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Risk and Protective Factors of Gambling Among Young Adults: Analysis of the Manitoba Longitudinal Study of Young Adults (MLSYA) Data

Principal Investigator(s): Dr. Sherry Stewart and Dr. Sean Mackinnon

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Abstract – Study 1

People engage in gambling behaviour for a variety of different reasons, some of which are riskier than others in terms of associations with heavy and problem gambling. Stewart and Zack (2008) developed a measure called the Gambling Motives Questionnaire (GMQ) that assesses levels of three distinct gambling motives: enhancement (to increase positive emotions), coping (to decrease negative emotions), and social (to increase affiliation). While this measure has been validated in a community-recruited sample of middle-aged gamblers (Stewart & Zack, 2008), the GMQ has yet to be validated in emerging adulthood (ages 18-25 years) – a developmental period associated with increased risk for heavy and problematic gambling. The current project tested the psychometric properties of the GMQ in a community sample of emerging adult gamblers using archival data from the Manitoba Longitudinal Study of Young Adults. Participants (*N* = 487; 73.9% Caucasian; 52.6% female; mean age 22.23 years) completed the GMQ and questionnaire measures of gambling behaviour and problems. Exploratory factor analysis revealed that a three-factor model adequately fit the data; however, problematic items were identified. A modified 9-item version of the GMQ with the problem items removed fit the data well. Both the original 15-item and the 9-item versions had acceptable subscale alpha reliabilities (αs > .78). While all three subscales (from both the 9-item and 15-item versions) were positively correlated with problem gambling, only enhancement motives emerged as a significant independent predictor when the other motives and gambling behaviours were entered as simultaneous predictors. These results suggest the GMQ is a valid measure for tapping motives in emerging adults, and that high enhancement motives are particularly predictive of gambling problems in this developmental period. Future intervention efforts might specifically target enhancement motives in emerging adults.

Key Words: Gambling Motives; Enhancement; Coping; Problem gambling

Introduction – Study 1

Validation of the Gambling Motives Questionnaire in Emerging Adults

Risky behaviours such as excessive substance use, unprotected sex, and problem gambling peak during emerging adulthood (ages 18-25 years; Arnett, 2000). Lifetime prevalence estimates for disordered gambling fall between 2-4% in North America; however, this estimate is elevated among college students, with 6-11% meeting criteria for disordered gambling (Shaffer & Hall, 2001). Canadian research indicates that approximately 72% of college students report gambling within the last 6 months, with 1.4% meeting criteria for severe problem gambling and another 6.2% meeting criteria for moderate-risk gambling (Williams, Connolly, Wood, & Nowatzki, 2006). Community samples of emerging adults show similar prevalence rates, with 6.5% meeting criteria for at-risk gambling and another 2.1% meeting criteria for problem gambling (Welte, Barnes, Tidwell, & Hoffman, 2008). In sum, research shows that emerging adults are at increased risk for problem gambling compared to older adults (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009).

Problem gambling is related to many adverse personal, social, financial, and vocational outcomes, including relationship and work problems, bankruptcy, insomnia, depression, and an increased risk for stress-related disorders (Griffiths, 2004). While problem gambling can lead to significant clinical difficulties, problem gamblers exhibit variability in their gambling behaviours and often gamble for different motivations. Thus, the present study aimed to validate a multidimensional scale of gambling motives in emerging adult gamblers.

Theory review

Although different labels have been suggested, one comprehensive review suggests the extant research converges on three distinct gambling motives: enhancement, coping, and social (Milosevic & Ledgerwood, 2010).[1] Gamblers reporting high levels of enhancement and coping motives gamble to regulate emotional states. Gamblers with high levels of enhancement motives for gambling are also characterized by high levels of sensation seeking and impulsivity, and gamble for the "high" and feelings of excitement that gambling can create (Bonnaire, Bungener, & Varescon, 2009; Ledgerwood & Petry, 2006; Ledgerwood & Petry, 2010; Stewart, Zack, Collins, Klein, & Fragopoulos, 2008; Turner, Jain, Spence, & Zangeneh, 2008; Vachon & Bagby, 2009). In contrast, gamblers with high levels of coping motives are characterized by increased levels of depression, anxiety and neuroticism, and gamble as a maladaptive way to escape these negative emotional states (Bonnaire et al., 2009; Ledgerwood & Petry, 2006; Ledgerwood & Petry, 2010; Stewart et al., 2008; Turner et al., 2008; Vachon & Bagby, 2009). Gamblers with high levels of social motives do not gamble to regulate their emotions, and instead gamble for social affiliation (e.g., as a fun outing with friends; Milosevic & Ledgerwood, 2010). Gamblers with high levels of social motives are generally free of comorbid psychopathology and maladaptive personality traits (Bonnaire et al., 2009; Ledgerwood & Petry, 2010; Moran, 1970; Stewart & Zack, 2008; Stewart et al., 2008; Turner et al., 2008; Vachon & Bagby, 2009). In sum, gamblers vary in their primary reasons, or motives, for gambling. Gamblers with high enhancement motives attempt to maximize positive emotions, gamblers high in coping motives attempt to minimize negative emotions, and gamblers high in social motives engage in gambling for social affiliation. Although some research attempts to subtype

[1] Milosevic and Ledgerwood (2010) actually use Blaszczyski and Nower's (2002) terms of behaviourally conditioned, emotionally vulnerable, and antisocial impulsivist to represent what Stewart and Zack (2008) call social, coping, and enhancement motives for gambling, respectively. Because the present paper focuses on Stewart and Zack's (2008) model, we use their terminology throughout the paper. However, many other terms to describe these distinct motives for gambling are currently in use (Milosevic & Ledgerwood, 2010).

gamblers based on these motivations (e.g., Milosevic & Ledgerwood, 2010; Stewart et al., 2008), the current study used a dimensional framework to examine gambling motives.

Prior research

In order to distinguish between these three theoretically distinct motives for gambling, Stewart and Zack (2008) developed the Gambling Motives Questionnaire (GMQ). The GMQ has three distinct subscales of gambling motivations: Enhancement motives (e.g., "because it's exciting"), coping motives (e.g., "to forget your worries"), and social motives (e.g., "as a way to celebrate"). It was developed based on similar theory and research on motivations for drinking alcohol (Cooper, Russell, Skinner, & Windle, 1992). Stewart and Zack (2008) supported their proposed 3-factor model for the GMQ in a community-recruited sample of middle-aged adult gamblers (mean age =35.5 years, *SD* = 10.7) using exploratory factor analysis. Alpha reliabilities were > .80 for all three subscales. Additionally, enhancement and coping gambling motives were significant independent predictors of gambling behaviours and gambling problems in incremental validity analyses (Stewart & Zack, 2008). Subsequent research with middle-aged gamblers have replicated and extended the favorable psychometric properties of the GMQ. For example, Dechant and Ellery (2011) replicated the measure's 3-factor structure.

In sum, there is good preliminary support for the psychometric properties of the GMQ among middle aged adults, including internal consistency, structural validity, concurrent validity, and incremental validity. However, more work to validate this measure is needed, particularly in the emerging adult age range where problem gambling risk is highest (Johansson et al., 2009).

Hypotheses

In the present study, we tested the psychometric properties of the GMQ in a sample of emerging adults (18-25 years old). Prior gambling motives research is limited by relatively small sample sizes with an overrepresentation of male participants; the present study uses a more representative sample of emerging adults in Canada. Previous research with adult gamblers suggests that coping and enhancement (but not social) motives are positively associated with gambling behaviours and problem gambling, supporting the GMQ's concurrent validity (Stewart & Zack, 2008); however, this has yet to be examined in a normative emerging adult sample. In the present study, the incremental validity of the each GMQ subscale was also tested to determine if each motive could predict problem gambling beyond gambling behaviours and the other motives. Previous research with adult gamblers demonstrates that coping motives account for unique variance in problem gambling above gambling behaviour, and enhancement motives are related to problem gambling through increased gambling involvement (Stewart & Zack, 2008), but more research is needed with emerging adults. We had four hypotheses:

H1: Using factor analysis, we expected to find support for the theorized 3-factor model of the GMQ (factorial validity).

H2: Using Cronbach's alpha, all three factors were expected to demonstrate acceptable (> .70) levels of internal consistency (reliability).

H3: Both coping and enhancement motives (but not social motives) were expected to positively predict gambling behaviours on the PGSI when all three motives were entered in as simultaneous predictors (concurrent validity).

H4: Coping motives were expected to positively predict problem gambling on both the PGSI and the Composite International Diagnostic Interview (CIDI; Kessler & Üstün, 2004) when all three motives and gambling behaviours were entered in as simultaneous predictors (incremental validity).

Method – Study 1

Participants

Wave 1 of the Manitoba Longitudinal Study of Young Adults (MLSYA; Manitoba Gaming Control Commission, 2011) consisted of 679 participants. In order to participate in the study, participants were required to be in a single cohort (18-20 years old at wave 1) and consent to repeated contact over a five-year period. Participants were recruited through a variety of methods. This included random-digit dialling (16.3%), participant referrals (63.9%), placing advertisements at post-secondary institutions and VLT sites (16.2%), survey recruiting (3.1%), and casino recruiting (.5%). Participants did not necessarily have to be gamblers in order to participate in the MLSYA.

For the current study, only data from wave 4 was used because this was the only wave where the GMQ was administered. At wave 4, the sample size was 530 participants (29.1% attrition from wave 1). Moreover, 43 non-gamblers (i.e., those who did not gamble at all in the past 12 months according to the PGSI) were removed from the analyses, as they could not complete the GMQ, leaving a final sample size of N = 487. The majority of the sample identified as Caucasian (73.9%), had an average age of 22.2 years (SD = 0.9), and 52.6% of the sample was female. At wave 4, roughly half of the sample (53.4%) reported school as their main activity during the past year, while 41.7% reported mainly working; the remainder of the sample reported looking for work or "other". The most common types of gambling reported by the sample were charity lotteries (49.4%), followed by lottery tickets (41.5%), instant win tickets (36.1%), casino slots (31.8%), VLTs at a bar or lounge (27.6%), and poker (25.1%). Gambling motive subscale means for the original 15-item version of the GMQ were lower than past samples of emerging adults (Goldstein, Stewart, Hoaken, & Flett, 2013; Stewart, Demetrioff, Ellery, & Wohl, 2011). This may be because prior data was collected specifically from university student gamblers rather than a normative random sample as in the current study.

Measures

Gambling Motives Questionnaire (GMQ; Stewart & Zack, 2008). The GMQ is a 15-item measure of gambling motives, which was designed to measure enhancement, coping, and social motives. Each subscale is comprised of 5 items that were rated on a 4-point scale (1 = *"almost never/never"*; 2 = *"sometimes";* 3 = *"often"*; 4 = *"almost always"*). The GMQ has demonstrated favorable psychometric properties in a community-recruited sample of middle-age adult gamblers, with exploratory principal components analysis supporting the 3-factor model, and alpha reliabilities all above acceptable levels (α's ranged from .81-.91; Stewart & Zack, 2008). A full list of items can be found in Table 1.

Problem Gambling Severity Index (PGSI; Wynne, 2003). The PGSI is a 9-item subset of the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) that specifically examines the extent to which an individual may be engaging in problem gambling behaviours (i.e. *"how often have you bet more than you could afford to lose?"*). Each item is rated on a 0-3 scale (0 = *"never"*, 1 = *"sometimes"*, 2 = *"most of the time"*, 3 = *"all of the time"*), and this measure was administered to all participants. The PGSI exhibits favorable psychometric properties, with a high alpha reliability (α's between 0.83 and 0.86) and concurrent validity with both the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) and DSM-IV (American Psychiatric Association [APA], 1994) criteria for problem gambling (Ferris & Wynne, 2001; Holtgraves, 2009). As in Rockloff and Dyer (2006), PGSI scores were dichotomized in the present study, such that participants were grouped as either reporting one or more gambling problems (i.e., scores of 1 – 27 were coded as 1) or reporting no gambling problems (i.e., scores of 0 were coded as 0). We scored the PGSI in this fashion because this was a non-clinical sample and this permitted a sufficient sample size of those endorsing problems to allow for statistical comparison. Scores on the PGSI were too positively skewed to permit use of the PGSI as a continuous measure (range 0-13, skewness = 5.76, kurtosis = 39.07). A recent study by Currie, Hodgins, and Casey (2013) supports the validity of our chosen scoring of the PGSI, by

demonstrating that the non-problem gamblers group (i.e., PGSI score of 0) is distinct from all other gambler groups (low-risk, moderate-risk, and problem gamblers) on amount of money spent gambling per month, the number of games played in the last year, and the prevalence of a substance use disorder. They also showed that the problem gamblers group (i.e., scores of ≥ 8 on the PGSI) was distinct from all other gambler groups, but that the low and moderate risk groups did not differ significantly. Their findings would justify a dichotomization of non-problem gamblers versus all other gamblers, or a dichotomization of problem gamblers versus all other gamblers, but not a dichotomization of moderate-risk and problem gamblers vs. non-problem and low risk gamblers. As ours was a non-clinical sample, there were too few participants meeting PGSI criteria for problem gambler status; thus, the non-problem gambler vs. all other gamblers dichotomization was chosen for our study.

Composite International Diagnostic Interview (CIDI; Kessler & Üstün, 2004). The CIDI is a standardized structured interview. Its pathological gambling subscale was used as a secondary measure of problem gambling. This measure has excellent internal consistency (α = .90) and convergent validity with ICD-10 (World Health Organization [WHO], 1993) and DSM-IV (APA, 1994) criteria for pathological gambling (Kessler, Hwang, LaBrie, Petukhova, Sampson, Winters, & Shaffer, 2008). Participants were asked if they have a) ever bet or spent money on gambling activities; b) had a time in their lives when gambling interfered with close relationships or important responsibilities such as work or school; c) lied to others about the extent of gambling; and d) ever spent $250 or more on gambling in a single year. Responding "yes" to any of questions b-d prompted a series of questions covering the ten DSM-IV (APA, 1994) diagnostic criteria for pathological gambling. CIDI scores were dichotomized such that all participants were grouped as either reporting one or more gambling problems (i.e., scores ≥ 1 were coded as 1) or reporting no gambling problems (i.e., scores of 0 were coded as 0). Once again, we scored in this fashion because this was a non-clinical sample and this permitted a sufficient sample size of those endorsing problems to allow for statistical comparison. Scores on the CIDI were too positively skewed to permit use of the CIDI as a continuous measure (range 0-4, skewness = 3.23, kurtosis = 12.25).

Money spent gambling. The yearly amount of money participants spent on gambling was measured using a subset of questions from the CPGI (Ferris & Wynne, 2001). For 14 different types of gambling (i.e. lottery tickets, slot machines, etc.) participants were asked '*in the past 12 months, how much money did you spend, not including winnings, on [type of gambling] in a typical month?'* Reported values were multiplied by 12 to obtain a yearly amount, and the amounts from each type of gambling were summed to create a total yearly amount. This was then divided by 365 to obtain money spent gambling per day in Canadian dollars. Two extreme univariate outliers were identified by visual inspection of the distribution, and were winsorized by transforming them to the next highest value plus one (Tabachnick & Fidell, 2011).[2]

Time spent gambling. Time spent gambling was also assessed using a subset of questions from the CPGI (Ferris & Wynne, 2001). For the 14 types of gambling, participants were asked '*in the past year, how much time did you normally spend each time you bet or spent money on [type of gambling]?'* For each activity, average time was multiplied by frequency in order to obtain the total yearly time spent gambling (in minutes). This value was then divided by 60 to obtain the total yearly time spent gambling in hours. Two extreme univariate outliers were winsorized (Tabachnick & Fidell, 2011).

Frequency of gambling occasions. The frequency of gambling occasions was also assessed using a subset of questions from the CPGI (Ferris & Wynne, 2001). For the 14 types of gambling, participants were asked '*in the past year, how often did you bet or spend money on [type of gambling]?'* Reported values were scored such that participants could gamble from one to 365 (daily gambler) occasions for each gambling activity endorsed. Scores were then

[2] In all cases where winsorizing was used, analyses did not change substantially when the outliers were left in the dataset untransformed.

summed across activities to obtain a total gambling frequency in the past year. One extreme univariate outlier was winsorized (Tabachnick & Fidell, 2011).

Procedure

Data was analyzed using an archival data set provided by the MLSYA. The MLSYA followed a sample of emerging adults in Manitoba over a five-year period (2007-2011), and participants were 18-20 years old at the first wave. Four waves of data collection occurred, at approximately 12-18 month intervals. The study received ethics committee approval in accordance with Canada's Tri-Council Policy Statement for Ethical Conduct for Research Involving Humans. All persons gave their informed consent prior to their inclusion in the study. During each wave of the study, participants were initially contacted by telephone to complete a telephone interview that included both closed- and open-ended questions. This was followed by a questionnaire battery that participants had the option of completing online (97.9%) or through a mail-in questionnaire (2.1%), both of which included the same measures in the same order.

Statistical Analysis

The current study employed more rigorous factor analyses using a maximum likelihood approach to examine the factor structure of the GMQ, rather than the principal components analyses used in prior studies (e.g., Dechant & Ellery, 2011; Stewart & Zack, 2008). Maximum likelihood approaches are less likely to inflate estimates of variance accounted for when compared to principal components analyses (Costello & Osborne, 2005). Overall, 8.2% of data were missing, with covariance coverage ranging from .80 to 1.00. In Mplus 7.0, full information maximum likelihood estimation was used to account for missing data, which provides relatively unbiased parameter estimates when data are missing at random, and produces less bias when compared to listwise deletion and single imputation (Enders & Bandalos, 2001). This is an approach for structural equation models, of which factor analysis and regression are special cases. When interpreting overall model fit for both a confirmatory factor analysis (CFA) and an exploratory factor analysis (EFA) in Mplus 7.0, a root-mean-square error of approximation (RMSEA) around 0.05, and a standardized root mean square residual (SRMR) around .08, and a comparative fit index (CFI) and Tucker-Lewis Index (TLI) around .95 are indicative of excellent fit (Kline, 2011). Furthermore, as an EFA compares nested models, a ΔCFI $\geq$ .01 between models was used as the criterion for model selection (Cheung & Rensvold, 2002).

Before moving on with hypothesis testing, descriptive statistics and bivariate correlations were analyzed. We specified a negative binomial distribution in Mplus 7.0 for predicting gambling involvement as these outcomes are count variables without a normal distribution (skewness ranged from 1.85 to 6.23, kurtosis ranged from 17.44 to 43.38). This was more appropriate than a zero-inflated solution or a Poisson distribution, as there were no zero values for these variables (all 43 non-gamblers were removed from the analysis) and the means and variances were not equal (a Poisson distribution assumes the mean and variance is equal). Pseudo-R^2 values were then calculated according to the formula $R^2 = 1 - LLF/LLI$, where LLF is the log-likelihood value for the model with the predictors and LLI is the log-likelihood value for the intercept-only model (Hilbe, 2011). When examining problem gambling, a likelihood ratio test (lr =2(LL2 – LL1), where LL1 is the log likelihood value of the model with fewer parameters and LL2 is the log likelihood value of the model with more parameters) was used to see if gambling motives predicted problem gambling above gambling behaviours.

Results – Study 1

15-item Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) was conducted on the original 15 items of the GMQ, with items loading as theorized in Stewart and Zack (2008). Fit indices for this CFA revealed that a three-factor model was a poor fit to the data, $\chi^2(N = 487) = 316.36$, $p < .001$; $\chi^2/df = 3.64$; CFI = 0.85; TLI = 0.81; SRMR = .08; RMSEA = .09 (90% CI: .08, .10). Factor loadings were all significant ($p < .001$) and salient (i.e., > .32; Tabachnick & Fidell, 2011), and ranged from .70-.83 for the enhancement motives factor, from .61-.74 for the social motives factor, and from .67-.83 for the coping motives factor. Latent correlations between the motives factors were as follows: social and coping ($r = .61$), social and enhancement ($r = .78$), and enhancement and coping ($r = .69$).

15-item Exploratory Factor Analysis

Given the poor fit when using CFA, exploratory factor analysis (EFA) was conducted to explore why the hypothesized model did not provide a stronger fit to the data. Geomin rotation (a type of oblique rotation) was used. Using a criterion of ΔCFI ≥ .01 when comparing nested models, a 3-factor model was found to fit the data best. The three-factor model adequately fit the data, $\chi^2(N = 487) = 176.41$, $p < .001$; $\chi^2/df = 2.80$; CFI = 0.94; TLI = 0.90; SRMR = .03; RMSEA = .06 (90% CI: .05, .08), and accounted for 51.7% of the variance. However, the items did not load precisely as expected based on Stewart and Zack's (2008) theory. See Table 1 for items, factor loadings, and communalities. Latent correlations between the factors were as follows: social and coping ($r = .11$), social and enhancement ($r = .59$), and enhancement and coping ($r = .46$). Eleven of the 15 items showed strong and salient loadings only on the theorized factor. However, the EFA also revealed one cross-loading item and three items loadings onto unintended factors, which may help explain the poor fit indices generated by the 15-item, 3-factor CFA. Specifically, the items "*because it's something I do on special occasions*" and "*as a way to celebrate*" loaded on the enhancement motives factor rather than the theorized social motives factor. Similarly, the item "*to relax*" loaded on the enhancement motives factor rather than the theorized coping motives factor. Finally, the item "*to cheer up when you're in a bad mood"* loaded onto the coping motives factor as theorized, but also unexpectedly cross-loaded onto the onto the enhancement motives factor. Overall, this re-analysis suggests decent support for a 3-factor model, with some room for improvement.

9-item Confirmatory Factor Analysis

A modified three-factor model was also examined where the three most salient items per factor from the previous EFA were retained (i.e., the strongest factor loadings on the expected factor and least amount of cross-loading). This created a 9-item measure, with three items per subscale (enhancement motives = items 3, 9, and 15; social motives = items 4, 7, and 13; coping motive = items 5, 8, and 11). The 3-item length of each revised scale is comparable to that used in a recently-developed short form of the Drinking Motives Questionnaire-Revised (see Kuntsche & Kuntsche, 2009). A CFA with these 9 GMQ items showed that a three-factor model provided an excellent fit to the data: $\chi^2(N = 487) = 45.56$, $p < .001$; $\chi^2/df = 1.90$; CFI = 0.97; TLI = 0.95; SRMR = .04; RMSEA = .05 (90% CI: .03, .07). The standardized factor loadings were all statistically significant ($p < .05$) and salient (i.e., > .32; Tabachnick & Fidell, 2011), and ranged from .73-.79 for enhancement motives, .73-.79 for coping motives, and .69-.82 for social motives. Latent correlations between the motive factors were as follows: social and coping ($r = .48$), social and enhancement ($r = .63$), and enhancement and coping ($r = .68$).

Conclusion of Factor Analyses

Overall, the theorized three-factor model had better absolute fit indices for the brief 9-item version of the GMQ than the original 15-item version. However, the 15-item version has the advantage of being more directly comparable to past research using the GMQ. Thus, we conducted all subsequent psychometric analyses using both the 15-item and 9-item versions separately to maximize factorial validity and comparability to prior research.

Descriptives and Bivariate Correlations

All three subscales demonstrated acceptable alpha reliabilities, indicating acceptable internal consistency (Table 2). Subscale means for enhancement motives and social motives were both higher than coping motives, a finding consistent with the theoretical model and past research with non-clinical samples (e.g., Dechant & Ellery, 2011; Goldstein et al., 2013). Dichotomized PGSI and CIDI scores revealed 8.0% - 15.0% of the sample acknowledged at least one gambling-related problem, respectively.

For the original 15-item measure, all three motive subscales were positively correlated with each other, with male sex, with problem gambling, as well as the gambling behaviour outcomes (money, time, and frequency). Moreover, the strength of the correlations between the motive subscales and the gambling behaviour and problem gambling outcomes is consistent with the theoretical model, such that enhancement and coping motives show a stronger correlation with the gambling criterion measures compared to social motives. There was one exception to this pattern, as enhancement and social motives showed a stronger correlation with time spent gambling than coping motives (although the correlation with enhancement was still the largest). Also as expected, there was a strong convergence between the two indices of problem gambling (PGSI and CIDI), as well as between the gambling behavioural outcomes. The gambling behavioural outcomes were also significantly positively correlated with problem gambling. The 15-item and 9-item versions of the GMQ were highly correlated, and the motive subscales on both versions demonstrated similar positive correlations with gambling problems and gambling behaviours.

Negative Binomial Regression Analyses when Predicting Gambling Behaviours

Negative binomial regression was used to examine the incremental validity of each gambling motive on the original 15-item measure when predicting the gambling behaviour outcomes (money, time, and frequency), after controlling for sex. As shown in Table 3, both enhancement and coping motives significantly predicted money spent gambling (social motives did not), supporting hypothesis 3. Enhancement motives also significantly predicted gambling frequency. Both enhancement and social motives predicted time spent gambling. Pseudo-R^2 values (Hilbe, 2011) indicated that gambling motives accounted for approximately 8-10% of the variance within these gambling behaviour outcomes.

Using the revised nine-item GMQ, a similar set of analyses was conducted. In this analysis, each gambling motive variable was specified as a latent variable with 3 indicators each (see 9-item CFA results above for measurement model fit indices). In this re-analysis, only enhancement motives emerged as a significant independent predictor of both money and frequency (see Table 3). Both enhancement and social motives remained significant predictors of time spent gambling. Pseudo-R^2 values were then calculated using the Hilbe (2011) formula, indicating that gambling motives accounted for 8-10% of the variance within these gambling behaviours.

Logistic Regression Analyses Predicting Gambling Problems

Logistic regression was used to examine the incremental validity for gambling motives when predicting gambling problems, after controlling for gambling behaviours. A likelihood ratio test revealed that motives predicted the CIDI (lr = 37.23, p < .001) and PGSI (lr = 62.71, p < .001) beyond gambling behaviours. As shown in Table 4, enhancement motives significantly predicted gambling problems on both the PGSI and the CIDI, while coping and social motives did not[3]. Odds ratios demonstrate that for every 1.00 unit increase in enhancement motives, young people are 1.14 – 1.20 times more likely to report at least one problem gambling symptom. Frequency remained a significant predictor of problem gambling on both the PGSI and the CIDI, as well as money on the CIDI. Pseudo-R^2 values indicate that, together, gambling motives and gambling behaviours account for 39% and 44% of the variance in reporting at least one problem gambling symptom on the CIDI and the PGSI, respectively.

Using the revised nine-item GMQ, a similar set of analyses was conducted. In this analysis, each gambling motive variable was specified as a latent variable with 3 indicators each as in the negative binomial regressions (see Table 4). A likelihood ratio test revealed that motives predicted the CIDI (lr = 456.03, p < .001) and PGSI (lr = 489.77, p < .001) beyond gambling behaviours. Similar to the analyses using the 15-item GMQ, only enhancement motives emerged as a significant independent predictor of gambling problems on the CIDI; however, no motives were significant independent predictors of gambling problems on the PGSI. For the CIDI, odds ratios indicated that for every 1.00 unit increase in enhancement motives, there was a 5.07 unit increase in the likelihood of reporting at least one symptom of problem gambling[4]. Similar to the 15-item model, money was also a significant predictor of problem gambling on both the PGSI and the CIDI. Time and frequency were also significant predictors of problem gambling on the PGSI. Pseudo-R^2 values demonstrated that gambling motives and behaviours together accounted for 33% and 37% of the variance within problem gambling on the CIDI and PGSI, respectively.

Discussion – Study 1

The current study tested the psychometric properties of the GMQ in a normative sample of emerging adults. Initially, confirmatory factor analysis indicated that the theorized factor structure was a relatively poor fit to the data. To investigate this issue further, exploratory factor analysis was used, which identified some problematic items. This unexpected result led to the examination of both the original 15-item GMQ and a modified 9-item GMQ, in which the problematic items were removed. Confirmatory factor analysis on the 9-item measure supported this modification, as the absolute fit indices were higher compared to the 15-item measure. In both models, all three motives subscales demonstrated acceptable internal consistency and were significantly correlated with problem gambling. We found that 8.0%-15.0% of the sample endorsed at least one symptom of problem gambling, an estimate in line with previous research indicating that 8.6% of emerging adults report at-risk or problem gambling (Welte et al., 2008). However, when all three motives were entered simultaneously into a regression analysis (which controlled for gambling behaviour), only enhancement motives were a significant predictor of problem gambling. Coping motives were not found to be a significant independent predictor of

[3]All significant predictors in Tables 3 and 4 remain significant when sex was added as a covariate. Moreover, sex was a significant independent predictor of gambling problems (i.e., men gambled more than women), accounting for an additional 1-4% of the variance over and above the three gambling behaviours and the three gambling motives.

[4]However, the large confidence interval of this estimate in Table 4 suggests that this estimate of effect size is imprecise when measurement error is accounted for in the latent variable model, so readers are cautioned not to interpret this larger effect size substantively when compared to the 15-item GMQ.

problem gambling, which was unexpected based on prior work and theory (Stewart & Zack, 2008).

The enhancement motives subscale of the GMQ seems to be both reliable and valid in emerging adults. As expected, enhancement motives remained a significant predictor of money gambled, time gambled, and frequency of gambling in both the original 15-item GMQ and the modified 9-item GMQ. That enhancement motives proved to be a robust predictor of gambling behaviour is consistent with past work in the gambling area (Stewart & Zack, 2008), and with addictive behaviours more broadly (e.g., Cooper et al., 1992). Furthermore, enhancement motives remained the only motive significantly predicting problem gambling even when controlling for gambling behaviours. This supports the psychometric validity of this subscale and suggests that among emerging adult gamblers in the community, enhancement motives are most strongly linked to experiencing at least one symptom of problem gambling. While previous research has also shown that enhancement motives are significant predictors of problem gambling in adult samples, this was association was no longer significant when controlling for gambling behaviour (i.e., coping motives were the only significant motive that significantly predicted problem gambling when controlling for gambling behaviour; Stewart & Zack, 2008). In the current study, the link between enhancement motives and problem gambling remained significant beyond gambling behaviour. This finding may be related to the young age of the participants, as research indicates that addictive behaviours are more strongly related to externalizing then internalizing traits among young people (King, Iacono, & McGue, 2004). Moreover, traits linked with enhancement motives such as sensation seeking (Comeau, Stewart, & Loba, 2001) reach their peak during emerging adulthood at 18-20 years of age (Zuckerman, 1974), and the frontal lobes of the brain are still undergoing development until the mid-20s (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999) which suggests there is still relatively little executive control exerted over thrill-seeking urges in emerging adulthood. For these reasons, enhancement motives (rather than coping motives) may be more important predictors of problem gambling among emerging adults, although this pattern may change with age.

As expected, social motives did not generally predict gambling problems or gambling behaviour, supporting the motivational theory (Cooper et al., 1992) that gambling for social reasons (i.e., not for affective regulation) is less risky. The one exception was that social motives significantly predicted time spent gambling. The general pattern indicates that the social motives subscale of the GMQ is also reliable and valid in emerging adults, as previous research also demonstrates that social motives are more commonly endorsed by non-problem gamblers and are less commonly endorsed by problem gamblers, who instead endorse both enhancement and coping motives most strongly (Dechant & Ellery, 2011; Stewart & Zack, 2008).

Finally, the coping motives subscale was a significant predictor of money spent, but not of the other gambling behaviours. As coping motives for drinking are more strongly related to quantity than frequency of alcohol use (e.g., Cooper et al., 1992), coping motives for gambling may also be more strongly related to money than frequency. Contrary to hypotheses, coping motives were not a significant independent predictor of problem gambling. It is important to note that compared to previously-tested samples of emerging adult gamblers, consisting largely of university students (Goldstein et al., 2013; Stewart et al., 2011), the present community-recruited normative sample of emerging adults reported a significantly lower endorsement of all three gambling motives (e.g., Cohen's *d* (Cohen, 1998) range from .40-.82, all $p < .01$, relative to Stewart et al., 2011). In particular, the endorsement and variability of coping motives in this sample was especially low, providing a possible explanation for the null findings for coping motives in the prediction of problem gambling symptoms in the present study. It appears that emerging adults in the community, as a group, rarely report gambling to cope, and thus are unlikely to develop problem gambling symptoms through this motivational pathway. Additionally,

as coping motives have been shown to be related to problem gambling in university samples of emerging adults (Stewart et al., 2011) but were unrelated to problem gambling in the current study, something about the experience of university may be conferring increased risk for problem gambling via gambling to cope. For example, it might be that university students experience more stress and negative emotions, which leads to more coping behaviours in general. Indeed, numerous studies have shown that university students experience significant psychological distress, with students experiencing increases in both anxiety and depression throughout the course of their degrees (Bayram & Bilgel, 2008; Bewick, Koutsopoulou, Miles, Slaa, & Barkham, 2010; Keyes, Eisenberg, Perry, Dube, Kroenke, & Dhingra, 2012). This discrepancy in the role of coping motives across studies may also be related to demographic and other social and psychological differences between community and university samples. However, such statements are merely speculative and future research on this issue is needed. In particular, it would be interesting to test whether coping gambling motives interact with neurotic personality traits (e.g., neuroticism, anxiety sensitivity, hopelessness) or with emotional disorder symptoms (e.g., symptoms of anxiety or depressive disorders) in predicting problem gambling symptoms in emerging adults.

It is worth noting that other models of gambling motivations have emerged in the literature. In a comprehensive review of the literature, Milosevic and Ledgerwood (2010) use the terms behaviourally conditioned, emotionally vulnerable, and antisocial impulsivist. These map on to Stewart & Zack's conceptualization to a degree; however, there are subtle differences. For instance, the behaviourally conditioned gamblers are thought to have little psychopathology and gamble based on social influence, like Stewart & Zack's (2008) social motives; however, Milosevic and Ledgerwood (2010) also highlight the importance operant conditioning and faulty cognitive processes, which are not captured by the social motives subscale. Moreoever, the "antisocial impulsivist" subtype gambles to enhance positive emotions, like the enhancement motives subscale, but also suggests that antisocial behaviours and impulsivity play a major role. Further, coping motives might benefit by separating out anxious and depressed affect into separate subscales, much like recent work on drinking motives (Grant et al., 2007). Thus, though the present study demonstrates the reliability and validity of the GMQ, there may be value in broadening the construct into a latent variable comprised of numerous gambling measures to achieve greater content validity.

Limitations and Future Directions

The results of the current study are limited to a normative general population sample of emerging adults, and may not be generalizable to clinical samples or to other samples of emerging adults (i.e., university students). Furthermore, because this was a cross-sectional study, cause and effect relations between the variables cannot be established. While the results indicated that the 15-item GMQ demonstrated acceptable fit of a three-factor model in the EFA, the examination of individual items showed some areas for improvement. Steps were taken to address this issue by removing the problematic items, creating the 9-item short form GMQ where a three factor model fit the data well. As both the 15-item and 9-item GMQ exhibited essentially the same results in concurrent validity analyses, it is unlikely that any findings in this study are due simply to factorial validity issues. This said, coping motives were not commonly endorsed in this population, decreasing the variance and thus possibly increasing Type II error for tests involving coping motives. Thus, future research might increase the sample size to increase power, or over-sample participants who endorse high and low coping motives to more clearly examine this relationship. Past studies have tended to use principal components analysis (Stewart & Zack, 2008; Dechant & Ellery, 2011), which is analogous to factor analysis, but often considered more liberal than the latent variable approach using Mplus software in the present study (Costello & Osborne, 2005). Thus, the discrepancies in factor structure when compared to prior research might be attributed to differences in statistical analysis techniques employed across studies. Moreover, the present study participants were not pre-selected to be

moderate gamblers as in prior studies (Stewart & Zack, 2008; Dechant & Ellery, 2011) which might also contribute to discrepancies in the findings. The dichotomous scoring for the problem gambling measures (i.e., as presence or absence of any problem gambling symptoms) may also be considered a possible study limitation, as this was not the original intended use of these measures. Problem gambling may be too broadly defined; therefore, some of the study findings might be instead attributed to the dichotomous scoring of the PGSI. Nonetheless, this operationalization has been previously used by others (Rockloff & Dyer, 2006). This liberal inclusion was necessary in the current study to maximize statistical power in this non-clinical sample. Future studies may use a more stringent cut-off with a larger sample to capture a more problematic group, to provide a stronger test of whether coping motives are a significant independent predictor of more clinically-significant problem gambling. An additional potential limitation is that the GMQ may not comprehensively tap all of the possible motives for gambling (see McGrath, Stewart, Klein, & Barrett, 2010). Future research should explore the role of other motives (e.g., conformity motives, financial motives) not tapped on the GMQ in the gambling behaviour of emerging adults. There is no specific, a-priori reason to expect that the CIDI would be predicted by motives rather than the PGSI for the 3-item version of the measures. This finding was unexpected, and suggests that the link between motives and problem gambling might be less robust than anticipated after accounting for measurement error with latent variables. This could potentially be due to a relatively low endorsement of gambling problems reducing statistical power. It might also be due to a relatively low endorsement of coping motives, relative to enhancement motives in the present sample.

Implications

Our findings suggest that the GMQ is psychometrically valid, suggesting it is a valid measure of use for end users seeking to use this measure. Moreover, by providing a psychometrically valid 9-item short form, this measure may be administered more quickly and reduces participant burden, which is of value for researchers and clinicians seeking to use this measure. Our results suggest that future prevention and treatment efforts should specifically target enhancement motives in emerging adults. Specifically, enhancement motivated emerging adult gamblers might be given motivation-matched treatments and/or prevention strategies, such as treatments that focus on finding more adaptive ways of achieving stimulation and excitement. Similar targeted interventions have been shown to be effective in reducing both enhancement and coping drinking motives, and were also effective in reducing symptoms of problem drinking and binge drinking in young people (Conrod, Castellanos-Ryan, & Mackie, 2011; Conrod, Stewart, Comeau, & MacLean, 2006). While the present paper finds the most support for enhancement motives as a predictor of gambling behaviour and problems in emerging adult gamblers, the positive association of coping motives with money spent gambling is also of clinical concern. Problem gamblers spend more money on gambling relative to non-problem gamblers (Nower & Blaszczynski, 2010), and thus the link between coping motives and money observed in the present study may be an early indicator of problem gambling among coping-motivated gamblers. Future longitudinal research is needed to examine the relationship that unfolds over time between coping motives, money spent gambling, and the development of problem gambling.

Conclusions

In sum, the GMQ appears to be a reliable and valid measure suitable for use in emerging adult populations, with enhancement motives emerging as the most salient predictor of gambling behaviour and problems at this developmental stage. Although the 15-item

measure exhibited some potentially problematic items in terms of factorial validity, the concurrent and incremental validity results did not vary greatly when these items were removed. Enhancement motives (but not social or coping motives) were a salient predictor of problem gambling and gambling behaviour across motives measures in this normative sample of emerging adults, suggesting that emerging adulthood might be a distinct developmental stage where enhancement gambling motives are particularly salient. Finally, this study led to the development of a psychometrically-sound short-form GMQ which may prove useful in situations where the length of the long form is prohibitive, such as in large-scale survey studies (see Kuntsche & Kuntsche, 2009).

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Table 1 Exploratory Factor Analysis: Factor loadings of the 15 original GMQ items.

	Factor 1: *Enhancement motives*	Factor 2: *Social motives*	Factor 3: *Coping motives*	Communalities
GMQ item				
Enhancement motives subscale				
3. Because you like the feeling	**.860***	-.019	-.060	.74
6. Because it's exciting	**.850***	.009	-.248*	.78
15. Because it makes you feel good	**.796***	-.086	.032	.64
12. Because it's fun	**.708***	.174*	-.233*	.59
9. To get a "high" feeling	**.634***	-.100	.152	.44
Social Motives Subscale				
7. To be sociable	-.064	**.859***	-.014	.74
13. Because it makes a social gathering more enjoyable	.010	**.715***	.189*	.55
4. Because it's what most of your friends do when you get together	.028	**.606***	.190*	.40
10. Because it's something I do on special occasions	**.354***	.266*	.019	.20
1. As a way to celebrate	**.635***	.049	.002	.41
Coping motives subscale				
11. Because it helps when you are feeling nervous or depressed	.149	.073	**.745***	.58
8. Because you feel more self-confident or sure of yourself	-.013	.262*	**.670***	.52
14. To cheer up when you're in a bad mood	**.346***	.003	**.595***	.47
5. To forget your worries	.292*	-.042	**.515***	.35
2. To relax	**.510***	.135	.209*	.32

*Note. *p < .05;* bold indicates salient factor loadings (≥ .32).

Table 2 Bivariate correlations between study variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1. EM (5-item)												
2. SM (5-item)	.65**											
3. CM (5-item)	.61**	.54**										
4. EM (3-item)	.93**	.58**	.66**									
5. SM (3-item)	.54**	.91**	.44**	.47**								
6. CM (3-item)	.48**	.43**	.91**	.56**	.36**							
7. Sex	.17**	.11*	.16**	.18**	.14**	.12**						
8. PGSI	.36**	.25**	.29**	.36**	.23**	.25**	.21**					
9. CIDI	.33**	.22**	.25**	.35**	.19**	.17**	.19**	.49**				
10. Money	.39**	.23**	.32**	.40**	.21**	.23**	.25**	.44**	.48**			
11. Time	.29**	.24**	.17**	.30**	.18**	.17**	.20**	.38**	.34**	.67**		
12. Frequency	.35**	.25**	.26**	.33**	.22**	.18**	.22**	.46**	.42**	.64**	.46**	
Mean	7.96	7.96	5. 88	4.07	4.75	3.36	---	---	---	1.84	25.05	28.42
SD	2.97	2.73	1.79	1.66	1.89	.98	52.6% female	15.0% problem	8.0% problem	4.39	79.14	52.51
Á	.85	.78	.83	.80	.78	.79	---	---	---	---	---	

Note. EM = enhancement motives, SM = social motives, CM = coping motives. Money is dollars spent gambling per day, Time is hours spent gambling per year, and Frequency is number of gambling occasions per year. Sex was coded as 1 = female, 2 = male.
***p <.01, *p <.05*

Table 3 Negative binomial regression with GMQ subscales predicting gambling behaviour (money spent on gambling per day, time spent gambling per year, and frequency of gambling occasions in past year).

	Money			Time			Frequency		
	B (SE)	Pseudo-R^2	95% CI B	B (SE)	Pseudo-R^2	95% CI B	B (SE)	Pseudo-R^2	95% CI B
EM (5 item)	.18*** (.04)		[.10, .25]	.12*** (.03)		[.07, .17]	.16*** (.04)		[.07, .24]
SM (5 item)	.02 (.03)		[-.05, .08]	.06* (.02)		[.01, .11]	.05 (.04)		[-.03, .12]
CM (5 item)	.16** (.06)		[.04, .27]	.04 (.04)		[-.03, .11]	.03 (.06)		[-.08, .15]
		.08			.09			.10	
EM (3 item)	1.60*** (.35)		[.92, 2.28]	.63*** (.15)		[.33, .93]	1.75*** (.55)		[.66, .2.81]
SM (3 item)	.19 (.34)		[-.48, .86]	.56*** (.17)		[.24, .89]	.09 (.47)		[-.83, 1.01]
CM (3 item)	-.38 (.69)		[-1.74 .97]	-.37 (.27)		[-.90, .16]	-1.30 (.75)		[-2.78, .17]
		.08			.08			.10	

Note. A negative binomial distribution was specified to correct for non-normality. EM = enhancement motives, SM = social motives, CM = coping motives. *** $p < .001$, ** $p < .01$ * $p < .05$

Table 4 Logistic regression with GMQ subscales and gambling behaviours (money, time, and frequency) predicting any problem gambling symptoms on both the PGSI and the CIDI

	PGSI Problem Gambling Symptoms				CIDI Problem Gambling Symptoms			
	B (SE)	OR	Pseudo-R^2	95% CI OR	B (SE)	OR	Pseudo-R^2	95% CI OR
Money	.09* (.05)	1.10		[1.00, 1.22]	.17*** (.05)	1.18		[1.08, 1.30]
Time	.02 (.01)	1.02		[.99, 1.04]	-.02 (.02)	.99		[.95, 1.02]
Frequency	.01** (.01)	1.01		[1.00, 1.02]	.01* (.00)	1.01		[1.00, 1.01]
EM (5 item)	.13* (.07)	1.14		[1.01, 1.31]	.17* (.09)	1.20		[1.02, 1.42]
SM (5 item)	-.04 (.08)	.96		[.82, 1.13]	.01 (.11)	1.01		[.82, 1.26]
CM (5 item)	.15 (.09)	1.16		[.98, 1.39]	.10 (.11)	1.11		[.89, 1.39]
			.39***				.44***	
Money	.11* (.05)	1.11		[1.00, 1.23]	.19*** (.05)	1.20		[1.08, 1.34]
Time	.03* (.01)	1.03		[1.01, 1.05]	-.01 (.02)	.99		[.96, 1.02]
Frequency	.01** (.00)	1.01		[1.01, 1.02]	.01 (.01)	1.01		[1.00, 1.01]
EM (3 item)	.59 (.47)	1.80		[.72, 4.55]	1.62** (.60)	5.07		[1.56, 16.44]
SM (3 item)	-.25 (.52)	.78		[.28, 2.14]	-.01 (.69)	.99		[.26, 3.87]
CM (3 item)	1.28 (.87)	3.59		[.65, 19.91]	-1.02 (1.09)	.36		[.04, 3.04]
			.37***				.33***	

Note. OR = Odds ratio, EM = enhancement motives, SM = social motives, CM = coping motives. *** $p < .001$, ** $p < .01$ * $p < .05$

Abstract – Study 2

The present study tested relations between specific personality domains in the five-factor model (FFM) of personality -- namely high Neuroticism and low Conscientiousness -- and gambling behavior/problems. Moreover, this study examined the potential mediating role of coping and enhancement gambling motives. A sample of 487 emerging adult gamblers (73.9% Caucasian; 52.6% female; mean age 22.23 years) participated in this study as a part of the third and fourth waves of the Manitoba Longitudinal Study of Young Adults (MLSYA; Manitoba Gaming Control Commission, 2011). Participants completed the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1992), the Gambling Motives Questionnaire (GMQ; Stewart & Zack, 2008), the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) as a measure of gambling behavior, and the Problem Gambling Severity Index (PGSI; Wynne, 2003) of the CPGI and the Composite International Diagnostic Interview (CIDI; Kessler & Üstün, 2004) as measures of gambling-related problems. Multiple mediator analyses, using bootstrapping, revealed a significant indirect effect of high Neuroticism on amount of money spent gambling that was mediated through coping gambling motives. These analyses also revealed significant indirect effects of low Conscientiousness on gambling problems (CIDI and PGSI), money spent gambling, and gambling frequency mediated through enhancement gambling motives. Unexpectedly, the significant indirect effect of low Conscientiousness on money spent gambling was also mediated through coping gambling motives. These findings suggest two distinct pathways to excessive and problematic gambling among emerging adults. Implications of the findings for prevention of excessive gambling and gambling problems in this population are discussed.

Introduction – Study 2

Emotion-Regulation Gambling Motives as Mediators of the Longitudinal Relation of Personality to Gambling Outcomes in Emerging Adults

The five-factor model (FFM) of personality suggests that human personality is comprised of five higher-order, trait-like dimensions (Digman, 1990). The five personality domains in the FFM are: (a) Neuroticism (a tendency to experience negative affect); (b) Extraversion (a tendency to experience positive affect and direct energy towards the social world); (c) Openness (a tendency to be reflective, imaginative, and intellectually curious); (d) Agreeableness (a tendency to be friendly, trustworthy, and prosocial); and (e) Conscientiousness (a tendency to constrain immediate impulses in favor of long-term goals). The FFM has been widely accepted and utilized by psychologists and researchers in the personality field (Costa & McCrae, 1992). It holds promise as a model for understanding the traits displayed by problem gamblers that may predispose them to develop excessive or problem gambling.

Personality and Gambling

Only a few published studies have used the FFM to investigate personality characteristics in pathological gamblers. Bagby et al. (2007) found that pathological gamblers score significantly higher in Neuroticism, and lower in Conscientiousness than non-pathological gamblers. In an Estonian sample, Kaare, Mottus, and Konstabel (2009) similarly showed that pathological gamblers scored significantly higher in Neuroticism and lower in Conscientiousness, compared to non-gambler controls. Likewise, Myrseth, Pallesen, Molde, Johnsen, and Lorvik (2009) found that high scores on the Neuroticism domain were positively related to pathological gambling. Miller, MacKillop, Fortune et al. (2012) found that Neuroticism was the most strongly related to symptoms of pathological gambling. Individuals with higher levels of Neuroticism had difficulties inhibiting gambling urges or cravings, particularly when experiencing negative affect (Miller et al., 2012). MacLaren, Best, Dixon, and Harrigan (2011) replicated these findings in a non-treatment-seeking emerging adult undergraduate sample. Specifically, they found that high Neuroticism and low Conscientiousness were significantly correlated with gambling. These results establish that the links between Neuroticism and Conscientiousness observed in treatment seeking gamblers hold in non-clinical samples, and suggest these relationships are not simply due to selection bias arising from the treatment-seeking nature of clinical samples. Overall then, the most consistent FFM personality correlates of problem gambling across various samples are high levels of Neuroticism and low levels of Conscientiousness.

Motives and Gambling

In addition to FFM personality traits, certain motivations for gambling appear characteristic of pathological gamblers. Stewart, Zack, Collins, Klein, and Fragopoulos (2008) identified three subtypes of pathological gamblers based upon their motivations for gambling: those who gamble for positive reinforcement (enhancement motivated), those who gamble for negative reinforcement (coping motivated), and a third group that gambled for reasons other than to modify their affect. Subsequent literature refers to this third group of gamblers as those who are socially motivated (i.e., to increase social affiliation; Stewart & Zack, 2008). Individual differences in these gambling motives have been shown to predict gambling outcomes and behavior. Coping and enhancement motives, rather than social motives, appear to be characteristic of pathological gamblers (McGrath, Stewart, Klein, & Barrett, 2010; Stewart & Zack, 2008). Coping-motivated gamblers also display greater severity of gambling problems than other gambler subtypes, and enhancement motivated gamblers display greater severity

and frequency of gambling than those who are socially motivated (Stewart et al., 2008). Thus, coping and enhancement motives appear to have the strongest relationship with adverse gambling outcomes and problem gambling.

Mediational Model

A mediation model was selected based on prior theory. Stewart and Zack's (2008) 3-dimensional model of gambling motivations has strong parallel's with Cooper, Russell, Skinner, and Windle's (1992) original drinking motivations theory, with both theories proposing three core motives: enhancement, coping, and social motives. In the drinking motives literature, a causal model is proposed whereby personality gives rise or causes a certain pattern of drinking motives, which in turn leads to drinking (Kuntsche, Knibbe, Gmel, & Engels, 2005). Within drinking motives research, both enhancement and coping motives have been identified as significant positive predictors of specific alcohol outcomes including heavy alcohol consumption, and drinking-related problems (see review by Kuntsche, Knibbe, Gmel, & Engels, 2005). Furthermore, according to Cooper's theory, specific antecedent personality factors should be linked to specific drinking motives (see Cooper, Kuntsche, Levitt, Barber, & Wolf, 2015). Due to their tendency to experience more intense negative emotions, those high in Neuroticism should be particularly prone to coping-motivated drinking to relieve these negative emotional states. In contrast, due to their failure to inhibit immediate impulses, those low in Conscientiousness should be particularly prone to positive reinforcement, enhancement-motivated drinking (e.g., Cooper, Frone, Russell, & Mudar, 1995). Motives are thought to be the most proximal predictor of behaviours in our model of addiction (i.e., drinking or gambling). Indeed, the motives are thought to give rise to gambling, rather than the reverse (Stewart & Zack, 2008). Moreover, personality traits) are thought to be sources of motivational styles that prioritize positive (i.e., low conscientiousness and enhancement motives) or negative reinforcement (i.e., neuroticism and coping motives). Consistent with theoretical prediction, enhancement and coping drinking motives have been shown to be predicted by FFM personality characteristics: enhancement motives by low Conscientiousness, and coping motives by high Neuroticism (Cooper et al., 1995; Stewart & Devine, 2000). Additionally, Stewart et al. (2001) found that coping motives partially mediated the relationship between Neuroticism and drinking problems, and enhancement motives were found to fully mediate the relationship between low Conscientiousness and heavy drinking behaviour (Stewart et al., 2001). This suggests that individuals high in Neuroticism, and low in Conscientiousness, may display more alcohol use and related problems due to their specific maladaptive motives for alcohol consumption. This finding is consistent with Cooper's motivational model of alcohol use/misuse which contends that drinking motives are the final common pathway through which other risk factors, such as personality, exert their influence on alcohol outcomes (Cooper, 1994; Cooper et al., 2015). However, no research to date has examined whether a similar motives mediational model may help explain links between the FFM personality characteristics of high Neuroticism and low Conscientiousness, and problem gambling outcomes such as heavy gambling and gambling-related problems.

The Present Study

The present study uses data previously collected in four waves, over five years, as a part of the Manitoba Longitudinal Study of Young Adults (MLYSA). The MYLSA dataset represents a unique opportunity to examine gambling motives as a mediator of the relationship between FFM personality traits and gambling outcomes. Though much research has examined motivations for drinking, comparatively little research has examined gambling motivations (c.f., Stewart & Zack, 2008). Thus, this study fills an important gap in the literature. The use of a

young adult sample overcomes concerns about a potential selection bias that is evident when treatment-seeking gamblers are employed (MacLaren et al., 2011). The use of longitudinal methods also represents an important methodological advance, as longitudinal studies allow for stronger causal inferences when compared to cross-sectional studies. Measures of Conscientiousness and Neuroticism were administered to a large sample of young adults at wave 3, and measures of gambling motives and problem gambling were administered to these same young adults at wave 4. We had three main hypotheses:
H1. We hypothesized that high Neuroticism and low Conscientiousness would be uniquely related to increased gambling behavior and increased gambling-related problems when entered as simultaneous predictors in multiple regression.
H2. We hypothesized that the positive relationship between Neuroticism and increased gambling behavior/problems would be mediated by coping motives.
H3. We hypothesized that the negative relationship between Conscientiousness and increased gambling behavior/problems would be mediated by enhancement motives.

Method- Study 2

Participants

Participants in the Manitoba Longitudinal Study of Young Adults (MLSYA; Manitoba Gaming Control Commission, 2011) were recruited from a variety of methods, including random-digit dialing, participant referrals, survey recruiting, placing advertisements at VLT sites and post-secondary institutions, and casino recruiting. In order to participate in the study, participants were required to be 18-20 years old at wave 1 and consent to repeated contact over a five-year period. Wave 1 consisted of 679 participants (51.8% female, mean age = 18.9 years), with 29.1% attrition by wave 4 (N = 530). In wave 4 of the study, 43 participants reported that they were non-gamblers. These participants were removed for the current study, as they could not have gambling motives or gambling behaviours.

Measures

NEO Five Factor Inventory (NEO-FFI). The NEO-FFI (Costa & McCrae, 1992) is a standardized 60-item measure of personality on five major domains: Neuroticism, Extraversion, Conscientiousness, Agreeableness, and Openness. Each domain consists of 12 Likert questionnaire items on which participants respond from 0 (*strongly disagree)* to 4 (*strongly agree)*. The NEO-FFI shows high test-retest reliability over a two-week interval (ranges from .86 to .90; Robins, Fraley, Roberts, & Trzesniewski, 2001) and acceptable levels of internal consistency (αs range from .68 to .86, Costa & McCrae, 1992). Missing responses were replaced by a score of 2 (*neutral*) as per instructions by the instrument's authors. For the current study, the neuroticism and conscientiousness subscales from wave 4 were used.

Gambling Motives Questionnaire (GMQ). The GMQ (Stewart & Zack, 2008) is a 15-item measure of gambling motives. It was designed to assess three dimensions of motives – enhancement (e.g., "because it's exciting"), social (e.g., "as a way to celebrate"), and coping (e.g., "to forget your worries"), with 5 items per factor. Participants respond to each of the items on a 1 (*almost never/never)* to 4 (*almost always)* Likert scale. Recently, the GMQ has been validated as a measure of gambling motives in emerging adults, with factorial validity supporting the 3-factor model and alpha reliabilities ≥ .78 for all three factors in the present sample (Lambe, Mackinnon, & Stewart, in press -- i.e., Study 1 above). In the current study, the coping motives subscale was $\log_{10}$ transformed to reduce non-normality (skew = 3.11, kurtosis = 12.78).

Problem Gambling Severity Index (PGSI). The PGSI (Wynne, 2003) is a 9-item measure contained within the CPGI that assesses the extent to which an individual may be engaging in problem gambling behaviour (e.g., "How often have you bet more than you could really afford to lose?"). Each item is scored on a 0 (*never*) to 3 (*almost always*) Likert scale, with possible scores ranging from 0 to 27 (higher scores indicate greater severity of harm). The PGSI is both a reliable (α = .83) and valid measure of problem gambling (Ferris & Wynne, 2001; Holtgraves, 2009). As this was a non-clinical sample, PGSI scores were positively skewed (skew = 5.76, kurtosis = 39.07) and thus were dichotomized (scores of 0 were scored as 0, and scores ≥ 1 were scored as 1; Rockloff & Dyer, 2006; Lambe et al., in press) in the current study.

Composite International Diagnostic Interview (CIDI). The CIDI (Kessler & Üstün, 2004) is a standardized, structured interview from which the pathological gambling subscale was used. Participants were asked if they have a) ever bet or spent money on gambling activities; b) had a time in their lives when gambling interfered with close relationships or important responsibilities such as work or school; c) lied to others about the extent of gambling; and d) ever spent $250 or more on gambling in a single year. Responding "yes" to any of questions b-d prompted a series of questions covering the ten DSM-IV (APA, 1994) diagnostic criteria for pathological gambling. The CIDI is both a reliable (α = .90) and valid measure of problem gambling (Kessler, Hwang, LaBrie, Petukhova, Sampson, Winters, & Shaffer, 2008). Similarly to the PGSI, the CIDI was scored dichotomously (i.e., scores ≥ 1 were coded as 1, scores of 0 were coded as 0) to reduce non-normality (skew = 3.23, kurtosis = 12.25; Lambe et al., in press).

Canadian Problem Gambling Index (CPGI). The CPGI (Ferris & Wynne, 2001) is an instrument that measures gambling involvement in various domains. For 14 different types of gambling (e.g., VLTs, bingo, etc.) participants are asked a variety of questions pertaining to the last 12 months, including: "*how much money did you spend, not including winnings, on [gambling type] in a typical month*"; "*how much time did you normally spend each time you bet or spent money on [gambling type]*"; and "*how often did you bet or spend money on [gambling type]*". For the current study, these questions were used to examine the total time spent gambling, the amount of money spent gambling, and gambling frequency. For money spent gambling, reported values were multiplied by 12 and summed across gambling types to obtain the total yearly amount; this value was then divided by 365 to obtain money spent gambling per day in Canadian dollars. For time spent gambling, average time was multiplied by frequency (for each type) to obtain the total yearly time spent gambling (minutes); this was then divided by 60 to obtain the total yearly time spent gambling in hours. Lastly, for gambling frequency, reported values were scored such that participants could gamble from one (once per year) to 365 (daily gambler) occasions for each gambling type endorsed. Scores were then summed across types to obtain a total gambling frequency in the past year. For these variables, five extreme univariate outliers were identified by visual inspection of the box plots and histograms (two for money, two for time, and one for frequency); in all cases, the outliers were winsorized by transforming them to the next highest value plus one (Tabachnick & Fidell, 2011).

Procedure

The MLSYA was a five-year longitudinal study that collected data from emerging adults in Manitoba. All participants gave informed consent before participation. During each wave, participants were initially contacted by telephone to complete a telephone interview that included both closed- and open-ended questions. This was followed by a questionnaire battery that participants had the option of completing online (97.9%) or through a mail-in questionnaire (2.1%), both of which included the same measures in the same order. Four waves of data collection occurred, at approximately 12-18 month intervals. Archival data provided by the MLSYA was used for the current study.

Statistical Analysis

Mediation was tested in a multiple mediator analysis (i.e., all three gambling motives were entered as possible mediational variables) using the PROCESS macro in SPSS 21.0 (Hayes, 2013). Mediation occurs when the direct effect (*c* path) between the predictor (i.e., personality) and the outcome (i.e., gambling involvement) is reduced when the intervening process is taken into account (i.e., gambling motives). The amount of mediation is the indirect effect, which can be approximated by taking the product of the a-path (i.e., personality to motives) and the b-path (i.e., motives to gambling outcomes). Mediation has occurred if the indirect effect is significant. Significance of indirect effects was calculated using bootstrapping with 20,000 replications (Hayes, 2008). Variables were standardized before analysis to create a better interpretation of the effect size for the indirect effect (i.e., completely standardized indirect effects; Preacher & Kelley, 2011). Additionally, analyses using Neuroticism as the predictor variable controlled for Conscientiousness (and vice versa) given the significant overlap between these two personality measures (i.e., high Neuroticism is correlated with low Conscientiousness; see Table 1).

Results – Study 2

Descriptive Statistics and Bivariate Correlations

Descriptive statistics and bivariate correlations are shown in Table 1. All measures showed good internal consistency (i.e., all αs ≥ .78). As expected, gambling motives, gambling problems, and gambling involvement measures were all significantly and positively correlated with one another. Neuroticism was positively correlated with coping motives, but it was related neither to gambling problems nor to gambling involvement. This was unexpected, given that previous research has found a positive association between neuroticism and problem gambling (Bagby et al., 2007, Kaare et al., 2009). Conscientiousness was negatively correlated with both enhancement and coping motives; in general, it was also negatively correlated with gambling problems and gambling involvement. This corresponds with previous research demonstrating that pathological gamblers have significantly lower levels of conscientiousness compared to non-problem gamblers and non-gamblers (Bagby et al., 2007, Kaare et al., 2009).

Neuroticism

A series of mediational models were examined with Neuroticism as the predictor, all three gambling motives as the mediators, and problem gambling and gambling involvement (money, time, and frequency) as the outcome variables of interest. Conscientiousness scores served as a covariate in these mediational models. As shown in Table 2, Neuroticism consistently and significantly predicted coping motives, and was unrelated to both social motives and enhancement motives. Enhancement motives were the only significant predictor of problem gambling symptoms on both the PGSI and the CIDI, and also significantly predicted all three measures of gambling involvement. Coping motives also significantly, independently predicted money spent gambling. Social motives were not a significant independent predictor of any of the gambling outcomes. As hypothesized, coping motives were a significant mediator between neuroticism and gambling outcomes, but only in the case of money spent gambling

(see Table 2). As hypothesized, mediation was not found for social motives or enhancement motives.

Conscientiousness

Next, another series of mediational models were examined, but with Conscientiousness as the predictor. Neuroticism scores served as a covariate in these mediational models. Conscientiousness was negatively related with both enhancement and coping motives and was unrelated to social motives in all models (see Table 3). Once again, enhancement motives were a robust predictor of all gambling outcome variables, and coping motives were also a significant predictor of money spent gambling. As shown in Table 3, mediational analyses revealed that enhancement motives significantly mediated the relationship between Conscientiousness and four of the five gambling outcomes (i.e., all but time spent gambling where no significant mediation was found). Unexpectedly, coping motives also significantly and independently mediated the relationship between conscientiousness and money spent gambling. As expected, social motives were not a significant mediator in any instance. For readers interested in the zero-order relationships between personality and outcomes (i.e., do the results hold when not entering both personality variables as predictors), see Table 1 for bivariate correlations. In general, the pattern of results is similar in Table 1 and Table 3.

Discussion – Study 2

The present study replicated previous findings in both treatment-seeking samples of gamblers (Bagby et al., 2007; Kaare et al., 2009) and in university students (MacLaren et al., 2011) showing significant relations between the Conscientiousness domain of the FFM and gambling outcomes. Specifically, wave 3 Conscientiousness from the NEO-FFI was found to be significantly negatively correlated with wave 4 gambling behavior (i.e., time, money, and frequency) on the CPGI and with gambling-related problems on the PGSI. This is consistent with low Conscientiousness as a risk factor for excessive gambling behavior and increased gambling-related problems. Unexpectedly, wave 3 Neuroticism from the NEO-FFI did not correlate significantly with any of the wave 4 gambling outcomes. The failure to replicate a relationship between Neuroticism and gambling outcomes (Bagby et al., 2007; Kaare et al., 2009; MacLaren et al., 2011; Miller et al., 2012; Myrseth et al., 2009) in the present study may be due to the prospective nature of the present study relative to the cross-sectional data used in prior findings. At first glance, this suggests that Neuroticism fails to confer vulnerability for excessive or problem gambling over time.

However, coping motives significantly mediated the relationship between high Neuroticism at wave 3 and increased money spent gambling at wave 4. This suggests that high Neuroticism may indirectly confer vulnerability for one aspect of excessive gambling (namely increased spending) over time by way of influencing future gambling to cope. It is fairly well-known that spending money on a freely chosen product or activity can reduce negative affect (i.e., “retail therapy; Atalay & Meloy, 2011). Thus, excessive spending might be a particularly important feature to achieve the negatively reinforcing qualities of problem gambling for people high in neuroticism. However, this remains speculative pending further research. The failure to observe indirect effects of Neuroticism to either index of gambling-related problems (i.e., PGSI or CIDI) was unexpected. It is possible this is due to the sample (young adults), and/or the time-frame. For example, since increased spending could lead to gambling-related problems over time, the interval between waves 3 and 4 in the current study may not have been sufficiently long to observe this indirect association though coping motives.

As hypothesized, significant indirect effects between low Conscientiousness at wave 3 and increased gambling outcomes at wave 4 were observed. Specifically, the effect of Conscientiousness was mediated through enhancement gambling motives in the case of two of the indices of gambling behavior (i.e., money and frequency) and both of the indices of gambling-related problems (i.e., PGSI and CIDI). This suggests that low Conscientiousness confers vulnerability for excessive, frequent and problematic gambling over time by way of influencing future gambling for excitement. Partially consistent with hypothesis, three of these four significant indirect pathways were specifically mediated by enhancement motives. The one exception was the indirect effect between wave 3 Conscientiousness and wave 4 money spent gambling from the CPGI which was independently mediated by both enhancement and coping motives. The finding that low Conscientiousness is related to both mood-regulation motives is consistent with findings from the alcohol literature showing that the related personality construct of impulsivity is associated with both enhancement and coping drinking motives (Woicik, Stewart, Pihl, & Conrod, 2009).

Limitations

This study has limitations. The present dataset did not measure personality and gambling motives concurrently over multiple waves. This precluded more rigorous tests of mediation, such as a longitudinal panel design (Cole & Maxwell, 2003). Thus, inferences of causality must be made with caution in the present study. Moreover, comparatively few participants had clinical levels of problematic gambling, which limits the statistical power and generalizability of results to clinical populations. There was also substantial attrition by wave 4, leading to reduced statistical power. Moreover, because this dataset contains a homogenous, young adult sample, results should not be generalized to other populations (e.g., middle-aged adults). Finally, other features of personality related to gambling problems (e.g., hopelessness, sensation-seeking) were omitted from this study. Future studies might investigate other personality characteristics related to problem gambling.

Implications

These findings have implications for intervention. Specifically, young adult gamblers who are high in Neuroticism would benefit from interventions focused on their tendency to gamble to cope as a way of preventing excessive spending over time. In contrast, young adult gamblers who are low in Conscientiousness would benefit from interventions focused on their tendency to gamble for excitement as a way of preventing adverse gambling outcomes in future. However, low Conscientious young adult gamblers could also benefit from additional focus on their higher levels of coping motives as another way of preventing excessive spending on gambling over time. Personality and motivation focused interventions with young people have proven effective in the substance abuse area (e.g., Conrod, Stewart, Comeau, & Maclean, 2006) but have yet to be employed in the problem gambling prevention field. Overall, these results suggest the importance of subtyping problem gamblers, as people gamble for a variety of different reasons. We believe this adds to the mounting evidence that problem gambling is heterogeneous (Blaszczynski & Nower, 2002), and that it likely requires distinct diagnosis and treatment for different subtypes of gambling.

Conclusion

The present findings extend prior work in treatment-seeking gamblers by examining these relations longitudinally and in a non-clinical sample where selection biases due to treatment seeking are not of concern. They also help establish that both low Conscientiousness, and to a lesser extent high Neuroticism, are risk factors for future adverse gambling outcomes in young people, and that these risk pathways operate, generally, by distinct motivational mechanisms. Specifically, low Conscientiousness generally confers vulnerability for adverse gambling outcomes by way of influencing future gambling for excitement, whereas high Neuroticism confers vulnerability for increased gambling spending by way of influencing future gambling to cope. These findings are consistent with an extension of Cooper's (1994; see also Cooper et al., 2015) motivational model to the problem gambling area by showing that motives are the common final pathway through which FFM personality factors exert their effects on gambling outcomes.

References – Study 2

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Table 1 – Bivariate Correlations, Descriptive Statistics, and Reliabilities

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Neuroticism	-									
2. Conscientiousness	-.36**	-								
3. EM	.08	-.12*	-							
4. SM	.02	-.02	.65**	-						
5. CM	.16**	-.15**	.63**	.56**	-					
6. PGSI	.09	-.13**	.36**	.25**	.32**	-				
7. CIDI	.05	-.08	.33**	.22**	.28**	.49**	-			
8. Money	-.03	-.10*	.39**	.23**	.33**	.44**	.48**	-		
9. Time	-.03	-.14**	.29**	.17**	.25**	.38**	.34**	.67**	-	
10. Frequency	-.01	-.11*	.35**	.25**	.27**	.46**	.42**	.64**	.46**	-
Mean	20.20	31.13	7.96	7.96	5.88	---	---	1.84	25.05	28.42
SD	8.04	5.97	2.97	2.73	1.79	---	---	4.39	79.14	52.51
α	.96	.97	.85	.78	.83	---	---	---	---	---

Note. EM = enhancement motives, SM = social motives, CM = coping motives, Money = money spent gambling per day, Time = hours spent gambling/year, Frequency = gambling occasions/year.

Table 2 Mediation Tests with Neuroticism as the Predictor (Controlling for Conscientiousness)

Outcome	Mediators	a path	b path	c path	c' path	95% CI	Total 95% CI	r^2 outcome
PGSI	EM	.04	.65***	.16	.09	[-.04, .12]	[-.04, .16]	.15
	SM	.01	.05			[-.02, .03]		
	CM	.12*	.25			[-.006, .10]		
CIDI	EM	.04	.74***	.13	.01	[-.04, .15]	[-.05, .18]	.16
	SM	.01	-.02			[-.04, .03]		
	CM	.12*	.25			[-.02, .11]		
Money	EM	.07	.30**	-.02	-.06	[-.009, .08]	[-.002, .09]	.17
	SM	.03	-.06			[-.02, .003]		
	CM	.13*	.17*			[.002, .06]*		
Time	EM	.07	.23*	-.05	-.08	[-.006, .07]	[-.001, .08]	.12
	SM	.03	-.04			[-.02, .004]		
	CM	.13*	.12			[-.0008, .05]		
Frequency	EM	.07	.26**	-.03	-.06	[-.009, .07]	[-.01, .08]	.13
	SM	.03	.05			[-.005, .02]		
	CM	.13*	.09			[-.008, .05]		

Note. Confidence intervals were derived using bootstrapping with 20,000 resamples. Presented values are standardized. Due to missing data, sample sizes differed between the models (PGSI/CIDI N = 444, Money/Frequency N = 399, Time N = 393).

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

Table 3 Mediation Tests with Conscientiousness as the Predictor (Controlling for Neuroticism)

PGSI	EM	-.10*	.65***	-.31*	-.24	[-.16, -.007]*	[-.19, -.002]*	.15
	SM	-.01	.05			[-.03, .02]		
	CM	-.10*	.25			[-.09, .004]		
CIDI	EM	-.10*	.74***	-.26	-.16	[-.19, -.007]*	[-.22, -.0004]*	.16
	SM	-.01	-.02			[-.03, .04]		
	CM	-.10*	.25			[-.10, .01]		
Money	EM	-.09*	.30**	-.10	-.06	[-.08, -.001]*	[-.11, -.005]*	.17
	SM	-.01	-.06			[-.005, .02]		
	CM	-.11*	.17*			[-.05, -.0004]*		
Time	EM	-.09*	.23*	-.17**	-.14*	[-.07, .006]	[-.10, -.001]*	.12
	SM	-.01	-.04			[-.006, .02]		
	CM	-.11*	.12			[-.05, .002]		
Frequency	EM	-.09*	.26**	-.12*	-.09	[-.07, -.0003]*	[-.09, .005]	.13
	SM	-.01	.05			[-.02, .006]		
	CM	-.11*	.09			[-.04, .006]		

Note. Confidence intervals were derived using bootstrapping with 20,000 resamples. Presented values are standardized. Due to missing data, sample sizes differed between the models (PGSI/CIDI N = 444, Money/Frequency N = 399, Time N = 393).

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

Abstract – Study 3

Previous cross-sectional research has shown that depression and problem gambling co-occur. Longitudinal research, however, allows for a better determination of directionality, as behavioural changes in gambling involvement can be more reliability studied over time. The present study assesses symptoms of depression and problem gambling across four waves and addresses whether their relationship is directional (with one reliably preceding the other), bidirectional, or pathoplastic.

As part of the Manitoba Longitudinal Study of Young Adults, prospective data was collected on Canadian young adults' (Wave 1: *N* = 679, 51.8% female, ages 18-20) depressive symptoms, involvement in gambling, and risky gambling behaviour. Recruitment and the first cycle of data collection (Wave 1) took place in fall 2007. Three additional waves of data collection then occurred in 12-18 month intervals: fall 2008, spring 2010, and spring 2011. The Problem Gambling Severity Index and the Composite International Diagnostic Interview – Short Form were administered via telephone interview at each wave.

Bivariate growth curve analyses showed that depressive and problem gambling symptoms were positively correlated at Wave 1. Neither disorder was found to be a risk factor for the other, though, and depression and problem gambling were not pathoplastically related (increases in one did not result in increases in the other, and vice versa).

While depression and problem gambling are related, their co-occurrence may be better explained not by depressive- or gambling-related risk, but by the presence of a common underlying factor (like substance abuse).

Clinical implications include active screening for and treatment of concurrent mental health disorders like depression; underlying vulnerabilities should be actively researched to better understand, prevent, and treat both depression and problem gambling.

Limitations of the current study: Depressive or problem gambling risk may not be conferred within the five year span that was studied, at least not among emerging adults. Also, while retention rates were fairly high (91.90%, 85.51%, and 78.06% for Waves 2 through 4, respectively), more data was missing over time. Finally, as might be expected in general population samples, rates of depression and problem gambling were low (despite use of symptom counts).

Key Words: major depressive disorder, problem gambling, emerging adults, longitudinal, comorbid, bi-directional, risk, pathoplastic effect

Introduction – Study 3

Investigating Possible Reciprocal Relationships between Depressive and Problem Gambling Symptoms in Emerging Adults

The lifetime prevalence rate of gambling disorder is approximately 0.4-1.0% in the general population, and past-year prevalence is 0.2-0.3% (APA, 2013). Gambling disorder typically originates in adolescence or young adulthood – a developmental trend that is demonstrated by elevated problem gambling (PG) risk in college and university samples. Approximately 42-85% of university students gamble, with 3-23% reporting risky weekly gambling patterns (LaBrie, Shaffer et al., 2003; Lesier, Cross et al., 1991). Compared to other age groups, emerging adults (ages 18-25) (Arnett, 2000), gamble more frequently and are more likely to have a gambling disorder. For example, adolescents problem gamble 2-4 times more often than adults (Blinn-Pike, Lokken, & Worthy, 2010) and, among college students, the lifetime prevalence rate of disordered gambling is 6-11% (Shaffer & Hall, 2001). Specifically, 6.2% of Canadian undergraduates are moderate-risk gamblers and 1.4% have severe PG (Williams, Connolly, et al., 2006). A critical review concluded that being under the age of 29 was a significant risk factor for the development of PG (Johansson, Grant el al., 2009). These results indicate a propensity for early gambling behaviour may develop into PG. The current generation of North American adolescents and young adults is also the first to grow up with exposure to widespread, legalized, government-operated gambling. This increase in gambling accessibility and salience may mean the likelihood of PG development is also greater (Petry, 2004). A focus on the correlates of gambling involvement in emerging adults (including risk factors and consequences) is therefore warranted.

Almost 38% of risky gamblers exhibit some form of mood disorder (Lorains, Cowlishaw & Thomas, 2011). More specifically, compared to other gamblers, pathological gamblers are more likely to be depressed (26% of pathological gamblers vs. 18% of non-pathological gamblers) (Adbollahnejad, Delfabbro & Denson, 2013). Lifetime major depressive disorder (MDD) is also more than three times more common for participants with lifetime PG than for those without (Petry, Stinson & Grant, 2005). Therefore, PG and MDD are positively associated, suggesting these disorders often co-occur. This is clinically significant because, among pathological gamblers seeking treatment, those with a comorbid psychiatric disorder tend to exhibit greater gambling pathology and psychopathology (Ibanex, Blanco et al., 2001).

Compared to their non-gambling peers, adolescent problem gamblers have been found to have poor coping skills, have low self-esteem, be depressed, and have attempted suicide (Blinn-Pike et al., 2010). Further, they are at a greater risk for delinquency, academic problems, social problems, and other addictions. Thus, these results demonstrate that PG and depression are related and their co-occurrence can result in serious negative social and academic consequences among emerging adults.

While these studies support the idea that PG and depression are associated, they do not tell us *how* or *why* they are related. If these disorders are causally related, then their association may be explained via one of two pathways. First, depression may lead to escalations in gambling involvement through maladaptive coping. Jacob's general theory of addictions posits that addictive behaviours like gambling are reinforced and maintained by permitting escape from a painful reality (Jacobs, 1986). A similar idea is proposed by Blaszczynski & Nower (2002), who suggest that emotional vulnerabilities such as MDD leads to problem gambling through classical and operant conditioning (i.e., negative reinforcement to reduce negative affect; see also Stewart & Zack, 2008). Alternatively, the serious negative consequences associated with PG may be sufficient to trigger MDD (Kennedy, Welsh et al., 2010). For instance, one prospective longitudinal study found that PG tended to precede MDD in the majority of cases

(McCormick, Russo, Ramirez, & Taber, 1984). This makes sense, as the financial consequences of PG can lead to serious life stressors (e.g., bankruptcy, divorce, losing one's possessions), which in turn could trigger MDD through diathesis-stress processes (Patten, 2013). These pathways are not mutually exclusive; a bi-directional relationship between PG and MDD symptoms may also be operative. Further, the two may be pathoplastically related, where an increase in one disorder would result in an increase in the other. To better understand the problematic gambling patterns of emerging adults, it is important that the direction of this relationship be better determined. Findings can inform targeted prevention and early intervention approaches.

The Present Study

The present study uses data collected in four waves over five years as part of the Manitoba Longitudinal Study of Young Adults (MLSYA). Conceptualized as a broad study of the risk and protective factors for PG, the MLSYA dataset provided a unique opportunity for better understanding the possible reciprocal relations between MDD and PG in emerging adults. Longitudinal research is particularly helpful when examining gambling antecedents and consequences, as changes in levels of risky gambling can be more reliability studied over time (Little, Preacher, et a., 2007).

Hypotheses

H1: In accordance with previous literature demonstrating that depressive and PG symptoms are related, it was hypothesized that MDD would be positively correlated with PG at Wave 1 when participants were aged 18 to 20.

H2: Based on the theory that depression causes escalations in risky gambling behaviour over time via a maladaptive coping process (Jacobs, 1986), it was hypothesized that higher levels of depressive symptoms at Wave 1 would predict a more pronounced increase in PG over time.

H3: Based on the theory that PG exacerbates depressive symptoms (Kennedy et al., 2010), the reverse was also hypothesized: higher levels of PG involvement at Wave 1 would predict a more pronounced increase in depressive symptoms over time.

H4: Finally, pathoplastic effects were also predicted. Increases in MDD would result in increases in PG, and vice versa, over time.

Graphical depictions of hypotheses appear in Figure 1. Income is differentially related to MDD and PG and past year problem gamblers with mood disorders are more likely to have lower incomes (Kennedy et al., 2010). As a result, personal income was used as a covariate in all analyses.

Method – Study 3

Participants

Random-digit dialing was primarily used to recruit the Manitoban participants. News releases and informational posters placed within gambling facilities also invited self-referral for participation. Geographic and gender quotas were established to ensure that male and female, and urban and rural Manitobans were appropriately represented relative to census data. Following recruitment, selected participants were followed over a five year interval. Recruitment and the first cycle of data collection (Wave 1) took place in fall 2007. Three additional waves of

data collection then occurred in 12 to 18 month intervals: during fall 2008, spring 2010, and spring 2011[5].

At Wave 1, 679 18-20 year olds (mean = 18.92, SD = 0.79) were enrolled. Just over half (51.8%) of the participants were female and most (72.5%) self-identified as being of European descent. In addition to being Canadian, 6.2% of participants were Aboriginal (First Nations or Métis), 6.2% Hispanic, 0.8% White, 0.7% Black, 3.8%, Asian, 0.6% Middle Eastern, and 3.8% reported a primary religious affiliation (Jewish or Mennonite). The mean personal income at Wave 1 was $10,498.87 (SD = $6,837.55, median = $10,000.00).

Measures

The MLSYA battery included over 15 distinct measures, including: personality, emotional disorders, gambling motives, gambling behaviour, gambling problems, and socio-demographics. Only those relevant to the current study are described.

Depressive Symptoms

The Major Depressive Episode (MDE) subscale of the Composite International Diagnostic Interview – Short Form (Kessler, Andrews et al., 1998; CIDI-SF) was used to assess depressive symptoms. This structured interview is aligned with International Statistical Classification of Diseases and Related Health Problems – 10th Revision (WHO, 2010; ICD-10) and DSM-III-R (APA, 1987) diagnostic criteria and was designed for use in epidemiologic studies.

The MDE subscale uses an established diagnostic algorithm and incorporates skip logic. Only participants' responses to the seven symptom-related questions were examined: feeling tired, weight changes, trouble sleeping, trouble concentrating, feeling down, and thoughts about death, and losing interest (e.g., "During a two week period where you felt sad, blue, or depressed, did you lose interest in most things, like hobbies, work, or activities that usually give you pleasure?"). Participants indicated whether they had (1) or had not (0) experienced each symptom.

The CIDI-SF (APA, 1987) MDE scale was scored continuously: the seven depressive item scores were summed to create a 0-7 total. Continuous scores were deemed to be more appropriate for this community sample (rather than categorical diagnosis vs. non-diagnosis scores) as they allow a greater symptom range to be examined (Haarasilta, Marttunen et al., 2005; Karsten, Hartman et al., 2010).

The CIDI-SF (Kessler et al., 1998) is psychometrically sound. A comprehensive review indicated that its test-retest reliability (κs .95) and inter-rater reliability (κs from .71) was adequate to excellent (Wittchen, 1994). Further, 89.6% of major depressive episodes were correctly identified using the CIDI-SF, compared to its longer version (Kessler et al., 1998).

Problem Gambling Symptoms

The Problem Gambling Severity Index (Wynne, 2003; PGSI), a nine-item subscale of the 31-item Canadian Problem Gambling Index (Ferris & Wynne, 2011; CPGI), was used to assess PG outcomes. Developed using the DSM-IV-TR (APA, 2000) and the South Oaks Gambling Screen (Lesieur & Blume, 1987; SOGS) criteria for PG, it measures the extent to which respondents engage in risky or problem gambling behaviours. Five items address PG's diagnostic criteria (e.g., "Have you bet more than you could really afford to lose?") and four address the negative consequences of gambling (e.g., "Has gambling caused any financial problems for you or your household?"). Respondents are asked to indicate the frequency of

[5] For more information, refer to <http://digitalcollection.gov.mb.ca/awweb/pdfopener?smd=1&did=17604&md=1>.

each behaviour or consequence within the last 12 months. Responses were scored on a four-point Likert scale ranging from 0 (never) to 3 (almost always).

The PGSI (Wynne, 2003) was scored continuously: the scores from all nine items were summed to form a 0-27 total. As with depression, continuous scores were deemed to be more appropriate for this community sample (Dellis, Sharp et al., 2014; Slutske, Kackson & Sher, 2003) compared to categorical non-gambler, non-problem gambler, low risk, moderate risk, and problem gambler scores (Currie, Hodgins & Casey, 2013).

The PGSI (Wynne, 2003) is internally consistent (α = .84). Its test-retest reliability over several days is *r* = .78 and it is correlated highly with both the SOGS (Lesieur & Blume, 1987) (*r* =.83) and the DSM-IV (APA, 2000) (*r* =.83) criteria for PG, thereby supporting its criterion validity.

Procedure

The CPGI (Ferris & Wynne, 2011) and the CIDI-SF (Kessler et al., 1998) were administered at each wave as part of a 30-45 minute telephone interview (that included both open- and closed-ended questions).

Statistical Analysis

Missing data analyses, tests of normality, and descriptive statistics were conducted in SPSS 20.0. After assessing each variable, the appropriate distributions were specified in Mplus 7.1 (normal, poisson, zero-inflated poisson, or dichotomous). Once the distribution was selected, univariate latent growth curve models were tested for both MDD and PG. Time was modeled as linear, with Wave 1 serving as the intercept (time coded as 0, 1, 2 and 3 for each of the four waves). Next, a bivariate growth curve (see Figure 1) was run for MDD and PG. Personal income at Wave 1 was entered as a time-invariant covariate.

This bivariate growth curve contained four effects of interest: (a) the correlation between the intercepts, which represents the correlation between MDD and PG symptoms at Wave 1; (b) the correlation between the MDD intercept and the PG slope, which tests whether depression is a risk factor for increased PG; (c) the correlation between the PG intercept and the MDD slope, which tests whether PG is a risk factor for increased depression; and (d) the correlation between the slopes, which tests whether MDD and PG are pathoplastically related.

Data Cleaning

Data from 679 participants was analyzed for the purposes of this study. Retention rates were 91.90% (624 participants), 85.12% (578 participants), and 78.06% (530 participants) for Waves 2-4, respectively. Missing data was handled using a full information maximum likelihood approach.

Univariate distributions were assessed by examining skewness, kurtosis, and visual plots (box plots, histograms, P-P plots). At each wave, MDD and PG were substantially positively skewed. To account for this deviation from normality, variables were modeled as negative binomial distributions using the COUNT (nb) command in Mplus 7.1. Robust standard errors were also calculated using the MLR estimator.

We also considered categorical models, poisson models, and zero-inflated models. In the categorical model, MDD and PG were dichotomized to indicate the likely presence or absence of that disorder. We decided against this method because symptom count scores tend to be more appropriate for community samples. Many participants experienced only a few symptoms of MDD and/or PG, and did not meet the full diagnostic criteria. However, our

method of calculating total scores allows for symptom counts below this threshold to be meaningful and allows for distinctions in symptom frequency and severity to be more readily made[6].

Poisson models, which are discrete probability distributions, were also examined. Here, the linear predictor of the regression model was connected to the outcome via a natural logarithm function. Another property of the poisson model, however, is that the mean must equal the variance. When the variance exceeds the mean, as it did with our data, then a negative binomial model is more appropriate (the standard error will be reliably larger, reflecting the additional outcome variance). When the data are over dispersed, the poisson models yield statistical tests that are too liberal[7], thereby increasing the probability of Type I error (Atkins, Baldwin et al., 2013).

Finally, zero-inflated models were considered. Here, 0 scores were modelled as a separate process from the poisson portion of the model (Atkins, Baldwin et al., 2013; Atkins & Gallop, 2007). While potentially appropriate for use in univariate growth models, this approach lacks parsimony when used with bivariate growth curves. Indeed, adding a zero-inflated component to the model outlined in Figure 1 would have doubled the number of parameters required (through simultaneous modeling of both the zeroes and poisson distributed portions) making the model more difficult to interpret, as well as increasing the Type I error rate (by doubling the number of paths in the model)[8].

Thus, having concluded that the negative binomial models with robust standard errors were the best fit for the data, we proceeded with this approach as the primary analytic strategy. Lastly, by converting the Wave 1 personal income values to z-scores and using 3.29 as a cut off, it was determined that many univariate outliers existed. All 21 of these outliers were removed[9].

Results – Study 3

Univariate Growth Curves

Means and standard deviations at each wave are presented in Table 1. Before examining the bivariate growth curve, univariate linear growth curves for both variables of interest were modelled. Looking first at the univariate growth curve for MDD, the intercept (intercept = -1.69, p <.01) and the variability of the intercept (σ = 5.52, p < .05) were significant but the slope (slope = -0.58, p = .198) and the variability of the slope (σ = 0.13, p = .132) were not. This suggests there are between-subject differences in MDD symptoms, with some emerging adults experiencing more symptoms at Wave 1, but no within-subject change in

[6] Categorical models were run, but the results replicate those presented below (using derived symptom count variables).

[7] When poisson models were run, many previously non-significant pathways became significant. Given the limitations of poisson models discussed above, we attributed this discrepancy to Type I error.

[8] Negative binomial inflated zero models were run, but since these more complicated models replicated the main analyses reported, we decided not to report them in the interest of maintaining model parsimony.

[9] At Wave 1, participants were 18-20 years old so it is highly unlikely they would have high annual personal incomes. It was assumed the question was misinterpreted so the outliers were deleted. When the outliers were retained or Winsorized, the models failed to converge because the matrix was not positive definite.

symptoms over time. For PG, the intercept and slope were significant (intercept = -1.17, $p < .001$; slope = -0.84, $p < .001$), suggesting there is systematic change in individual levels of PG across waves. There was also significant variability in the intercept ($\sigma = 2.50$, $p < .001$) and the slope ($\sigma = 0.26$, $p < .001$), suggesting on average, some emerging adults experience increased symptoms while others saw a decrease.

Bivariate Growth Curve

Refer to Table 2 and Figure 2 for a summary of the bivariate growth curve results. Looking at MDD: its intercept and slope were uncorrelated, suggesting having symptoms of MDD at Wave 1 is unrelated to future changes in MDD symptoms. Neither MDD's intercept nor its slope was correlated with personal income, suggesting that Wave 1 income is unrelated to MDD symptoms at Wave 1 or over time. PG's intercept and slope were positively correlated, suggesting greater symptoms of PG at Wave 1 were related to greater escalations in PG over time. The intercept of PG was positively related to personal income, suggesting, at Wave 1, emerging adults with a higher income tend to exhibit more symptoms of PG. The slope of PG, however, was uncorrelated with personal income, suggesting that income at Wave 1 is unrelated to changes in PG involvement over time.

The intercepts of MDD and PG were positively correlated, suggesting that, at Wave 1, emerging adults experiencing MDD symptoms also tend to exhibit symptoms of PG, and vice versa. The intercept of MDD and the slope of PG were uncorrelated, suggesting Wave 1 MDD symptoms are unrelated to changes in PG involvement over time. The intercept of PG and the slope of MDD were also uncorrelated, suggesting Wave 1 PG symptoms are unrelated to changes in MDD symptoms over time. Finally, the slopes of MDD and PG were uncorrelated, suggesting changes in one disorder are not associated with changes in the other.

Discussion – Study 3

The bivariate growth curve showed that MDD and PG symptoms were positively correlated at Wave 1, which supports H1 and is consistent with previous literature (Adbollahnejad et al., 2013; Petry et al., 2005). Contrary to H2 and H3, neither disorder was found to be a risk factor for the other. Furthermore, MDD and PG were not pathoplastically related, thus failing to support H4.

It may be that symptoms do not vary sufficiently within the emerging adult period. Depressive symptoms tend to emerge between ages 13-15 (for both overall rates of MDD and new cases) (Hankin, Abramson et al., 1998). From 15-18 symptom rates then increase dramatically (for both genders), before plateauing from 18-21 (overall rates of MDD do not continue to increase and new cases decline). These results are consistent with our univariate MDD growth curve, which showed between- but not within-subject symptom change over time. Since there was little evidence of improvement or decompensation in depressive symptoms between 18-25 years, this age range may have been ill-suited for the longitudinal study of MDD risk factors. It is therefore unsurprising that PG did not increase MDD risk. Likely, its risk factors exert a greater influence earlier in life (i.e., in adolescence).

PG, on the other hand, appears to be more transitory and episodic. Mid-adolescent gambling involvement is thought to lead to gambling problems which may, in turn, predict continuance of adult gambling problems. Alternatively, adolescents may mature out of their gambling problems (Wanner, Vitaro et al., 2009). These results are consistent with our univariate PG growth curve, which showed systematic change in individual symptoms levels

over time. Intercept and slope variability suggested some emerging adults experienced increased symptoms while others saw a decrease. This systematic and within-person PG change suggests that we had a reasonable chance of finding MDD as a risk factor for PG. However, this hypothesis was unsupported by the data. It is therefore possible the co-occurrence of depressive and gambling symptoms at Wave 1 may be better explained not by MDD related risk but by the presence of a common underlying causal factor.

A systematic meta-analytic review found that, in addition to depression (weighted mean effect size of 23.1%), disordered gamblers also experienced high levels of alcohol misuse (28.1%), illicit drug use (17.2%), and nicotine dependence (60.1%) (Adbollahnejad et al., 2013). The link between MDD and substance use has been clearly established; both are also related to PG involvement. Substance use may therefore be a "third variable" underlying the MDD-PG relationship at Wave 1. For example, in a sample of 1,430 undergraduate students, disordered gamblers exhibited disproportionately higher depression (40.0% vs. 23.3% in the general population) and problem drinking (81.6% vs. 28.1% in the general population) co-morbidity rates (Martin, Usdan et al., 2014). Furthermore, participants who met the threshold for problem drinking also evidenced higher gambling rates (9.0% vs. 4.2% for the entire sample) and participants who met the threshold for depression were engaging in more problematic gambling (9.4%, vs. 4.2% for the entire sample).

Limitations

At Wave 1, in fall 2007, participants were aged 18-20. Three additional waves of data collection occurred in fall 2008, spring 2010, and spring 2011. At Wave 4, participants were approximately 23 to 25 years old. As previously discussed, it is possible that peak MDD and/or PG symptoms occur before or after this age range or that risk is not conferred within five years. The dichotomous scoring for the problem gambling measures also remains as a limitation. Problem gambling may be too broadly defined with this dichotomous scoring, and is not directly comparable to prior research using other scoring schemes (however, see Rockloff & Dyer, 2006 for a precedent using this coding scheme). Second, while retention rates were fairly high, more PGSI (Wynne, 2003) and CIDI-SF (Kessler et al., 1998) data was missing over time. This is a problem if data was missing not at random; for example, if the participants with more severe psychopathology participated less over time. However, maximum likelihood approaches, which were used in the present study, are among the most effective in handling missing data (Enders & Bandalos, 2011). There are also limitations of the MYLSA dataset itself. Though retention rates were generally good, approximately 22% of the data were missing by the final wave, reducing statistical power. Though the sample was generally representative, we were not able to examine differences in specific at-risk populations, such as First Nations participants, because the majority of participants were of European descent. Moreover, though the measures of anxiety and depression contained in this dataset are useful clinical tools, it would have been better to use measures more appropriate for non-clinical populations (e.g., the Center for Epidemiological Depression Scale; Radloff, 1977) to increase the variability in these measures to increase statistical power. Broadly speaking, this sample had relatively good psychological health on the whole, which substantially reduced statistical power to test effects.

Finally, rates of depression and problem gambling involvement were low in our sample, despite the use of symptom count scores. However, our use of negative binomial distributions and robust standard errors helps mitigate this limitation.

Conclusion

The bivariate growth curve supports the co-occurrence of MDD and PG in emerging adults. Therefore, active screening for and treatment of co-occurring mental health disorders like depression may be critical for help-seeking gamblers. For example, among pathological gamblers seeking treatment, those with a comorbid psychiatric disorder have been shown to exhibit greater severity of both gambling pathology and psychopathology (Ibanez et al., 2001). Further, MDD is associated with suicide, and in a sample of 500 problem gamblers, 48% reported suicide ideation and 13% reported suicide attempts (Frank, Lester & Wexler, 1991). MDD and bipolar disorder outpatients with comorbid PG were more than twice as likely to have attempted suicide in the past month as were those without (Kennedy et al., 2010).

Given the co-occurrence of MDD and PG, clinicians should screen for and provide treatment for both disorders. We cannot assume that treating one will resolve the other, as these disorders were found to be unrelated over time. Once common factors underlying the MDD-PG relationship are identified, these should be further targeted in preventative interventions. Although individuals with comorbid disorders tend to have lower psychosocial functioning, treatment has been found to effective and satisfying regardless of co-occurring disorder frequency (Soberay, Faragher et al., 2014).

References – Study 3

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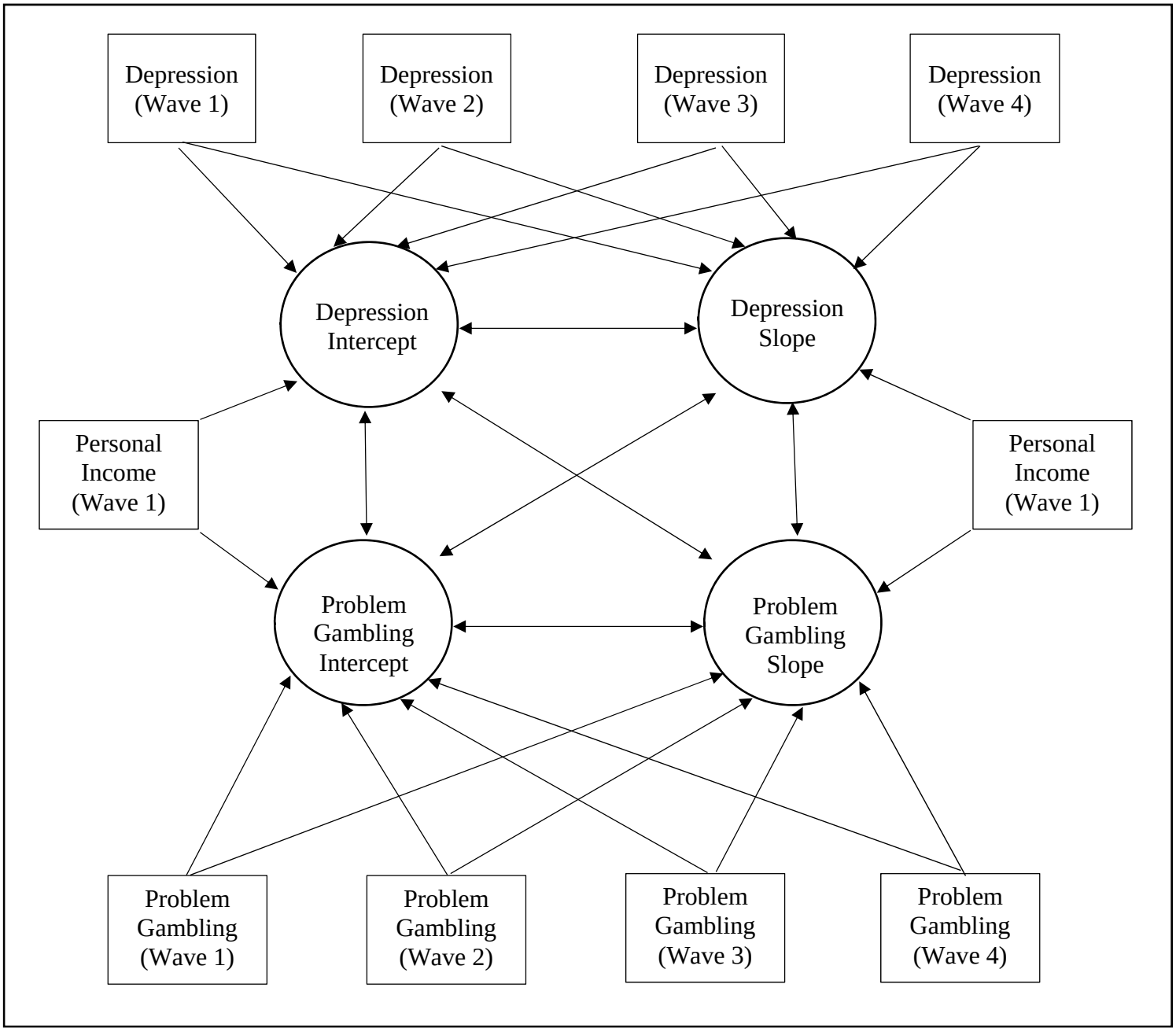

Figure 1 Model of bivariate growth curve hypotheses

Note. Bivariate growth curve analysis of emotional disorder and gambling symptomology. Rectangles represent measured variables and ovals represent latent intercepts and slopes. Double-headed arrows represent factor loadings.

Table 1 Sample descriptive statistics

	Wave 1	Wave 2	Wave 3	Wave 4
Depression Symptomology	0.79 (1.81)	0.85 (2.32)	0.92 (2.40)	0.43 (1.45)
Problem Gambling Symptomology	0.97 (2.01)	0.66 (1.77)	0.59 (1.96)	0.41 (1.48)
Personal Income	10,495 (6,837.55)			

Note. Mean (standard deviation) presented for each variable of interest at each applicable wave.

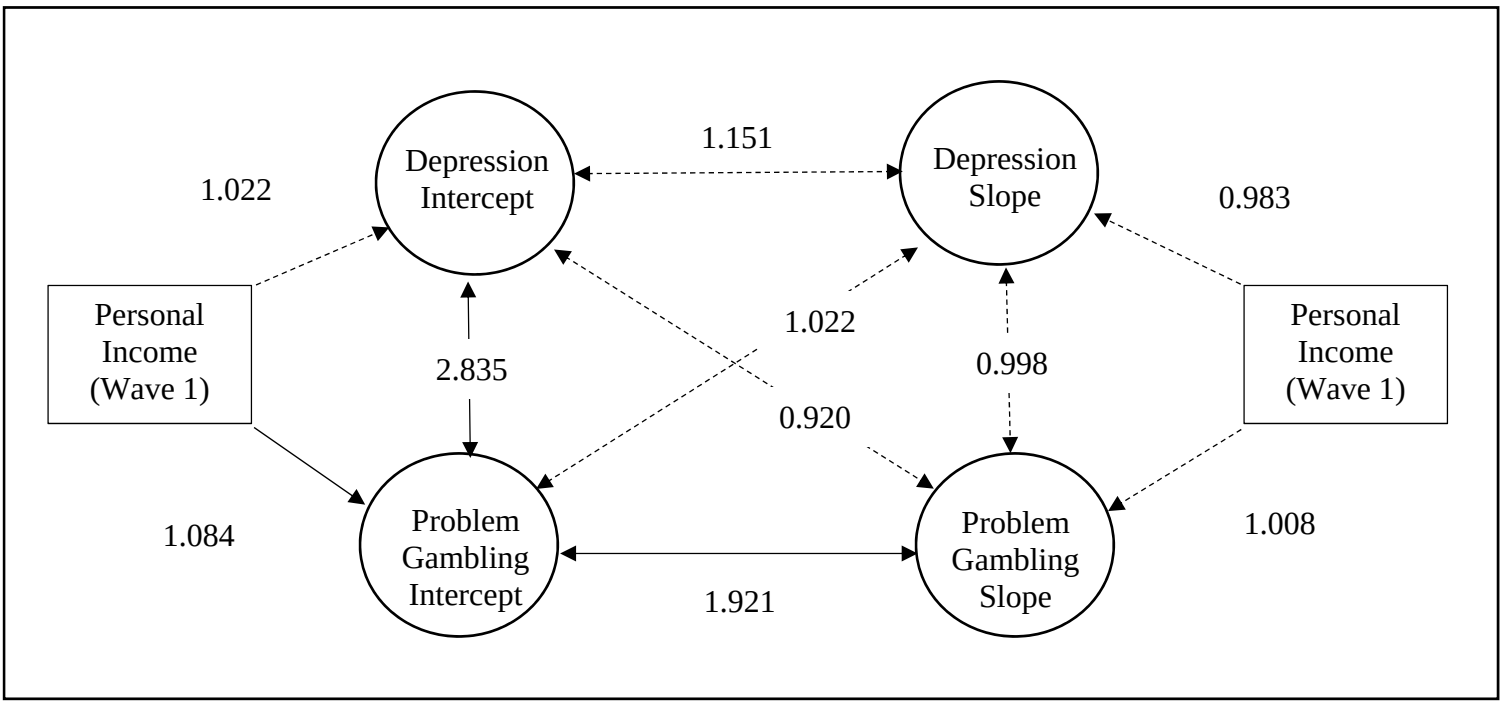

Figure 2 Model of depression and problem gambling bivariate growth curve

Note. Bivariate growth curve analysis of depressive and gambling symptomology. Rectangles represent measured variables and ovals represent latent intercepts and slopes. Double-headed arrows represent factor loadings. Single-headed arrows represent paths. Solid arrows represent statistically significant pathways and dotted arrows represent non-significant pathways. Numbers represent incident rate ratios for paths and correlations.

Table 2 Depression and problem gambling results

	B	p	Standard Error	Incident Rate Ratio	99% Confidence Interval of Incident Rate Ratio
Depression Intercept on Depression Slope	0.141	.943	1.965	1.151	[.007, 181.454]
Gambling Intercept on Gambling Slope	0.653	.000	0.123	1.921	[1.402, 2.635]
Depression Intercept on Gambling Slope	-0.083	.751	0.262	0.920	[.469, 1.808]
Gabling Intercept on Depression Slope	0.022	.952	0.370	1.022	[.394, 2.651]
Depression Intercept on Gambling Intercept	1.042	.002	0.337	2.835	[1.190, 6.753]
Depression Slope on Gambling Slope	-0.002	.953	0.030	0.998	[.924, 1.079]
Depression Intercept on Personal Income	0.022	.197	0.025	1.022	[.958, 1.092]
Depression Slope on Personal Income	-0.017	.399	0.010	0.983	[.958, 1.008]
Gambling Intercept on Personal Income	0.081	.000	0.001	1.084	[1.058, 1.112]
Gambling Slope on Personal Income	0.008	.288	0.006	1.008	[.993, 1.022]

Note. Statistically significant pathways ($p < .05$) are bolded.