses employed in this study encompassed descriptive statistics, independent samples t-tests, and hierarchical regression modeling. Among students who engaged in gambling in the past month, the constructs of participatory dialogue ($\beta = 0.052$; $p < 0.05$), behavioral confidence ($\beta = 0.073$; $p < 0.0001$), and changes in the physical environment ($\beta = 0.040$; $p = 0.0137$) accounted for 27.7% of the variance in the likelihood of initiating the behavior change. Furthermore, the constructs of emotional transformation ($\beta = 0.104$; $p = 0.0003$) and practice for change ($\beta = 0.060$; $p = 0.0368$) accounted for 22.6% of the variance in the likelihood of sustaining quitting gambling behavior. The Multi-Theory Model (MTM) can be employed to design interventions aimed at reducing problem gambling among college students.

Keywords: behavior; theory; addiction; gambling; college students; university students; young adults; betting; gaming

1. Introduction

The years spent in higher education mark a significant turning point in an individual's life, one that bridges the gap between childhood and adulthood. Problem behaviors may occur alongside the considerable rise in freedom and leisure options that characterize this stage of emerging adulthood [1]. In addition to alcohol and drug use, college students are exposed to gambling on campuses and in the college community. One pastime that can quickly become problematic is gambling, especially considering the explosive growth in the industry over the previous two decades among people of all age groups [1]. The importance of gambling as a public health concern has been emphasized more and more recently [2–4]. Drug abuse, physical and sexual violence, and mental health problems, including anxiety and depression, are negative outcomes associated with gambling [2].

Legal gambling stations are prevalent throughout the southwestern region of the United States. Among various demographics, problem gambling poses a significant concern, particularly among college students. This group possesses the necessary resources, proximity, leisure time, and inclination to engage in various gambling options, including online gambling, lotteries, fantasy sports leagues, and more. [5,6]. Research has indicated that around 75% of college students have engaged in legal or illegal gambling within the past year [6,7]. Recent studies have shown that the male gender, depression, low parental guide or monitoring levels, previous winnings, and attention deficit hyperactivity disorder (ADHD) are antecedents of problem gambling [8,9]. The prevalence of gambling has increased due to the availability and legalization of all forms of gambling [10]. College students may have a higher propensity than adults to develop gambling problems, particularly if they have a fondness for sports or engage in sports betting [11]. Many students gamble to "have fun," "mingle with friends," and "present as the cool kids." However, "significant numbers of students engage in gambling or betting to the extent that their actions are consistent with problem gambling or pathological gambling, a mental disease [1]. The estimated lifetime prevalence of problem gambling among college students is approximately 5% [6].

Gambling among college students can lead to issues such as low grades, suicide, missed classes, physical violence, binge drinking, and mental health problems [12]. Problem gambling is characterized by uncontrollable destructive, and compulsive gambling with significant deleterious personal, social, financial, psychological, vocational, and academic consequences among college students [8,13]. Problem gamblers have little behavioral control and are frequently preoccupied with gambling-related thoughts, which may later lead to pathological gambling [14]. Pathological gambling is defined as the inability to regulate the urge to gamble. It is a destructive and compulsive behavior [6].

Given the enduring adverse effects of problem gambling on college students, it is crucial to comprehend and elucidate the gambling behavior exhibited by this population [11]. Numerous studies have employed the theory of planned behavior to explain the behavioral intention and problem gambling behavior, which predicts individuals' behavioral intention and perceived behavioral control. In contrast, attitudes toward the behavior, subjective norms, and perceived control over the behavior significantly influence individuals' intentions. [11,15,16].

This study aimed to explore the correlates of problem gambling behavior among college students using the multi-theory model (MTM) of health behavior change [17]. The unique, fourth-generation MTM examines university students' gambling behavior. The MTM is divided into two components: initiation and sustenance. The initiation can be divided into three constructs, i.e., participatory dialogue (e.g., advantages outweighing the disadvantages), behavioral confidence (e.g., an individual's level of assurance in engaging in behavioral change), and changes in the physical environment (e.g., the individual changes their physical environment regarding the availability and accessibility of necessary resources). Sustenance can also be divided into three constructs, i.e., changes in the social environment (e.g., the ability to sustain one's behavior change through receiving social support from family and friends), practice for change (e.g., the individual's capacity to overcome obstacles like losing gambling friends or experiencing bullying because they decided to quit gambling) and emotional transformation (e.g., changes in a person's feelings towards behavior change). These questions guided the study; to what extent do the correlates based on MTM explain the initiation of quitting gambling behavior among university students while controlling for demographic covariates? To what extent do the correlates based on MTM explain the maintenance of quitting gambling behavior among university students while controlling for demographic covariates? The findings of this study can inform the development of health promotion interventions that effectively encourage the target population to initiate and maintain healthy gambling behavior.

 doi:10.20944/preprints202306.0750.v1

2. Materials and Methods

2.1. Study Design and Study Participants

This study employed a cross-sectional design, with data collection conducted between January 25, 2023, and February 17, 2023. The study targeted enrolled students at a large southwestern university in the United States. Eligible participants included students aged 18 years or older, proficient in English, and who provided their consent to participate.

2.2. Ethical Considerations

On November 18, 2022, the study received an exemption from the institutional review board of the university (Protocol # UNLV-2022-511). Participants provided their consent by voluntarily agreeing to participate in the study. The informed consent form provided participants with comprehensive information regarding the study's objectives, significance, associated risks, and the option to withdraw their participation at any time. Participants who selected the "Agree" option were directed to proceed to the survey. No personal data such as name or email address were collected.

2.3. Recruitment and Data Collection

The participants were initially recruited through announcements in the university's student newsletters. Then, student directory information was obtained from the registrar's office, and students were directly contacted through their university emails. Complete details about the study and an anonymous link to the survey were provided through these direct emails. Once participants clicked the link, they were directed to the Qualtrics (Provo, UT) online survey. Participants could enter a drawing for $20 Visa gift cards. Twenty-five randomly selected participants had the opportunity to receive one gift card as an incentive for participation. To preserve the anonymity of participants, we provided a separate survey link to enter the gift card drawing after the completion of the cross-section study survey. Participants were asked whether they were interested in participating in the drawing for gift cards. If they selected "Yes," they were directed to the gift card drawing survey, where we asked them to provide their email address for contact purposes. The "Prevent multiple submissions" option in Qualtrics was switched on to prevent participants from taking the surveys multiple times. The bot detection option was switched to identify whether bots were taking the surveys, and "RelevantID" was switched to detect fraudulent responses.

2.4. Survey Instrument

The instrument comprises a 39-item survey designed by the theory's originator. The first question determined whether the students had participated in gambling within the last 30 days. The following nine questions were used to collect the participants' demographic data. Those were the type of gambling, if they considered their gambling as problematic, gender, age, race/ethnicity, student status (freshmen, sophomore, etc.), GPA, living condition (on or off campus), and working status. The remaining 29 questions assessed the constructs of the multi-theory model (MTM) for both initiation and sustenance models.

Participatory dialogue is measured by perceived advantages and disadvantages. Each was measured by five items. Each item was measured on a five-point scale (0 = never to 4 = very often). The range of scores for perceived advantage and disadvantage is 0 to 20, and the range of scores for the participatory dialogue is -20 to 20 (perceived advantage – perceived disadvantage). Behavior confidence was measured by five items. Similar to perceived advantages and disadvantages, behavior confidence items were measured with five-point scales (0 = not at all sure to 4 = completely sure). The range of scores for behavioral confidence is 0 to 20. The remaining four constructs were measured by three items each. These were also measured with five-point scales (0 = not at all sure to 4 = completely sure). The possible range of scores for each construct is 0 to 12. The overall initial score was measured by one item, which has a five-point scale (0 = not at all likely to 4 = completely likely) with a possible range of scores of 0 to 4. The instrument used a similar method to measure the overall

 doi:10.20944/preprints202306.0750.v1

sustenance score. The Flesch reading ease is 50.5 for the instrument, and Flesch-Kincaid Grade Level is 8. 2.

2.5. Statistical Analyses

All data were analyzed using SAS version 9.4 (SAS Institute Inc) and R Statistical Software version 4.3.0 (R Core Team, 2021). A first-order, multi-factor model was used in the confirmatory factor analysis for initiation and sustenance models. The confirmatory factor analysis (CFA) for construct validation was performed using the R package lavaan [18]. We used Weighted Least Squares with Mean and Variance adjustments (WLSMV) designed for ordinal data [19] in implementing the CFA. The robust estimates of the comparative fit index (CFI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR) were used to diagnose the fit for the presented model. We used the following cutoff criteria recommended by Hu and Bentler (1999) [20] to assess acceptable fit: CFI values above 0.95, RMSEA values below 0.06, and SRMR values below 0.08. The internal consistency of the subscales and the entire scale was tested using Cronbach's alpha values, using 0.70 as the lower threshold for acceptable values. Convergent validity was measured using the average variance extracted (AVE). The AVE values for each subscale should be at least 0.5 to establish convergent validity. The model's reliability was measured using the McDonald's omega values using a lower threshold of 0.7. Descriptive statistics for continuous variables were presented using mean and standard deviation, while categorical variables were summarized using frequencies and percentages. Our dependent variables were the likelihood of intention and sustenance of gambling behavior among university students. The independent variables in this study were the MTM constructs, while gambling type, age, sex, race/ethnicity, class, and GPA served as covariates. An independent samples t-test was used to compare the mean differences in MTM constructs between individuals who did not engage in gambling in the past month and those who participated in gambling during the past month. Correlations among the independent variables were tested using Pearson's correlations test. Hierarchical multiple regression analysis was employed to predict the likelihood of initiating and sustaining quitting gambling behavior. Model assumptions: independence of observations, linearity, normality, and equal variance were tested using Durbin–Watson statistic, partial regression plots, Shapiro-Wilk test, and White test, respectively. The multicollinearity of the final model was tested using the variance inflation factor (VIF). The significant level was set to 0.05 for all statistical analyses.

3. Results

3.1. Sample Characteristics

A total of 1474 valid responses were collected. Most of the participants were female students (64.72%, n = 954), there were 497 male students (33.72%), and 23 students (1.56%) who chose the "Other" option for gender (Table 1). The average age is 25.3 years, with a standard deviation of 7.7 years. There were 595 (40.37%) White, 326 (22.12%) Hispanics, and 236 (16.01) Asian American students. The remaining 317 (20.51%) students belong to Multi-racial, Black, Native American, or other races/ethnicities (Table 1). The majority of participants were undergraduate students (68.92%, n = 1016), most of the students (61.71%, n = 910) reported having a GPA of 3.50 or above, 912 (61.87%) students reported not participating in gambling for the past month (Table 1).

Table 1. Descriptive statistics of the demographic variables (n = 1474).

Variable	Characteristics	Mean ± SD	n (%)
Age	-	25.3 ± 7.7	-
Gender	Male	-	497 (33.72)
	Female	-	954 (64.72)
	Other	-	23 (1.56)
Race/Ethnicity	White	-	595 (40.37)
	Black	-	74 (5.02)

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 June 2023 doi:10.20944/preprints202306.0750.v1

	Hispanic	-	326 (22.12)
	Asian American	-	236 (16.01)
	Native American	-	5 (0.34)
	Multi-racial	-	171 (11.60)
	Other	-	67 (4.55)
Class	Freshmen	-	164 (11.13)
	Sophomore	-	179 (12.14)
	Junior	-	318 (21.57)
	Senior	-	355 (24.08)
	Graduate	-	407 (27.61)
	Professional	-	51 (3.46)
GPA	Less than 1.99	-	14 (0.95)
	2.00 - 2.49	-	43 (2.92)
	2.50 - 2.99	-	133 (9.02)
	3.00 - 3.49	-	374 (25.37)
	3.50 - 4.00	-	910 (61.74)
Living condition	Off campus	-	1365 (92.61)
	On campus	-	109 (7.39)
Employment	Yes	-	1032 (70.01)
	No	-	442 (29.99)
Working hours per week *	-	26.4 ± 12.3	-
Participated in gambling at least one time in the past month	Yes	-	562 (38.13)
	No	-	912 (61.87)
Type of gambling	Single type	-	791 (53.66)
	Multiple type	-	683 (46.34)

* Only 1032 (70.01%) students had employment.

3.2. Reliability Analysis, Construct Validity, and Fit Diagnostics

We established construct validity for initiation and sustenance models by assessing internal consistency through Cronbach's alpha, reliability using McDonald's omega, and convergent validity using average variance extracted (AVE). All calculated values are listed in Table 2. All scales and subscales for initiation and sustenance models had Cronbach's alpha values above 0.7, which establishes the instrument's internal consistency for initiation. The McDonald's omega values for all constructs in both models were at least 0.70, which meets the criteria for reliability. The convergent validity of the model was also confirmed by the AVE values, which were above the 0.5 threshold constructs with recorded values from 0.50 to 0.80.

Table 2. Internal consistency, reliability, and convergent validity measurements for the different MTM constructs.

Subscale	Cronbach's Alpha (95% Confidence Interval)	McDonald's Omega	AVE
Perceived Advantage	0.93 (0.92,0.93)	0.93	0.74
Perceived Disadvantage	0.88 (0.87,0.89)	0.87	0.62
Behavioral Confidence	0.90 (0.89, 0.91)	0.91	0.66
Changes in the Physical Environment	0.77 (0.75, 0.79)	0.70	0.50
Overall Initiation Scale	0.80 (0.79, 0.82)	-	-
Emotional Transformation	0.92 (0.91, 0.93)	0.92	0.80
Practice for Change	0.83 (0.82, 0.85)	0.84	0.63
Changes in the Social Environment	0.80 (0.78, 0.82)	0.80	0.58
Overall Sustenance Scale	0.89 (0.88, 0.90)	-	-

The fit diagnostics of the confirmatory factor analysis for the initiation model used for construct validation show that the model fits the data we collected. We recorded a robust CFI estimate of 0.95, RMSEA of 0.067, and SRMR of 0.06. The factor loadings for the initiation model ranged from 0.563 to

 doi:10.20944/preprints202306.0750.v1

0.985 implying that the items are highly correlated to the constructs. All these indices fall within the acceptable range of values to establish a good fit stated in Section 2.5. The sustenance model also fits the data we collected with respective CFI, RMSEA, and SRMR estimates of 0.997, 0.023, and 0.025. Like the initiation model, the sustenance model also yielded high factor loadings ranging from 0.659 to 0.909. These findings support the construct validity of the instrument.

3.3. Characteristics of Study Variables and Inferential Statistics

The mean scores differences in initiation and sustenance of those who did not participate in gambling during the past month and those who participated in gambling were significant (Table 3). The mean initiation score was significantly higher among individuals who did not engage in gambling during the past month (M = 3.79, SD = 0.70) compared to those who participated in gambling (M = 2.95, SD = 1.37), with a statistically significant mean difference of M = 0.84, 95% CI [0.73, 0.95], $p < 0.0001$ (Table 3). Likewise, the mean score for sustenance was significantly higher (M = 3.17, SD = 1.18) among individuals who did not participate in gambling during the past month compared to those who did (M = 1.78, SD = 1.48), with a statistically significant mean difference of M = 1.39, 95% CI [1.25, 1.53], $p < 0.0001$ (Table 3).

To assess the impact of MTM constructs on initiation likelihood, hierarchical multiple regression was conducted by sequentially adding the MTM constructs to the demographic variables. The analysis aimed to determine whether the inclusion of the constructs improved the prediction of initiation (Tables 4 and 6). The full model (Model 4) for those who did not participate in gambling during the past month was statistically significant, $R^2 = 0.165$, $F(13, 898) = 13.63$, $p < 0.0001$; adjusted $R^2 = 0.153$ (Table 4). Incorporating participatory dialogue into the prediction of initiation (Model 2) resulted in a statistically significant increase in R^2 of 0.059. Furthermore, including behavioral confidence in the prediction of initiation (Model 3) led to a statistically significant increase in R^2 of 0.072.

In the hierarchical regression analysis of the sustenance model for individuals who did not participate in gambling during the past month, the full model (Model 4) yielded a statistically significant result, with an R^2 of 0.306, $F(13, 898) = 30.47$, $p < 0.0001$, and an adjusted R^2 of 0.296 (Table 5). Incorporating emotional transformation into the prediction of sustenance (Model 2) resulted in a statistically significant increase in R^2 of 0.171. Additionally, including practice for change in the prediction of sustenance (Model 3) led to a statistically significant increase in R^2 of 0.028.

The full model (Model 4) for those who participated in gambling during the past month was statistically significant, $R^2 = 0.294$, $F(13, 548) = 17.56$, $p < 0.0001$; adjusted $R^2 = 0.277$ (Table 6). Including participatory dialogue in the prediction of initiation (Model 2) resulted in a statistically significant increase in R^2 of 0.098 (see Table 6). Furthermore, incorporating behavioral confidence in the prediction of initiation (Model 3) led to a statistically significant increase in R^2 of 0.084. After controlling for the other predictors, when the participatory dialogue is increased by 1%, the likelihood to practice initiation significantly increased by 0.052 (95% CI = 0.035, 0.068; p-value < 0.0001) on average. Similarly, after controlling for the other predictors, when the behavioral confidence is increased by 1%, the likelihood to practice initiation significantly increased by 0.073 (95% CI = 0.049, 0.097; p-value < 0.0001) on average.

In the hierarchical regression analysis of the sustenance model for individuals who participated in gambling during the past month, the full model (Model 4) yielded a statistically significant result, with an R^2 of 0.244, $F(13, 548) = 13.60$, $p < 0.0001$, and an adjusted R^2 of 0.226 (see Table 7). Additionally, incorporating emotional transformation into the prediction of sustenance (Model 2) resulted in a statistically significant increase in R^2 of 0.067. After controlling for the other predictors, when the emotional transformation is increased by 1%, the likelihood of continuing to abstain from gambling significantly increased by 0.104 (95% CI = 0.048, 0.160; p-value = 0.0003) on average. Similarly, after controlling for the other predictors, when the practice for change is increased by 1%, the likelihood of continuing to abstain from gambling significantly increased by 0.060 (95% CI = 0.004, 0.116; p-value = 0.0368) on average.

 doi:10.20944/preprints202306.0750.v1

Table 3. Descriptive statistics of multi-theory model constructs of behavior change (n = 1474).

	Students who did not participate in gambling in the past month (n = 912)			**Students who participated in gambling in the past month (n = 562)**			s
Constructs	Possible score range	Observed score range	Mean ± SD	Possible score range	Observed score range	Mean ± SD	p-value
Initiation	0 - 4	0 - 4	3.79 ± 0.70	0 - 4	0 - 4	2.95 ± 1.37	<.0001
Perceived Advantage (PA)	0 - 20	0 - 20	15.30 ± 5.37	0 - 20	0 - 20	11.23 ± 5.67	<.0001
Perceived Disadvantage (PDA)	0 - 20	0 - 20	3.48 ± 4.43	0 - 20	0 - 20	4.63 ± 4.20	<.0001
Participatory Dialogue (PA - PDA)	-20 - +20	-9 - +20	11.82 ± 6.99	-20 - +20	-15 - +20	6.60 ± 6.29	<.0001
Behavioral confidence	0 - 20	0 - 20	17.11 ± 3.85	0 - 20	0 - 20	14.22 ± 4.87	<.0001
Changes in the physical environment	0 - 12	0 - 12	7.40 ± 3.49	0 - 12	0 - 12	6.17 ± 3.63	<.0001
Sustenance	0 - 4	0 - 4	3.17 ± 1.18	0 - 4	0 - 4	1.78 ± 1.48	<.0001
Emotional transformation	0 - 12	0 - 12	10.87 ± 2.13	0 - 12	0 - 12	9.43 ± 3.04	<.0001
Practice for change	0 - 12	0 - 12	10.20 ± 2.55	0 - 12	0 - 12	9.13 ± 3.08	<.0001
Changes in the social environment	0 - 12	0 - 12	9.50 ± 3.06	0 - 12	0 - 12	8.68 ± 3.34	<.0001

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 June 2023 doi:10.20944/preprints202306.0750.v1

Table 4. Hierarchical multiple regression predicts the likelihood of initiation for those who did not participate in gambling during the past month (n = 912).

Variables		Model 1		Model 2		Model 3		Model 4	
		β	p-value	β	p-value	β	p-value	β	p-value
Intercept		3.442	<.0001	3.194	<.0001	2.472	<.0001	2.453	<.0001
Type of Gambling	(Single type reference)	0.020	0.6857	0.050	0.2908	0.091	0.0453	0.097	0.032
Age		0.006	0.0892	0.004	0.2159	0.002	0.5327	0.002	0.5299
Sex	Female (Male reference)	0.138	0.0060	0.144	0.0032	0.090	0.0577	0.083	0.0776
Race/Ethnicity	Hispanic (White reference)	0.138	0.0253	0.147	0.0144	0.139	0.0158	0.124	0.0315
	Asian	0.023	0.7422	0.042	0.5353	0.057	0.3741	0.051	0.4305
	Others	-0.065	0.3001	-0.066	0.2772	-0.049	0.4039	-0.053	0.3595
Class	Sophomore + Junior (Freshmen reference)	0.030	0.6575	0.015	0.8166	0.009	0.8799	0.007	0.9043
	Senior	0.020	0.7637	0.007	0.9153	0.002	0.9752	0.001	0.9852
	Graduate	0.060	0.4099	0.058	0.4073	0.012	0.8549	0.016	0.8141
GPA	(Less than 3.50 reference)	0.071	0.1524	0.049	0.3101	0.057	0.2191	0.064	0.1654
Participatory dialogue				0.025	<.0001	0.017	<.0001	0.016	<.0001
Behavioral confidence						0.052	<.0001	0.047	<.0001
Changes in the physical environment								0.015	0.0237
R^2		0.029		0.088		0.160		0.165	
F		2.70	0.0029	7.90	<.0001	14.28	<.0001	13.63	<.0001
ΔR^2				0.059		0.072		0.005	

Adjusted R^2 of model 4 = 0.153.

Table 5. Hierarchical multiple regression predicting the likelihood of sustenance for those who did not participate in gambling during the past month (n = 912).

Variables		Model 1		Model 2		Model 3		Model 4	
		β	p-value	β	p-value	β	p-value	β	p-value
Intercept		3.078	<.0001	0.816	0.0002	0.813	0.0001	0.789	0.0003
Type of Gambling	(Single type reference)	-0.571	<.0001	-0.536	<.0001	-0.513	<.0001	-0.512	<.0001
Age		-0.005	0.3984	-0.012	0.0227	-0.013	0.0102	-0.013	0.0113
Sex	Female (Male reference)	0.335	<.0001	0.195	0.0081	0.154	0.0345	0.153	0.0348
Race/Ethnicity	Hispanic (White reference)	0.406	<.0001	0.394	<.0001	0.365	<.0001	0.366	<.0001
	Asian	0.340	0.0024	0.389	0.0001	0.372	0.0002	0.373	0.0002

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 June 2023 doi:10.20944/preprints202306.0750.v1

	Others	0.062	0.5410	0.101	0.2673	0.089	0.3164	0.093	0.2992
Class	Sophomore + Junior (Freshmen reference)	-0.086	0.4292	-0.096	0.3224	-0.133	0.1637	-0.133	0.1643
	Senior	-0.004	0.9704	-0.043	0.6596	-0.046	0.6259	-0.049	0.6054
	Graduate	0.185	0.1133	0.050	0.6346	0.036	0.7257	0.033	0.7474
GPA	(Less than 3.50 reference)	0.050	0.5348	0.037	0.6066	0.014	0.8394	0.017	0.8133
Emotional transformation				0.235	<.0001	0.135	<.0001	0.134	<.0001
Practice for change						0.115	<.0001	0.110	<.0001
Changes in the social environment								0.010	0.447
R^2		0.108		0.278		0.306		0.306	
F		10.87	<.0001	31.54	<.0001	32.98	<.0001	30.47	<.0001
ΔR^2				0.171		0.028		0.0004	

Adjusted R^2 of model 4 = 0.296.

Table 6. Hierarchical multiple regression predicting the likelihood of initiation for those who participated in gambling during the past month (n = 562).

Variables		Model 1		Model 2		Model 3		Model 4	
		β	p-value	β	p-value	β	p-value	β	p-value
Intercept		3.336	<.0001	2.749	<.0001	1.595	<.0001	1.563	<.0001
Type of Gambling	(Single type reference)	-0.415	0.0002	-0.242	0.024	-0.120	0.2437	-0.102	0.3208
Age		-0.022	0.0043	-0.016	0.028	-0.017	0.0155	-0.017	0.0176
Sex	Female (Male reference)	0.493	<.0001	0.399	0.0002	0.372	0.0002	0.352	0.0005
Race/Ethnicity	Hispanic (White reference)	0.099	0.5133	0.028	0.845	0.036	0.7879	0.001	0.9946
	Asian	0.089	0.5961	0.144	0.3674	0.196	0.194	0.160	0.2892
	Others	-0.170	0.2485	-0.144	0.2986	-0.080	0.5447	-0.091	0.4869
Class	Sophomore + Junior (Freshmen reference)	-0.111	0.5042	-0.179	0.2544	-0.177	0.2333	-0.169	0.254
	Senior	0.046	0.7752	-0.013	0.9306	0.020	0.8932	0.028	0.8476
	Graduate	-0.148	0.3866	-0.242	0.1347	-0.282	0.0666	-0.271	0.077
GPA	(Less than 3.50 reference)	0.329	0.0051	0.301	0.0065	0.283	0.007	0.269	0.0102
Participatory dialogue				0.071	<.0001	0.054	<.0001	0.052	<.0001
Behavioral confidence						0.087	<.0001	0.073	<.0001
Changes in the physical environment								0.040	0.0137
R^2		0.105		0.203		0.286		0.294	

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 12 June 2023 doi:10.20944/preprints202306.0750.v1

F	6.43	<.0001	12.71	<.0001	18.34	<.0001	17.56	<.0001
ΔR^2			0.098		0.084		0.008	

Adjusted R^2 of model 4 = 0.277.

Table 7. Hierarchical multiple regression predicting the likelihood of sustenance for those who participated in gambling during the past month (n = 562).

Variables		Model 1		Model 2		Model 3		Model 4	
		β	p-value	β	p-value	β	p-value	β	p-value
Intercept		2.730	<.0001	1.460	<.0001	1.371	<.0001	1.456	<.0001
Type of Gambling	(Single type reference)	-0.653	<.0001	-0.563	<.0001	-0.557	<.0001	-0.558	<.0001
Age		-0.036	<.0001	-0.033	<.0001	-0.033	<.0001	-0.034	<.0001
Sex	Female (Male reference)	0.461	<.0001	0.400	0.0004	0.393	0.0005	0.394	0.0005
Race/Ethnicity	Hispanic (White reference)	0.521	0.0010	0.576	0.0002	0.573	0.0002	0.565	0.0002
	Asian	0.480	0.0064	0.649	0.0002	0.634	0.0002	0.629	0.0002
	Others	0.177	0.2476	0.255	0.0833	0.256	0.0825	0.238	0.1065
Class	Sophomore + Junior (Freshmen reference)	-0.399	0.0214	-0.410	0.0137	-0.419	0.0117	-0.396	0.0175
	Senior	-0.187	0.2689	-0.227	0.1631	-0.212	0.1919	-0.203	0.2119
	Graduate	-0.286	0.1089	-0.312	0.0683	-0.335	0.0509	-0.322	0.06
GPA	(Less than 3.50 reference)	0.119	0.3293	0.037	0.7548	0.038	0.7468	0.042	0.7214
Emotional transformation				0.129	<.0001	0.095	0.0007	0.104	0.0003
Practice for change						0.046	0.0949	0.060	0.0368
Changes in the social environment								-0.035	0.0903
R^2		0.169		0.236		0.240		0.244	
F		11.23	<.0001	15.45	<.0001	14.45	<.0001	13.60	<.0001
ΔR^2				0.067		0.004		0.004	

Adjusted R^2 of model 4 = 0.226.

 doi:10.20944/preprints202306.0750.v1

4. Discussion

Our study employed a novel fourth-generation behavior theory, the multi-theory model (MTM) of health behavior change, to comprehensively explain gambling behavior among university students. Gambling is legal in most of the states in the United States. However, only 38.13% of students reported participating in gambling during the past month. This study shows that despite gambling being legal and students having easy access to gambling, 61.87% on the Campus of this study chose not to participate in gambling during the past month. Still, it can be appreciated that a significant number of university students are engaging in gambling, thus necessitating the need for designing interventions to curb problem gambling and pathological gambling.

The study revealed that 27.7% of the likelihood of practice initiation variance could be explained by the final model for those who participated in gambling during the past month. The study findings demonstrated that among those who participated in gambling during the past month, approximately 18.9% of the variance in the likelihood to practice initiation was significantly predicted by two factors: participatory dialogue, which assesses the advantages and disadvantages of gambling behavior, and behavioral confidence, which represents the sureness in abstaining from gambling despite potential barriers. Those who participated in gambling saw more disadvantages in not participating in gambling than those who did not participate in gambling. Based on the observed results, it is recommended that individual-level behavior change interventions targeting gambling behavior among university students should focus on incorporating the constructs of participatory dialogue and behavioral confidence. These constructs were found to be significant predictors of the likelihood of practice initiation among those who participated in gambling during the past month. By emphasizing the assessment of the advantages and disadvantages of gambling behavior and promoting a strong sense of confidence in abstaining from gambling, interventions can effectively address and modify gambling behaviors among university students. There is evidence from other studies on MTM that these two constructs are important for behavior change [21–23]. Participatory dialogue can be built by emphasizing the advantages of quitting gambling, such as less stress, better health, saving money, better academic performance, less anxiety, etc. At the same time, the disadvantages of quitting gambling, such as less enjoyment, recurrence of cravings, missing feelings of high, and so on, need to be refuted through discussion or other educational tools.

The variance in the likelihood of continuing to abstain from gambling for those who participated in gambling during the past month was 22.6%. The study results revealed the significance of emotional transformation, which involves converting feelings into goals of abstaining from gambling, in promoting abstaining behavior among university students. Additionally, the contribution of practice for change, which focuses on creating a habit of abstaining from gambling and integrating it into one's way of life, was found to be statistically significant in predicting the likelihood of continuing to abstain from gambling. These findings highlight the importance of incorporating emotional transformation and practice for change in interventions aimed at promoting long-term abstinence from gambling among university students. The findings are also supported by data from those who did not participate in gambling during the past month. Based on these results, individual-level behavior change interventions for gambling behavior among college and university students should utilize the constructs of emotional transformation and practice for change. There is evidence from other studies on MTM that these two constructs are important for behavior change [23–25]. To build emotional transformation, converting emotions, especially negative ones into goals, overcoming self-doubt, and self-motivation for behavior change is vital for sustaining quitting gambling. These can be built through educational programs. Likewise, to influence practice for change, self-monitoring gambling behavior, overcoming barriers, and having contingency plans in relapse are vital for quitting gambling.

4.1. Implications for Practice

The results from the study can be used for designing interventions for college and university students to help them quit gambling or participate in responsible gambling. The finding shows that more than one-

 doi:10.20944/preprints202306.0750.v1

third of college students have participated in gambling during the past month. To prevent these students from falling victim to problem gambling or pathological gambling, designing individual-level behavioral change interventions is needed targeting college and university students. Such educational interventions can be delivered at student wellness centers on campuses. There can be different modalities for such interventions, such as face-to-face educational interventions, asynchronous web-based instruction, remote synchronous classes, social media, and apps. A randomized control trial (RCT) design can be utilized to establish the efficacy of such interventions, where MTM-based interventions can be compared with another theory-based or knowledge-based intervention.

MTM-based interventions have previously been used, targeting college and university students for various health behavior changes [21,22,24–28]. The participatory dialogue, which underscores the advantages of gambling over the disadvantages, can be improved by highlighting facts such as, "Not participating in gambling saves money," "Not participating in gambling helps perform better in classes," and "Not participating in gambling helps reduce anxiety." Behavioral confidence can be built by role-playing activities, photovoice, journaling, and introducing them to new hobbies.

When looking at the constructs of sustenance, emotional transformation is more prominent. Self-awareness of one's feelings is the first step in building this construct [29]. Once identified those feelings, the next step is to create goals. The goal of a gambling behavior change intervention should be that when an individual craving for gambling, they should divert this feeling to initiate another hobby and participate in it until it feels natural and they no longer have a craving for gambling. Self-reflecting and self-monitoring can be used to build practice for change.

4.2. Strengths and Limitations of the Study

This study uses MTM of behavior change, a new approach with high explanatory potential well supported in health promotion and public health research [30,31]. The findings of this study provide ways to design an effective intervention for helping college and university students quit gambling or participate in responsible gambling. The instrument used in this study demonstrated acceptable readability, validity, and reliability, suggesting its suitability for future cross-sectional and interventional studies. The findings indicate that the instrument effectively measured the intended constructs and produced consistent and trustworthy results. This implies that researchers can confidently utilize the instrument in future studies to assess gambling behavior and related constructs among college and university students.

This study acknowledges certain limitations. Firstly, it was conducted solely at one large university in the southwestern region of the United States. Consequently, the generalizability of the findings to other universities or populations may be limited. It is advisable for future research to include a more diverse range of universities or expand the sample to enhance the external validity of the study's conclusions. Secondly, the study's reliance on self-reported information is a limitation, as it introduces potential biases such as recall bias, dishonesty, and acquiescence bias. Participants may have difficulty accurately recalling their gambling behavior or may provide socially desirable responses. However, it is important to note that self-reported data remains the primary method for collecting information on attitudes and behaviors related to health behavior. To address these limitations, efforts were made to ensure confidentiality and anonymity. Thirdly, the lack of test-retest reliability assessment prevents us from examining the instrument's consistency over time. However, this limitation also presents an opportunity for future research to explore the stability of the instrument by conducting test-retest studies. Conducting such studies would enhance the robustness of the instrument and provide valuable insights into its stability and consistency over time. Lastly, it is important to note that due to the cross-sectional design of the study, causal relationships cannot be established. Cross-sectional studies provide a snapshot of data at a specific point in time, making it challenging to determine the direction of causality between variables. While this study provides valuable insights into the associations and predictors of gambling behavior among university students, caution must be exercised in drawing definitive conclusions about causality. Future research utilizing longitudinal or experimental designs would be valuable in investigating the temporal relationships and causal mechanisms underlying gambling behavior among this population.

5. Conclusions

This study made significant findings regarding the prevalence of gambling behavior among university students, with over one-third of the participants reporting recent gambling activity. These tendencies raise concerns about the potential risks of problem gambling and pathological gambling among this population. Importantly, this study is pioneering in its application of the contemporary theoretical framework of MTM to understand and explain gambling behavior among university students. The results highlight the promise of the novel MTM framework in elucidating the factors associated with quitting gambling behavior among university students. These findings suggest that future researchers can leverage the MTM framework to develop targeted interventions aimed at assisting college and university students in quitting gambling or engaging in responsible gambling practices.

Author Contributions: Conceptualization, M.S.; Methodology, M.S.; Validation, M.F.; Formal Analysis, S.K., and M.F.; Investigation, S.K., L.B., and A.C.; Resources, S.K., and M.F.; Data Curation, S.K.; Writing – Original Draft Preparation, S.K., L.B., A.C., and M.F.; Writing – Review & Editing, M.S. and M.F.; Visualization, S.K., and M.F.; Supervision, M.S.; Project Administration, S.K.; Funding Acquisition, S.K., L.B., and A.C. All authors have read and agreed to the published version of the manuscript.

Funding: This study was funded by the Nevada Department of Public and Behavioral Health through a grant program of the Nevada Council on Problem Gambling and the UNLV International Gaming Institute.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of the University of Nevada, Las Vegas (protocol code # UNLV-2022-511 approved on November 18, 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Weinstock J, Petry NM. Pathological Gambling College Students' Perceived Social Support. J Coll Stud Dev. 2008, 49(6) ,625-632. doi:10.1353/csd.0.0047
2. John B, Holloway K, Davies N, et al. Gambling Harm as a Global Public Health Concern: A Mixed Method Investigation of Trends in Wales. Front Public Health. 2020, 8, 320. doi:10.3389/fpubh.2020.00320
3. Price A, Hilbrecht M, Billi R. Charting a path towards a public health approach for gambling harm prevention. Z Gesundh Wiss. 2021, 29(1), 37-53. doi:10.1007/s10389-020-01437-2
4. Wardle H, Reith G, Langham E, Rogers RD. Gambling and public health: we need policy action to prevent harm. BMJ. 2019, 365, l1807. doi:10.1136/bmj.l1807
5. Caldeira KM, Arria AM, O'Grady KE, Vincent KB, Robertson C, Welsh CJ. Risk factors for gambling and substance use among recent college students. Drug Alcohol Depend. 2017, 179, 280-290. doi:10.1016/j.drugalcdep.2017.06.024
6. Nowak DE. A Meta-analytical Synthesis and Examination of Pathological and Problem Gambling Rates and Associated Moderators Among College Students, 1987-2016. J Gambl Stud. 2018, 34(2), 465-498. doi:10.1007/s10899-017-9726-y
7. Barnes GM, Welte JW, Hoffman JH, Tidwell MC. Comparisons of gambling and alcohol use among college students and noncollege young people in the United States. J Am Coll Health. 2010, 58(5), 443-452. doi:10.1080/07448480903540499
8. Emond AM, Griffiths MD. Gambling in children and adolescents. Br Med Bull. 2020, 136(1), 21-29. doi:10.1093/bmb/ldaa027
9. Waluk OR, Youssef GJ, Dowling NA. The Relationship Between Problem Gambling and Attention Deficit Hyperactivity Disorder. J Gambl Stud. 2016, 32(2), 591-604. doi:10.1007/s10899-015-9564-8
10. Rinker DV, Rodriguez LM, Krieger H, Tackett JL, Neighbors C. Racial and Ethnic Differences in Problem Gambling among College Students. J Gambl Stud. 2016, 32(2), 581-590. doi:10.1007/s10899-015-9563-9
11. Wang X, Won D, Jeon HS. Predictors of Sports Gambling among College Students: The Role of the Theory of Planned Behavior and Problem Gambling Severity. Int J Environ Res Public Health. 2021, 18(4), 1803. doi:10.3390/ijerph18041803

12. Riley BJ, Oster C, Rahamathulla M, Lawn S. Attitudes, Risk Factors, and Behaviours of Gambling among Adolescents and Young People: A Literature Review and Gap Analysis. Int J Environ Res Public Health. 2021, 18(3), 984. doi:10.3390/ijerph18030984
13. National Council on Problem Gambling. https://www.ncpgambling.org/help-treatment/faq/ (accessed 2023-06-06).
14. Jazaeri SA, Habil MH. Reviewing two types of addiction - pathological gambling and substance use. Indian J Psychol Med. 2012, 34(1), 5-11. doi:10.4103/0253-7176.96147
15. St-Pierre RA, Temcheff CE, Derevensky JL, Gupta R. Theory of Planned Behavior in School-Based Adolescent Problem Gambling Prevention: A Conceptual Framework. J Prim Prev. 2015, 36(6), 361-385. doi:10.1007/s10935-015-0404-5
16. Wu AM, Tang CS. Problem gambling of Chinese college students: application of the theory of planned behavior. J Gambl Stud. 2012, 28(2), 315-324. doi:10.1007/s10899-011-9250-4
17. Sharma, M. Theoretical foundations of health education and health promotion; Jones & Bartlett Learning, 2022.
18. Rosseel, Y. Lavaan: An R Package for Structural Equation Modeling. J. Stat. Soft. 2012, 48, 1-36. doi:10.18637/jss.v048.i02.
19. DiStefano C, Hess B. Using confirmatory factor analysis for construct validation: An empirical review. J. Psychoeduc. Assess. 2005, 23(3), 225-241. doi:10.1177/073428290502300303
20. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct. Equ. Modeling. 1999, 6(1), 1-55. doi:10.1080/10705519909540118
21. Sharma M, Anyimukwu C, Kim RW, Nahar VK, Ford MA. Predictors of Responsible Drinking or Abstinence Among College Students Who Binge Drink: A Multitheory Model Approach. J Am Osteopath Assoc. 2018, 118(8), 519-530. doi:10.7556/jaoa.2018.120
22. Sharma M, Largo-Wight E, Kanekar A, Kusumoto H, Hooper S, Nahar VK. Using the Multi-Theory Model (MTM) of Health Behavior Change to Explain Intentional Outdoor Nature Contact Behavior among College Students. Int J Environ Res Public Health. 2020, 17(17), 6104. doi:10.3390/ijerph17176104
23. Sharma M, Batra K, Davis RE, Wilkerson AH. Explaining Handwashing Behavior in a Sample of College Students during COVID-19 Pandemic Using the Multi-Theory Model (MTM) of Health Behavior Change: A Single Institutional Cross-Sectional Survey. Healthcare (Basel). 2021, 9(1), 55. doi:10.3390/healthcare9010055
24. Nahar VK, Wilkerson AH, Stephens PM, Kim RW, Sharma M. Using the Multitheory Model to Predict Initiation and Sustenance of Physical Activity Behavior Among Osteopathic Medical Students. J Am Osteopath Assoc. 2019, 119(8), 479-487. doi:10.7556/jaoa.2019.089
25. Sharma M, Catalano HP, Nahar VK, Lingam VC, Johnson P, Ford MA. Applying Multi-Theory Model (MTM) of Health Behavior Change to Predict Water Consumption Instead of Sugar-Sweetened Beverages. J Res Health Sci. 2017, 17(1), e00370.
26. Knowlden AP, Sharma M, Nahar VK. Using Multitheory Model of Health Behavior Change to Predict Adequate Sleep Behavior. Fam Community Health. 2017, 40(1), 56-61. doi:10.1097/FCH.0000000000000124
27. Sharma M, Catalano HP, Nahar VK, Lingam V, Johnson P, Ford MA. Using multi-theory model to predict initiation and sustenance of small portion size consumption among college students. Health Promot Perspect. 2016, 6(3), 137-144. doi:10.15171/hpp.2016.22
28. Sharma M, Stephens PM, Nahar VK, Catalano HP, Lingam VC, Ford MA. Using a Multitheory Model to Predict Initiation and Sustenance of Fruit and Vegetable Consumption Among College Students. J Am Osteopath Assoc. 2018, 118(8), 507-517. doi:10.7556/jaoa.2018.119
29. Goleman, D. Emotional Intelligence; Bantam: New York, NY, USA, 1995.
30. Asare M, Agyei-Baffour P, Lanning BA, et al. Multi-Theory Model and Predictors of Likelihood of Accepting the Series of HPV Vaccination: A Cross-Sectional Study among Ghanaian Adolescents. Int J Environ Res Public Health. 2020, 17(2), 571. doi:10.3390/ijerph17020571
31. Brown L, Sharma M, Leggett S, Sung JH, Bennett RL, Azevedo M. Efficacy testing of the SAVOR (Sisters Adding Fruits and Vegetables for Optimal Results) intervention among African American women: A randomized controlled trial. Health Promot Perspect. 2020, 10(3), 270-280. doi:10.34172/hpp.2020.41