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ORIGINAL PAPER

Testing the Validity of a Cognitive Behavioral Model for Gambling Behavior

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Abstract Currently, cognitive behavioral therapies appear to be one of the most studied treatments for gambling problems and studies show it is effective in treating gambling problems. However, cognitive behavior models have not been widely tested using statistical means. Thus, the aim of this study was to test the validity of the pathways postulated in the cognitive behavioral theory of gambling behavior using structural equation modeling (AMOS 20). Several questionnaires assessing a range of gambling specific variables (e.g., gambling urges, cognitions and behaviors) and gambling correlates (e.g., psychological states, and coping styles) were distributed to 969 participants from the community. Results showed that negative psychological states (i.e., depression, anxiety and stress) only directly predicted gambling behavior, whereas gambling urges predicted gambling behavior directly as well as indirectly via gambling cognitions. Avoidance coping predicted gambling behavior only indirectly via gambling cognitions. Negative psychological states were significantly related to gambling cognitions as well as avoidance coping. In addition, significant gender differences were also found. The results provided confirmation for the validity of the pathways postulated in the cognitive behavioral theory of gambling behavior. It also highlighted the importance of gender differences in conceptualizing gambling behavior.

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Introduction

The gambling literature has implicated a range of variables in the development and maintenance of problem gambling (e.g., Blaszczynski and Nower 2002; Raylu and Oei 2004b). These included familial/genetic, sociological and individual (e.g., an individual's personality, biochemistry, psychological states and cognitions) factors (Raylu and Oei 2002). Researchers have presented comprehensive models that have integrated complex interactions between these factors (e.g., Blaszczynski and Nower 2002; Sharpe 2002, 2003). Despite the numerous models in the gambling literature, there has been a significant lack of studies that have assessed the validity of these models via statistical means.

Several reviews have suggested that of all the various psychotherapies suggested for the treatment of problem gambling, cognitive behavioral therapy appear to have been most studied and has shown to be effective in treating gambling problems (Raylu and Oei 2002; Toneatto and Ladoceur 2003; Toneatto and Millar 2004; Oei et al. 2010; Loo et al. 2012). Cognitive behavioral theories postulate that gambling is a consequence of principles of operant (intermittent wins produce states of arousal), and classical (repeated pairings of arousal and the gambling environment) conditioning (Lehman and Salovey 1990; Hersen and Bellack 1999). Gambling is reinforced when negative emotional states are reduced by excitement of gambling (i.e., physiological arousal; Stewart et al. 2008). As gambling becomes habitual, thinking errors regarding personal skill and probability of winning develops. With continued gambling, complex interactions between gambling cognitions and physiological arousal strengthen as they are reinforced which encourages continued gambling despite losses (Sharpe 2002). Internal states (e.g., boredom or stress) or external gambling cues elicit patterns of arousal and gambling urges, which trigger gambling-related cognitions (Raylu et al. 2013). Poor coping strategies, which could be related to a deficient in the gambler's life skills (e.g., problem solving; Carver et al. 1989) or externally mediated factors (e.g., mood or substance use), are likely to lead to a failure to resist the urge, impairs decision making processes and encourage individuals to continue gambling despite significant losses (Sharpe and Tarrier 1993; Sharpe 2002; Loo et al. 2014).

Most of the existing comprehensive models of problem gambling (e.g., Blaszczynski and Nower 2002; Sharpe 2002, 2003; Oei and Goh 2014) incorporate the cognitive behavioral theory to explain the development and maintenance of gambling problems. These models support three important cognitive behavioural variables including negative psychological states (i.e., depression, anxiety and stress), avoidance coping (e.g., denial, substance use, self-blame, behavioral disengagement and self-distraction), and gambling cognitions in predicting gambling behavior (Loo et al. 2012; Raylu and Oei 2004a; Oei et al. 2008; Oei and Goh 2014). The substance abuse literature also supports the role of these variables in predicting substance use (Lin et al. 2006; Sartor et al. 2007; Andrews et al. 2008).

Previous research show that these three variables often interact with one another. First, psychological states (e.g., depression, anxiety and stress) have been significantly related to gambling cognitions. Casey et al. (2008) reported significant negative correlations between negative mood states (depression, anxiety and stress) and scores on an instrument assessing

individual's belief as to whether or not they could resist an opportunity to gamble in a given situation among both clinical and community samples. Some studies have also found high correlations between gambling cognitions and negative psychological states such as depression and anxiety (Tang and Oei 2011; Raylu and Oei 2004a; Oei et al. 2008; Oei and Goh 2014). Källmén et al. (2008) observed that fallacious beliefs of control and gaming outcomes among gamblers are related to gamblers' self-perceived experience of depression, although the role of depression as a trigger or consequence of gambling behaviors remains to be determined. The relationship between negative psychological states and cognitions has also been supported by the substance abuse literature (Hasking and Oei 2004, 2007; Oei and Goh 2014). Hasking and Oei (2007) reported that negative expectancies interacted with venting emotion in predicting volume and frequency of drinking in the dependent sample.

Second, psychological states have been significantly related to coping styles. A number of researchers have reported that some individuals gamble to regulate or escape from negative psychological states (Wood and Griffiths 2007; Donahue and Grant 2007). Studies have also found high maladaptive coping styles, especially avoidance coping styles such as use of distracting behaviors or escaping problems through fantasy, denial and substance use among those experiencing gambling problems (Nower et al. 2004; Matheson et al. 2009; Lightsey and Hulsey 2002). Farrelly et al. (2007) reported that individuals, who are more depressed, engage in escape-avoidance coping techniques. Bergevin et al. (2006) reported that the association between stressful life events and gambling severity is mediated by emotional coping among adolescents. Lightsey and Hulsey (2002) found that gambling was related to emotion-focused coping in high stress conditions for men who are non-impulsive.

Third, researchers that have explored coping styles among gamblers and problem gamblers have found a relationship between gambling behavior/problem gambling and avoidance coping styles. Studies have shown that there is an increased likelihood of using avoidance/emotional coping compared to problem focused coping among problem gamblers (e.g., Gupta et al. 2004; Matheson et al. 2009; Nower et al. 2004; Thomas et al. 2011). However, coping styles appear to be dependent on gender (Nower et al. 2004). Nower et al. (2004) explored the relationship between problem gambling and coping styles among 637 male and 702 female adolescents. Non-gambling males were more likely than social gamblers or problem gamblers to use active, task-oriented strategies for coping with stress. On the other hand, problem gambling males were more likely to engage in distracting behaviors, fantasy, humor, denial and substance abuse to cope with stress. Among females, the only significant result found was that non-gamblers used significantly more active coping and planning than social gamblers and were less likely to use substances to cope than either social gamblers or problem gamblers. In addition, Matheson et al. (2009) also observed that female problem gamblers relied on social support more than males in coping with depression associated with pathological gambling.

Another important variable that is contained in the cognitive behavioral models of gambling behavior and has been shown to predict gambling behavior is gambling urges. Negative psychological states (i.e., depression, anxiety and stress), avoidance coping, and gambling urges can influence gambling behavior indirectly via gambling cognitions or directly. To determine the validity of these cognitive behavioural pathways, they need to be validated statistically. Thus, the aim of the first part of this study was to use structural equation modeling to assess the validity of the pathways postulated in the cognitive behavioral theory of gambling behavior. It is predicted that the cognitive behavioral model assessed will be a good fit to the data and the above parameters and relationships will be substantiated.

These particular cognitive behavioural variables were chosen from the existing biopsychosocial models for a number of reasons. First, previous studies in the gambling literature had shown that these are important variables in the development of maintenance of problem gambling (Raylu and Oei 2002). Furthermore, the aim was to assess the cognitive behavioral component of the model (rather than the biological component). Second, since this was the first time such a study had been conducted in the gambling literature, the aim was to evaluate a parsimonious model. Thus, predisposing factors, biological factors and different types of gambling were not included in the assessed model. Finally, a mixture of state and trait constructs was included in the assessed model as the gambling literature suggests that both these constructs affect gambling behaviors (Raylu and Oei 2002). The aim was to test an associative model (see Figs. 1, 2) rather than a predictive/mechanistic model of gambling.

Significant gender differences have been reported for some of these gambling related variables of interest including motivations toward gambling, forms of gambling, gambling urges, gambling cognitions, etc. (Burger et al. 2006; Echeburúa et al. 2011; Heater and Patton 2006; Ko et al. 2005; Tang et al. 2007). Second, current problem gambling models

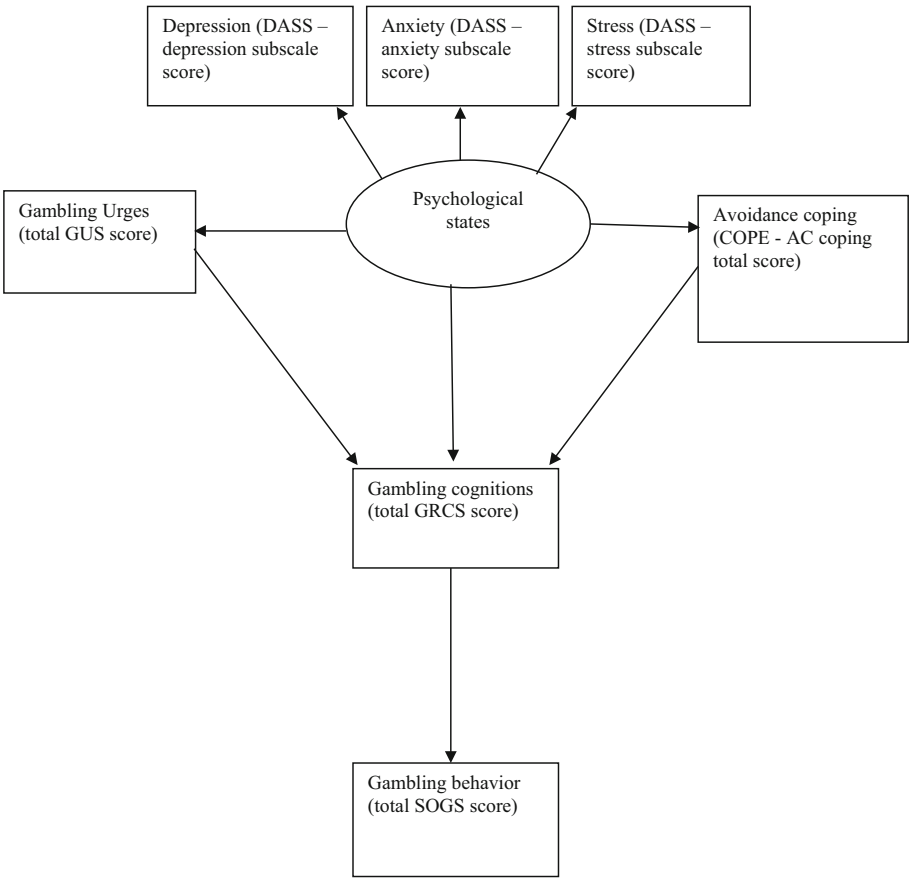

Fig. 1 Model 1 showing the relationships of gambling urges, psychological states and avoidance coping with gambling behavior via gambling cognitions

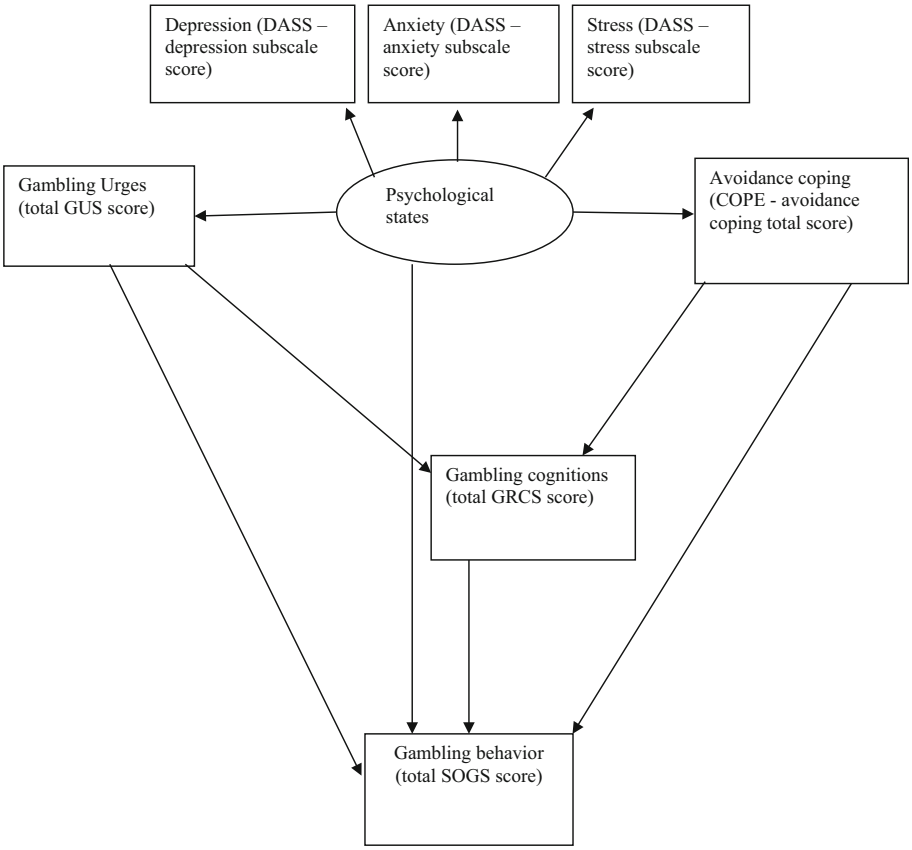

Fig. 2 Model 2 showing the relationships of gambling urges, psychological states and avoidance coping with gambling behavior both directly as well as indirectly via gambling cognitions

are based on studies in the gambling literature that have predominantly male samples (Raylu and Oei 2002; Wenzel et al. 2009). Thus, it is possible that the level of the proposed constructs would be different for the two genders. This is supported in the current literature (Raylu and Oei 2002). Thus, the second part of the study aims to assess whether the magnitude of parameter estimates between the variables vary for the two genders. Given the gender differences found in a number of gambling variables in the literature, it is predicted that the magnitude of parameter estimates between the variables would be different for the two genders.

Method

Participants

Nine hundred and sixty-nine participants (63.4 % females) with a mean age 31.8 years (range 16–73) were involved in this study. Approximately 52.4 % of the individuals were single, 42.9 % were married and 4.7 % had other marital statuses (e.g., divorced, separated

or widowed). 33.2 % identified themselves as Catholics, 22.5 % reporting having no religion, 21.2 % identified themselves as Protestants, 8.7 % as Anglicans, 3.6 % as Buddhists, 2.5 % as Hindus, and 8.3 % as other religions.

Sixty-four percent had South Oaks Gambling Screen (SOGS) score of zero, 31.3 % had SOGS score of 1–4 and 4.7 % had a SOGS score of $\geq$5. These figures are consistent to those reported in comprehensive reviews in the problem gambling literature (Petry and Armentano 1999; Raylu and Oei 2002), which have stated that lifetime prevalence rates have ranged from 0.1 to 5.1 % (our figure of 4.7 % is within the literature range).

Measures

The following well established and commonly found measures in the gambling literature were used in this study:

1. The South Oaks Gambling Screen (SOGS; Lesieur and Blume 1987)
2. The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond and Lovibond 1995; Oei et al. 2013; Antony et al. 1998)
3. The Gambling Related Cognitions Scale (GRCS; Raylu and Oei 2004a)
4. The Gambling Urge Scale (GUS; Raylu and Oei 2004b)
5. The Brief COPE (Carver 1997; Hasking and Oei 2002).

The validity and reliability were published previously and thus, they were not presented in full here. In addition, a short questionnaire pertaining to demographic information (e.g., gender, age, employment status, education level and ethnicity) was also completed.

Procedures

This project was advertised in the local newspapers and volunteers from the community who agreed to participate in the study were either handed or mailed a set of questionnaires and asked to return them to the researchers in stamped, addressed envelopes. Students from a local University completed the questionnaires in groups of 8–11 in the presence of a researcher. All participants were provided the battery of questionnaires in the same order. The average time taken to complete the questionnaires was 30 min. The overall response rate (% of questionnaires returned) was 90 %, whereas the overall completion rate (% of returned questionnaires that were completely answered) was 95 %. Responses were confidential to the researchers, and participants used identifying codes rather than names.

Data Analyses

All data cleaning and descriptive analyses were conducted using SPSS version 20. Minor missing data (e.g., 1–2 unanswered items per questionnaire) were found for approximately two percent of individuals and these were replaced with means. All variables were within the acceptable range for skewness and kurtosis (i.e., $\pm$2.00) except for gambling urge and SOGS (positive skew), and DASS-anxiety, GUS, GRCS and SOGS (positive kurtosis); which is reasonable in consideration of the sample being from the community. Pearson product-moment correlations were calculated to show the relationships between all of the variables (see Table 1). AMOS 20, a path analysis program was used to assess the extent to which the model tested fit the data. Structural equation modeling uses a hypothesis testing approach to analyze structural theory on a phenomenon (Byrne 2001). Maximum likelihood procedures were used to estimate parameter estimates and fit indices.

Table 1 Descriptive statistics and correlation matrix of the assessed variables

Variables	SOGS-T	GRCS-T	GUS-T	DASS-D	DASS-A	DASS-S	COPE-AC	Mean (SD)
SOGS-T	1	.43***	.43***	.22***	.21***	.15***	.22***	0.89 (1.90)
GRCS-T		1	.41***	.14***	.20***	.12***	.17***	40.52 (19.71)
GUS-T			1	.14***	.15***	.11**	.19***	7.44 (3.62)
DASS-D				1	.69***	.77***	.61***	8.44 (9.32)
DASS-A					1	.73***	.59***	6.44 (8.26)
DASS-S						1	.54***	11.98 (10.07)
COPE-AC							1	7.10 (5.36)

SOGS-T South Oaks Gambling Screen total score, *GRCS-T* Gambling Related Cognitions Scale total score, *GUS-T* Gambling Urges Scale total score, *DASS-D* Depression Anxiety Stress Scale-Depression subscale score, *DASS-A* depression Anxiety Stress Scale-Anxiety subscale score, *DASS-S* Depression Anxiety Stress Scale-Stress subscale score, *COPE-AC* COPE-avoidance coping total score

** $p < 0.01$; *** $p < 0.001$

To assess gambling cognitions, the total GRCS score was used. The GUS total score was used to assess gambling urges. The total score of five brief COPE subscales (COPE-SD subscale score, COPE-DL subscale score, COPE-SU subscale score, COPE-BD subscale score and COPE-SB subscale score) representing avoidance coping styles were used to assess avoidance coping. The three subscales of the DASS (depression, anxiety, and stress subscale scores) were used to assess the three respective psychological states. The three DASS subscale scores were used rather than the total score (as was used for other measured variables) as most validation data/studies on this questionnaire report on the three subscales separately rather than the total DASS score (e.g., Lovibond and Lovibond 1995).

A number of parameter estimates were explored. First, the parameter estimates needed to be viable and reasonable. That is, correlations needed to be less than 1.00 and variances needed to be positive (Byrne 2001). Second, standard errors were required to be neither excessively large nor small (Joreskog and Sorbom 1989). Finally, the statistical significance of parameter estimates (assessed via a test statistic called critical ratio—parameter estimate divided by its standard error) had to be greater than ±1.96 (based on 0.05 significance level) (Byrne 2001).

The fit of the models were assessed using a range of goodness-of -fit indices. Chi-square (χ^2) is one of the most commonly used goodness of fit index. A large χ^2 in relation to the degrees of freedom indicates a poor fit. Ideally, χ^2/df ratio should be no more than 4 (Byrne 2001). However, since a non-significant χ^2 is difficult to achieve with large sample sizes (Bentler 1990; Marsh et al. 1988), a range of other fit indices were also used, including Bentler Bonett Normed Fit Index (NFI) and the Comparative Fit Index (CFI). By convention, these values are regarded acceptable if they are generally greater than 0.9 (Marsh 1993; Bentler 1995). The root mean square error of approximation (RMSEA), which is based on population error of approximation measures "discrepancy per degree of freedom", was also used (Joreskog and Sorbom 1993, p. 124). A value of 0.05 or less is recognized as suggesting a close fit (values up to 0.08 is recognized as a reasonable error of approximation).

Prior to testing for invariance across the genders, the baseline model for each gender was completed. An initial test was performed to a differential multigroup model without equality constraints specified to the pathways of the model. The model was then tested

once equality constraints were specified to the pathways in the model. Specifically, this process involved first selecting the group for which labels apply and labeling all parameters to be constrained equal across the two genders (Byrne 2001). The estimated values of the structural paths for the males will be held constrained at those values for the female group (i.e., the structural paths were constrained equally across the two groups).

Results

Distribution of Measured Variables and Relationship Between Assessed Variables

Table 1 presents the means and standard deviations of the measured variables in the models. The correlation matrix of all the variables used for testing the models has also been presented in Table 1 to provide a summary of how each variable in this study was related to one another. All variables significantly and positively correlated with one another, with correlations ranging from .11 to .77.

Models Testing

Model 1 assumed that negative psychological states (i.e., depression, anxiety and stress), avoidance coping, and gambling cognitions can predict gambling behavior indirectly via gambling cognitions. Analyses of Model 1 (as shown in Fig. 1) showed that only some of the fit indices were acceptable indicating that this model was not the best fit to the data [$\chi^2(12) = 188.25$, $p < 0.01$]. Although both fit indices were above 0.9 (CFI = 0.94; NFI = 0.93), the RMSEA value was above the preferred 0.08 level (RMSEA = 0.12). Parameter estimates in relation to correlations, variances and standard errors were all appropriate (i.e., all correlations were less than 1.00; all variances were positive, and all standard errors were neither excessively large nor small). However, the critical ratio was less than ±1.96 (based on 0.05 significance level) for the psychological states to gambling urges pathway.

Next, the validity of Model 2 was assessed. Model 2 assumed that the three negative psychological states, avoidance coping, and gambling cognitions can predict gambling behavior indirectly via cognitions as well as directly. The non-significant pathway found in Model 1 was removed from this model. This model can be found in Fig. 2. This showed a better fit [$\chi^2(10) = 68.16$, $p < 0.01$]. However, as with Model 1, although both fit indices were above 0.9 (CFI = 0.98; NFI = 0.98), the RMSEA value was 0.08 rather than below the preferred 0.08 level. Parameter estimates in relation to correlations, variances and standard errors were all appropriate (i.e., all correlations were less than 1.00; all variances were positive, and all standard errors were neither excessively large nor small). However, the critical ratio was less than ±1.96 (based on 0.05 significance level) for the avoidance coping to gambling behavior pathway indicating that this pathway was not significant.

Finally, the validity of the third model was assessed (Model 3) which consisted of the pathways of Model 2 (except the non-significant pathway from avoidance coping to gambling behavior). Model 3 (see Fig. 3) showed a good fit to the data [$\chi^2(11) = 82.29$, $p < 0.001$] where all fit indices were in the appropriate range. Both fit indices were above .90 (CFI = .98; NFI = .98). Furthermore, the RMSEA value was at the preferred .08 level (RMSEA = 0.08). All parameter estimates were appropriate (i.e., all correlations were less

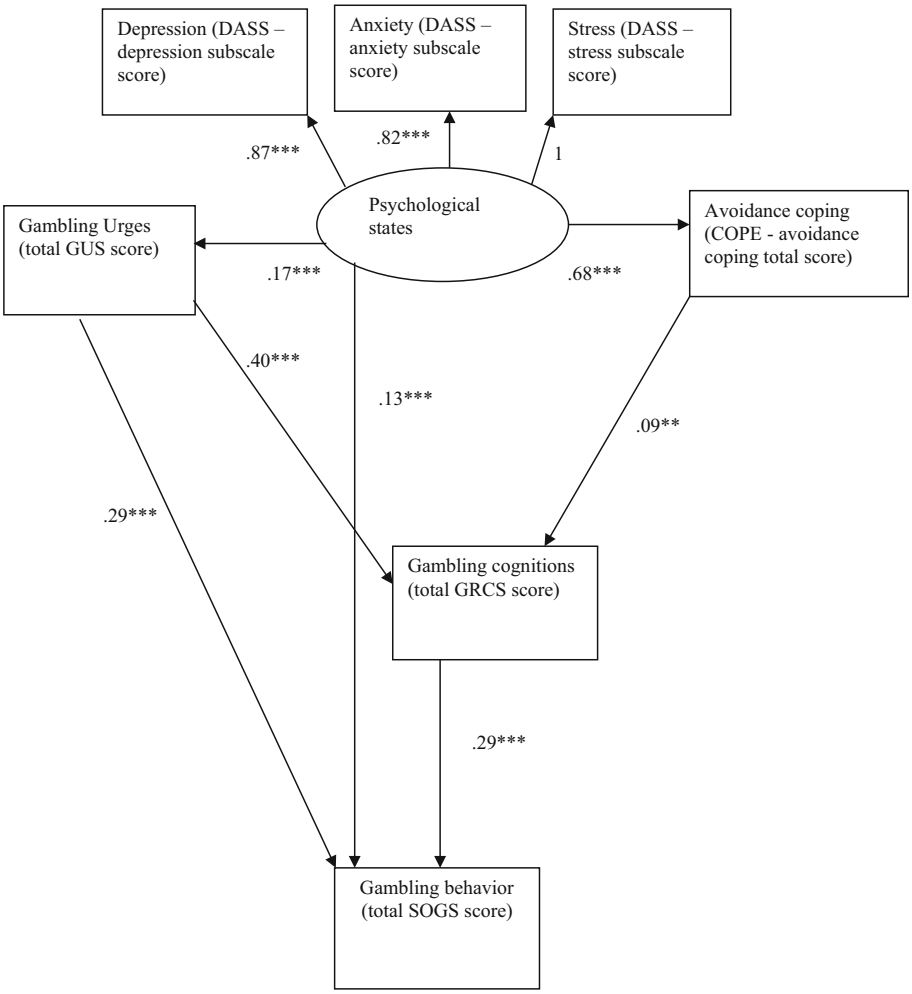

Fig. 3 Model 3 (including estimate of regression weight for the pathways) for all participants (***$p < 0.001$; **$p < 0.01$; *$p < 0.05$)

than 1.00; all variances were positive, and all standard errors were neither excessively large nor small). Finally, all critical ratio values were less than ± 1.96 (based on 0.05 significance level) indicating all pathways were significant. Model 3 (with standardized estimates) can be found in Fig. 3.

Testing Invariance Across Genders

Gender Differences

Significant gender differences were found for a number of assessed variables including total GRCS, GUS and SOGS scores ($p > 0.01$). These differences have been either

published in other papers (Raylu and Oei 2004a, b) or will be described in more detail in subsequent papers.

Baseline Models

Prior to testing for invariance across the genders, the baseline model (i.e., Model 3) for each gender was completed. Overall fit for the female model was good [$\chi^2(df = 11) = 67.99$, CFI = 0.97; NFI = 0.96, RMSEA = 0.09]. Overall fit indices for the male model was also good [$\chi^2(df = 11) = 35.07$, CFI = 0.98; NFI = 0.97; RMSEA = 0.07]. See Figs. 4 and 5 for the male and female models (with standardized estimates), respectively.

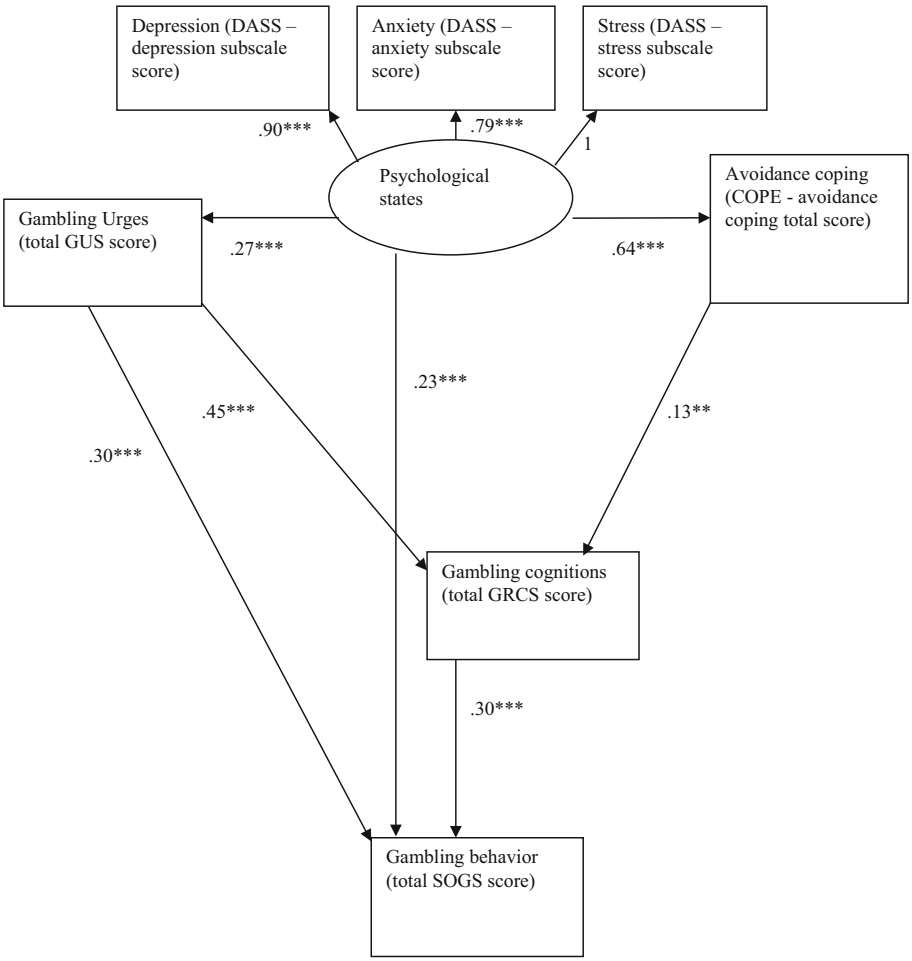

Fig. 4 Model 3 (including estimate of regression weight for the pathways) for males only (***$p < 0.001$; **$p < 0.01$; *$p < 0.05$)

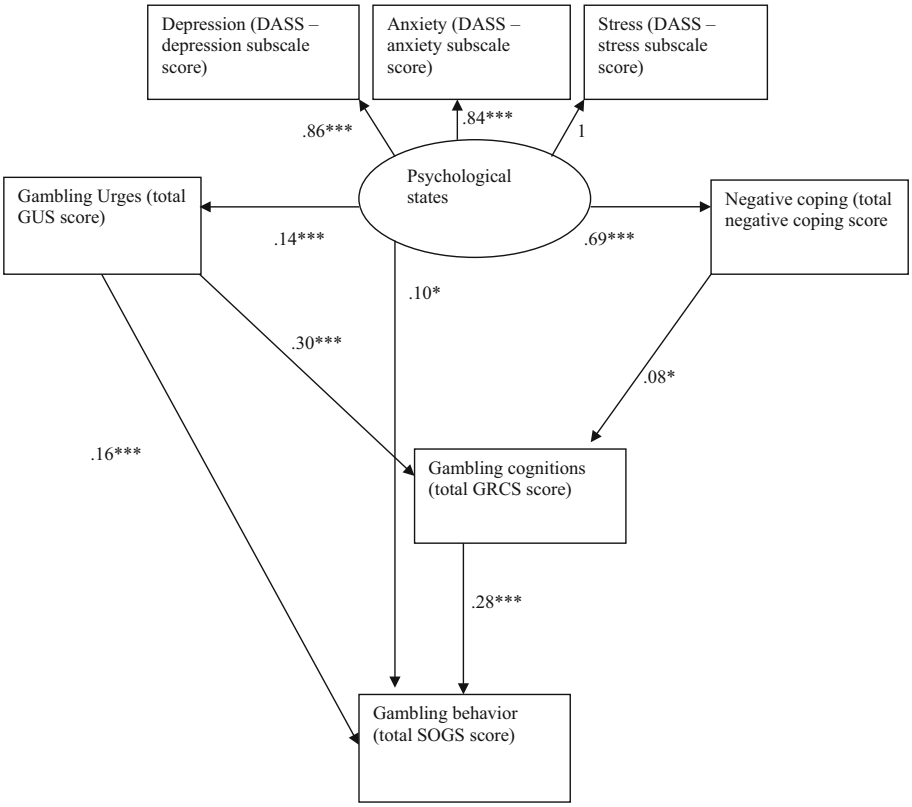

Fig. 5 Model 3 (including estimate of regression weight for the pathways) for the females only (***$p < 0.001$; **$p < 0.01$; *$p < 0.05$)

Testing for Multi-group Invariance Across Gender

An initial test was performed to a differential multi-group model without equality constraints specified to the pathways of the model. The goodness-of-fit with the two groups in combination with no equality constraints imposed (Model 1: Unconstrained multi-group model) was good [$\chi^2(df = 22) = 89.25$, $p < 0.01$, CFI = 0.98; NFI = 0.97, RMSEA = 0.06]. The goodness-of-fit with the two gender groups with equality constraints (Model 2: Constrained multi-group model) was acceptable [$\chi^2(df = 23) = 112.05$, $p < 0.01$, CFI = 0.97; NFI = 0.96, RMSEA = 0.06].

Model 2 showed acceptable goodness-of-fit properties. As Model 2 is nested within Model 1 (constrained), Chi-square differences test (χ^2) is used to compare between models. Differences were noted for a number of pathways between the models of the two genders. Figures 4 and 5 show that majority of the standardized path estimates were higher among males than females. Comparison of the constrained model (Model 2) and the unconstrained model (Model 1) yields a χ^2 difference of 22.8 and degrees of freedom difference of 1, which is statistically significant at .001 level. In other words, the model pathways are statistically different between genders.

Discussion

Our findings showed that Model 3 fitted the data well. Our findings on gambling cognitions, negative psychological states (e.g., anxiety, depression and stress), gambling urge, and avoidance coping were consistent with past empirical research in gambling literature as playing a role in gambling behavior and gambling problems (Raylu and Oei 2002). As these are important variables in cognitive behavioral framework, the results support a cognitive behavioral conceptualization of gambling behavior. Results also supported previous studies (e.g., Bergevin et al. 2006) that have suggested important interactions between certain gambling related variables and correlates (e.g., the relationship negative psychological states has with gambling cognitions and avoidance coping).

Results showed that gambling urge predicted gambling behavior directly as well as indirectly via gambling cognitions. However, the indirect pathway was much stronger than the direct one. This supports previous research, which has already shown that gambling cognitions work together with arousal (including the need for stimulation) and desire to win to promote further gambling (Clark et al. 2012; Dixon et al. 2011). Sharpe (2002) stated that when gambling cognitions and arousal gets activated, this elicits "physiological state associated with the gambling behavior" (p. 20). Several researchers have suggested that gamblers' cognitions may interact with gambling urges (Ladouceur et al. 2003; O'Connor and Dickerson 2003). Ladouceur et al. (2003) suggested that the expectancy of winning money rather than playing the game incites arousal. When gamblers experience near-misses, they get physiologically aroused and their cognitions suggest that they are not constantly losing but constantly "nearly winning" and, this encourages continued gambling despite losses (Clark et al. 2012). The frequency of the cognitive errors elicited during some forms of gambling (especially gaming machines) has also been found to correlate significantly with autonomic arousal indicating that arousal in problem gambling may be mediated by cognitions (Clark et al. 2012; Dixon et al. 2011).

A possible mechanism for this urge could be similar to the mechanisms underlying alcohol-related urge explained by Oei and Baldwin (1994) for individuals with alcohol problems. Internal or external triggers that have been associated with previous gambling episodes trigger memories of the previous gambling situations and, more importantly, the cognitions (e.g., cognitions related to the ability to predict or influence gambling outcomes) into the present. It is not necessary for the gambler to be able to attribute these positive feelings to the gambling on previous episodes since these cognitions are no longer conscious (Oei and Baldwin 1994). Conscious processes play a role only when the action plan is disrupted in some way (e.g., pressure from spouse to stop gambling). However, to validate these mechanisms, further research is required.

Results also showed that that negative psychological states (i.e., depression, anxiety and stress) directly predicted gambling behavior. It also showed that negative psychological states predicted gambling behavior via gambling cognitions or avoidance coping. This is consistent to Bergevin et al. (2006) study that found emotion-oriented coping mediates the link between negative life events and gambling severity. The findings suggest that the degree to which negative psychological states determine gambling behavior is dependent on individuals' coping styles.

Our findings showed sex invariance. This is not surprising as it is well documented that males gamble more frequently and report having significantly more gambling problems than females. Also, significant gender differences in a number of gambling related variables and gambling correlates have also been noted (Loo et al. 2012; Raylu and Oei 2002).

The pathways of the cognitive behavioral models assessed were much stronger for males than females.

It is interesting to note the pathway of avoidance coping predicting gambling behavior indirectly via gambling urges was stronger for males than females. The study included only avoidance coping strategies in the model as previous research have shown that they have been most strongly related to gambling problems (Thomas et al. 2011; Nower et al. 2004). Research with adolescents have shown that male problem gamblers were more likely than their peers to deal with problems by using avoidance coping (Bergevin et al. 2006; Nower et al. 2004). For probable problem gambling female adolescents, significant relationships were not generally found for any coping strategies, however, their non-probable problem gambling counterparts were more likely to engage in active and task-orientated coping strategies (Nower et al. 2004). Matheson et al. (2009) found that female pathological gamblers used more social support than males in coping with depression associated with gambling behaviors. It is possible that if all forms of coping were included in the model we would see stronger relationships with some of these forms of coping for females.

The main strengths of this study were its large sample size ($N = 969$). Furthermore, it was the first study of its type to test a cognitive behavioural model of gambling behavior using empirical/statistical means. There were several weaknesses in this study. First, since the model was tested using a community sample, generalizability of the results to clinical populations was limited. However, the community-based study allowed us to assess the model using a sample with a continuum of gambling involvement and degree of problems. Future studies should replicate the study with other samples (e.g., patients attending primary care settings). Clinical samples are usually skewed and, thus, it is difficult to comment on causal pathways. Second, it is difficult to ascertain from the current model whether certain relationships (e.g., the relationship between coping, urges, and gambling behaviour) are trait-based orientation of the individual to such circumstances or a result of gambling history. It would be important to understand developmentally how such a model might adopt similar/differential predictions among non-regular gamblers and problem gamblers.

Future studies could assess the model using different groups of gamblers. Due to the small number of pathological gamblers, this was not conducted in this study. Third, two third of our sample were females. Future research needs to ensure approximately equal gender representation in their samples. Fourth, biological factors were excluded from the study to keep the preliminary study simple. Excluding biological factors from our study prevented the assessment of certain variables adequately (e.g., motivation and gambling urges). For example, Potenza (2008) presented evidence of neural mechanisms of gambling urges. Furthermore, recent literature reviews (e.g., Goudriaan et al. 2006; van Holst et al. 2010) have suggested that biological variables are important in the development and maintenance of problem gambling. Thus, considering that certain variables that are important in the conceptualization of problem gambling comprise of both psychological and biological components, further studies need to explore all components of these variables to obtain a comprehensive measure of them. Fifth, types of gambling were not factored into the analyses to keep the model assessed simple. Future research needs to assess how the model differs for the different types of gambling.

In summary, the results provided initial support for the validity of the cognitive behavioral theory of gambling behavior. More importantly, it highlighted the importance of gender differences in the development of gambling behavior.

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