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Alcohol And Other Drug Moderators Of The Relationship Between Negative Emotional States, Emotional Impulsivity, And Problematic Gambling

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Abstract. Problematic gambling is often associated with symptoms of depression, anxiety and substance use, and harms associated with gambling may be increased by impulsivity. The present study explores if alcohol or other drug use in the context of emotional impulsivity is associated with increased problematic gambling. Baseline outcome measures data from clients accessing treatment for alcohol and other drugs, mental health, and/or gambling were analysed using hierarchical regression and moderated mediation. Higher risk problematic gambling was associated with increased symptoms of depression and anxiety, emotional impulsivity, and harms associated with methamphetamine use, however not for harms associated with alcohol or cannabis use. The relationship between negative emotional states and problematic gambling was mediated by emotional impulsivity, and in turn moderated by harms associated with methamphetamine use, but not alcohol or cannabis. Service providers supporting individuals impacted by problematic gambling should be alert to the co-existence and potential contribution of mood symptoms, emotionally driven impulsivity, and co-occurring methamphetamine use particularly for individuals reporting higher levels of problem gambling behaviour. Addressing underlying impulsivity factors presents as a promising direction for therapeutic interventions.

Keywords: Gambling, Substance Use, Impulsivity.

Introduction

The co-occurrence of problematic gambling, substance use, and mental health concerns is well-established, with a remarkably high comorbidity rate for problematic gambling with substance use disorder (57.5%), and Axis I mood or anxiety disorders (57.0%) (Cowlishaw, Hakes, & Dowling, 2016; Dowling, et al., 2017; Lorains, Cowlishaw, & Thomas, 2011). Concerningly, a compounding effect of psychosocial harm is observable with co-occurring mental health, substance use, and problematic gambling (Cowlishaw et al., 2014; Manning et al., 2017; Moreira, Azeredo, & Dias, 2023). Recognising this complexity, increased attention has been directed toward identifying psychological factors underlying these commonly co-presenting concerns, with impulsivity emerging as a key mediating variable (Jauregui, Estevez & Urbiola, 2016; Wang et al., 2023). Wang et al. (2023) identify that methamphetamine use is driven by impulsivity, and markedly more likely to follow the onset of problematic gambling rather than precede it (Wang et al., 2023). This suggests that methamphetamine use, and potentially other substance types, may exert a moderating effect on gambling behaviour thereby increasing gambling related harms. The present study explores the mediating role of impulsivity and the proposed moderating role of substance use within the relationship between negative emotions and problematic gambling.

Symptoms of anxiety and depression are frequently observed in individuals experiencing problematic gambling (Cowlishaw, Hakes, & Dowling, 2016; Gratz & Roemer, 2004; Manning et al., 2017). While acknowledging the relationship between mood and gambling can be bi-directional, often the negative emotional states associated with depression and anxiety exacerbate gambling behaviour and related harms, with gambling functioning as a maladaptive coping strategy (Cowlishaw, Hakes, & Dowling, 2016; Manning et al., 2017). This suggests that problematic gambling in response to negative emotional states indicates difficulties with emotion regulation (Marchica et al., 2019). Though many definitions of emotion regulation exist, Gratz and Roemer's (2004) model is widely employed. In this model, emotion regulation entails awareness, understanding and acceptance of emotions; impulse control and goal persistence when experiencing negative emotions; and flexible emotion regulation strategies to meet situational demands and achieve individual goals (Gratz & Roemer, 2004). Emotion regulation has consistently demonstrated a mediating role between mental health concerns and gambling-related harms, indicating that people who respond impulsively to negative emotional states may be more likely to engage in other harmful behaviours (Clarke, Abbott, Tse, Townsend, Kingi, & Manaia, 2006; Jauregui, Estévez, & Urbiola, 2016; Manning et al., 2017). This suggests that many harmful behaviours such as substance use and problematic gambling stem from difficulties with emotion regulation, resulting in emotionally driven impulsivity.

Impulsivity consistently emerges as a key psychological risk factor across mental health concerns, substance use, and problematic gambling (Clarke, 2006; Dong, Shen, & Hao, 2022; Liu et al., 2022; Moreira, Azeredo, & Dias, 2023). The long-established relationship between negative emotions and impulsive behaviour demonstrates a clear causative link between emotionally driven impulsivity and harmful behaviours (Clarke, 2006). Psychiatric concerns such as borderline personality disorder, bipolar disorder, and psychotic disorders are noted for increased impulsivity, which often includes substance use and gambling as examples (Manning et al., 2017). The connection between negative emotions, difficulties with emotion regulation, and subsequent impulsivity is observable in this context, consistent with Gratz and Roemer's (2004) model. In response, considerable research attention has been directed toward defining impulsivity and the development of tools to measure impulsivity in individuals (Carver & Johnson, 2018; Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007; Johnson, Elliott, & Carver, 2020).

While several measures of impulsivity have been developed and employed clinically and in research, not all include a strong focus on emotionally driven impulsivity (Morean et al., 2014). An advantage of the Short Impulsive Behaviour Scale (SUPPS-P) is the inclusion of measures of emotionally driven impulsivity (Cyders et al., 2014; Rochat et al., 2018). The SUPPS-P measures five factors of impulsivity: negative urgency (impulsivity in response to negative emotions), positive urgency (impulsivity in response to positive emotions), lack of perseverance (difficulty maintaining focus on tasks), lack of premeditation (acting without thinking about consequences), and sensation seeking (desire for novelty and risk-taking) (Lynam et al., 2007). Of the five impulsivity traits there is some evidence questioning the distinction between negative urgency and positive urgency, indicating a single emotional urgency trait that captures impulsivity in response to strong positive and negative emotions (Billieux et al., 2021). Studies utilising the SUPPS-P have identified lack of premeditation and negative urgency as key impulsivity traits linked to poor substance use treatment outcomes and overall substance use risk (Hershberger, Um, & Cyders, 2017). Other studies have found associations between distress driven impulsivity (i.e. negative urgency) and an increase in problematic drinking (Lieu et al., 2022). Similarly, impulsivity also has been found to play a mediating role in the prevalence of various gambling related behaviours and associated harms (Zhou, Hung, Xie, Yuan, & Wu, 2022).

There is a growing body of research demonstrating that certain impulsivity factors can be linked to specific substance use behaviours (Verdejo-Garcia et al., 2007; Hides et al., 2020). For example, lack of perseverance is strongly associated with drinking quantity, positive and negative urgency are associated with problem drinking, negative urgency is associated with alcohol dependence, and all five SUPPS-P traits predict frequency of drinking (Coskunpinar, Dir, & Cyders, 2013). Additionally,

clinical implications also exist for mental health and substance use treatment programs, with some studies finding poorer treatment outcomes and significantly higher drop-out rates where impulsivity traits and problematic gambling behaviours are identified (Baxley et al., 2021; Hershberger, Um, & Cyders, 2017; Wieczorek & Dąbrowska, 2023). An emerging consensus suggests that specific impulsivity traits can be measured and used to inform personality-targeted treatment approaches (Davis et al., 2019; Hershberger, Um, & Cyders, 2017; Hides et al 2020; Smith & Cyders, 2016). While the mediating pathway between negative emotions, impulsivity, and problematic gambling is well-established, exploring how substance use moderates the impact of impulsivity on the severity of problematic gambling offers an opportunity to expand our understanding and identify additional treatment targets (Wang et al., 2023).

Aims and Hypotheses

This study investigates the mediating effect of impulsivity on the relationship between negative emotional states and problem gambling, in addition to the proposed moderating effect of substance use on the relationship between impulsivity and problem gambling. It is hypothesised that negative emotional states, impulsivity, and substance use will all be positively correlated with problem gambling. It is further hypothesised that the relationship between negative emotional states and problem gambling will be mediated by impulsivity, with impulsivity better explaining the relationship between distress and problematic gambling behaviour. Finally, it is hypothesised that the relationship between impulsivity and problem gambling will be positively moderated by substance use, collectively demonstrating that problematic gambling increases as a function of substance use driven by impulsivity.

Method

Participants

The participants in the study were clients accessing treatment services at Lives Lived Well; an Australian not-for-profit service that provides treatment for alcohol and other drug and related mental health concerns, including gambling services. Lives Lived Well extensively employs routine outcome measures to facilitate client assessment, with nearly all clients accessing services completing a comprehensive baseline outcome measure. The present study drew from baseline client outcome measure data from the period of 24/08/2020 to 06/12/2023, identifying 5604 unique baseline outcome measures from a total of 9506 that reported engagement in gambling. No missing data were observed, and no participants were excluded. Clients accessing Lives Lived Well services are informed that their data may be used in non-identifiable form for research and quality assurance/improvement purposes, as outlined in the Lives Lived Well form: Client Rights, Privacy & Consent, and discussed comprehensively when obtaining informed consent to participate in

treatment. Human research ethics exemption was granted by the University of Queensland Human Research Ethics Committee (2023/HE001205).

Measures

Patient Health Questionnaire 9 (PHQ-9)

The Patient Health Questionnaire-9 (PHQ-9) is a self-report measure for the presence and severity of depression symptoms. Developed by Kroenke, Spitzer, and Williams (2001), the PHQ-9 consists of nine items that correspond to the diagnostic criteria for major depressive disorder as outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM). Each item is rated on a four-point scale, from 0 (not at all) to 3 (nearly every day), with the total score ranging from 0 to 27. The PHQ-9 has been extensively evaluated and is regarded for its strong psychometric properties, including high internal consistency with Cronbach's alpha coefficients typically above .80, indicative of excellent reliability (Kroenke, Spitzer, & Williams, 2001). The PHQ-9 has been validated against diagnostic interviews, with high criterion validity for the diagnosis of major depression at a cut-off score of 10 or above (Kroenke, Spitzer, & Williams, 2001). The scale demonstrates good construct validity, with scores correlating well with other established measures of depression, supporting its convergent validity (Beard et al., 2016).

Generalized Anxiety Disorder 7 (GAD-7)

The Generalized Anxiety Disorder-7 (GAD-7) is a self-report questionnaire designed to screen for the presence and severity of generalized anxiety disorder (Spitzer, Kroenke, Williams, & Löwe, 2006). It is composed of seven items that assess the frequency of anxiety symptoms experienced over the past two weeks. Respondents rate each item on a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day), yielding a total score between 0 and 21. The GAD-7 has demonstrated robust psychometric properties. In terms of reliability, it has shown high internal consistency, with Cronbach's alpha coefficients regularly exceeding .80 across diverse populations (Löwe et al., 2008). The GAD-7 scores correlate strongly with other validated measures of anxiety, indicating good convergent validity (Spitzer et al., 2006). The measure has also demonstrated discriminant validity, as it distinguishes between anxiety disorders and other psychiatric conditions (Löwe et al., 2008).

The Patient Health Questionnaire Anxiety and Depression Scale (PHQ-ADS)

The PHQ-ADS is a composite of the PHQ-9 and GAD-7 that provides a combined measure of depression and anxiety symptoms (Kroenke et al., 2016). It consists of the 9 items from the PHQ-9 and 7 items from the GAD-7, scored in the same manner as the original scales, with cut-points of 10, 20, and 30 for mild, moderate, and severe symptoms respectively (Kroenke et al., 2016). The PHQ-ADS has demonstrated strong

construct and convergent validity and applicability in research and clinical contexts (Kroenke et al. 2016).

The World Health Organization's Alcohol, Smoking and Substance Involvement Screening Test (WHO-ASSIST)

Developed by the World Health Organization (WHO), the WHO-ASSIST was created with the objective of identifying individuals with problematic or risky substance use behaviours that may require more detailed assessment and intervention (Humeniuk et al., 2008). The WHO-ASSIST questionnaire consists of eight questions covering frequency of use, dependency symptoms, and personal and social consequences related to substance use. Responses are scored and yield a risk score for each substance, categorising the level of risk as low, moderate, or high. Reliability and validity studies have supported the WHO-ASSIST's use as a screening tool, and it has demonstrated good internal consistency, with Cronbach's alpha values indicating acceptable reliability for its subscales (Newcombe et al., 2005). Test-retest reliability studies have shown that it provides consistent results over time when substance use status is stable. The WHO-ASSIST has shown strong criterion validity, correlating well with other established diagnostic criteria for substance use disorders. It has also been validated in diverse cultural contexts and has shown good construct validity, accurately reflecting the constructs of risky and problematic substance use as separate from substance dependence (Humeniuk et al., 2008).

The Short Impulsive Behaviour Scale (SUPPS-P)

The SUPPS-P is a psychometric instrument designed to measure the multifaceted nature of impulsivity across five distinct dimensions: (1) Negative Urgency, (2) Lack of Premeditation, (3) Lack of Perseverance, (4) Sensation Seeking, and (5) Positive Urgency. The SUPPS-P contains 20 items, with each subscale represented by four items. Respondents rate each item on a four-point Likert scale, from 1 (agree strongly) to 4 (disagree strongly). Reliability analyses have consistently shown high internal consistency for the total scale and its subscales, with Cronbach's alpha coefficients often exceeding .70, indicating good reliability (Cyders et al., 2007). Test-retest reliability assessments have also provided evidence of the scale's temporal stability alongside strong construct validity (Dugré, Giguére, Percie du Sert, Potvin, & Dumais, 2019). Convergent and discriminant validity have been supported through correlations with other established measures of impulsivity and related behaviours (Cyders & Smith, 2007).

The Problem Gambling Severity Index (PGSI)

The Problem Gambling Severity Index (PGSI) is a validated and widely recognised tool developed by Ferris and Wynne (2001) that consists of nine items measuring gambling behaviour and its consequences over the

past 12 months. Each item is scored on a scale from 0 (never) to 3 (almost always), with the total scores ranging from 0 to 27. The total score facilitates categorisation into one of four gambling behaviour categories: non-problem (0), low-risk (1-2), moderate-risk (3-7), and problem gambling (8 or above). The PGSI is noted for its robust psychometric properties, including high reliability and validity across various populations (Ferris & Wynne, 2001; Gorenko, Konnert, O'Neill, & Hodgins, 2022).

Data Analysis

The analytic plan was structured to examine how emotional distress (PHQ-ADS) influenced gambling severity (PGSI), both directly and indirectly through impulsivity traits (SUPPS-P). As an initial step, descriptive statistics and bivariate correlations were computed among all variables. To ensure parsimony and theoretical alignment, only predictors that demonstrated significant correlations with PGSI were retained for subsequent modelling. These included PHQ-ADS, Negative Urgency, Positive Urgency, and methamphetamine use (as a moderator). Other SUPPS-P subscales (e.g., Lack of Premeditation, Sensation Seeking) were excluded from the mediation model due to weak or non-significant associations with the PGSI.

Data were first cleaned to ensure all predictor variables were numeric and free from missing values. All analyses were conducted using SPSS (Version 29.0), with Hayes' PROCESS macro (Version 4.2) used for moderated mediation modelling. Inspection of residual plots indicated that the assumptions of normality, linearity and homoscedasticity were upheld. Model 14 of the PROCESS Macro was used to conduct moderated mediation analysis. Indirect effects were estimated using bootstrapping (5,000 samples), with 95% percentile confidence intervals.

Results

Descriptive Statistics

Participant demographics and categorical variables are detailed in Table 1. Most participants were middle aged, with the eldest being 98 and the youngest being 14. Participants were more likely to identify as male rather than female, with a limited representation of clients identifying their gender as other, or gender not stated. The most common category of gambling behaviour was the non-problem category, followed by the problem gambler category, with the intermediate categories being less common. The distribution of risk categories across alcohol, cannabis, and methamphetamine, indicate the low risk category is most common, generally followed by the high risk category except for cannabis, with the high risk category being smallest.

Table 1

Participant Demographics and Categorical Variables

Continuous Variables	Mean (*SD*)	Skewness	Kurtosis
Age	35.53 (10.20)	.62	.35
Categorical Variables	**Count**	**%**	
Participant Gender			
Female	2338	41.7	
Male	3237	57.8	
Other	18	.3	
Not Stated	11	.2	
PGSI Category			
Non-Problem	2467	44	
Low Risk	569	10.2	
Moderate Risk	977	17.4	
Problem Gambler	1591	28.4	
WHO-ASSIST Alcohol			
Low Risk	2486	44.4	
Moderate Risk	1065	19	
High Risk	2053	36.6	
WHO-ASSIST Cannabis			
Low Risk	2800	50.0	
Moderate Risk	1711	30.5	
High Risk	1093	19.5	
WHO-ASSIST Methamphetamine			
Low Risk	2234	39.9	
Moderate Risk	1255	22.4	
High Risk	2115	37.7	

Note. N =5604

Participant results on the continuous variables measured are detailed in Table 2. Depression and anxiety symptoms as measured by PHQ-9 and GAD-7 suggested a prevalence of moderate symptoms, however considerable variance was observed. The impulsivity profiles indicated average levels across the various dimensions of the SUPPS-P, with scores on negative urgency presenting as highest in general. Harms associated with substance use varied, with the greatest average scores reported for alcohol and methamphetamine. The distributions of these measures were generally close to normal, with some variations in skewness and kurtosis, suggesting varying degrees of tail heaviness and asymmetry in the data. Collectively, a diverse cohort appears represented by the data.

Table 2

Descriptive Statistics for Survey Subscales

Variable	Mean (*SD*)	95% CI	Skewness	Kurtosis
PGSI	5.29 (7.15)	[5.10, 5.48]	1.47	1.31
PHQ-9	13.76 (7.23)	[13.57, 13.95]	.04	-.92
GAD-7	11.17 (6.27)	[11.01, 11.34]	.01	-1.12
PHQ-ADS	24.94 (12.84)	[24.60, 25.27]	-.01	-.96
Negative Urgency	11.46 (2.46)	[11.39, 11.52]	-.35	.14
Positive Urgency	9.72 (2.51)	[9.66, 9.79]	.14	-.02
Sensation Seeking	10.00 (2.39)	[9.93, 10.06]	.03	-.09
Lack of Premeditation	9.42 (2.36)	[9.35, 9.48]	.32	.12
Lack of Perseverance	8.52 (2.03)	[8.47, 8.58]	.22	.69
WHO-ASSIST Alcohol	17.00 (14.65)	[16.62, 17.39]	.15	-1.62
WHO-ASSIST Cannabis	10.91 (13.25)	[10.56, 11.26]	.87	-.77
WHO-ASSIST Methamphetamine	16.29 (15.60)	[15.88, 16.70]	.19	-1.71

Note. N =5604

The correlation between survey variables is detailed in Table 3. Problem gambling was positively correlated with most survey variables, with moderate correlations observed for negative and positive urgency, alongside problems associated with methamphetamine use. Weaker though notable correlations were also observed between problem gambling and both depression and anxiety symptoms, with a very strong correlation observed between depression and anxiety. Notable relationships within the SUPPS-P include a strong positive relationship between negative urgency and positive urgency, suggesting individuals who experience increased impulsivity in response to strong emotional states may experience this for both negative and positive emotions. A strong negative correlation was observed between alcohol and methamphetamine on the WHO-ASSIST, suggesting these two substances may be mutually exclusive for some participants.

Table 3

Correlation Matrix for Survey Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
PGSI (1)	--											
PHQ-9 (2)	.27*	--										
GAD-7 (3)	.26*	.81*	--									
PHQ-ADS (4)	.28*	.96*	.94*	--								
Negative Urgency (5)	.31*	.47*	.49*	.51*	--							
Positive Urgency (6)	.33*	.37*	.38*	.40*	.58*	--						
Sensation Seeking (7)	.14*	.05*	.06*	.06*	.22*	.36*	--					
Lack of Premeditation (8)	.20*	.28*	.24*	.27*	.32*	.34*	.01	--				
Lack of Perseverance (9)	.02	.07*	-.01	.04*	-.07*	-.03*	-.20*	.45*	--			
WHO-ASSIST Alcohol (10)	-.04*	.15*	.14*	.15*	.13*	.08*	-.02	.04*	.02	--		
WHO-ASSIST Cannabis (11)	.09*	.20*	.20*	.21*	.15*	.20*	.15*	.09*	.02	0.01	--	
WHO-ASSIST Methamphetamine (12)	.36*	.21*	.19*	.21*	.18*	.23*	.14*	.15*	.02	-.40*	.14*	--

Note. N =5604, *p < .05

Hypothesis Testing

To test the hypothesis that negative emotional states, impulsivity and substance use would be associated with increased problem gambling, a hierarchical regression was conducted, with the results detailed in Table 4. The dependent variable was problem gambling, and the independent variables were depression and anxiety symptoms (PHQ-ADS) in the first step, impulsivity (negative urgency, positive urgency, lack of premeditation, sensation seeking) in the second step, and methamphetamine harms (WHO-ASSIST) in the third step. Lack of perseverance, alcohol, and cannabis were excluded as they demonstrated weak correlations with problem gambling. Depression and anxiety symptoms were significant in the first step and accounted for 8% of variance in problem gambling. The inclusion of the four measures of impulsivity in the second step reported an increase to 15% of variance in problem gambling explained. The inclusion of methamphetamine related harms in the third step demonstrated a further increase to 22% of variance in problem gambling explained, with sensation seeking dropping out. The results indicate that problem gambling increases as negative emotional states, various forms of impulsivity, and methamphetamine related harms increase.

Table 4
Hierarchical Regression Analysis for Variables associated with Problem Gambling

Variable	Model 1			Model 2			Model 3		
	B	SE B	β	B	SE B	*β*	B	SE B	*β*
PHQ-ADS	.16	.01	.28*	.08	.01	.14*	.06	.01	.10*
Negative Urgency				.31	.05	.10*	.32	.05	.11*
Positive Urgency				.54	.04	.17*	.42	.04	.14*
Lack of Premeditation				.20	.04	.07*	.15	.04	.05*
Sensation Seeking				.13	.04	.04*	.06	.04	.02
Methamphetamine							.13	.01	.27*
R Square		.28			.39			.47	
R Square Change		.085			.15			.22	
F Change		484.32*			112.96*			486.20*	

Note. *N* =5604, *p < .05

To further explore the relationship between problem gambling and the predictor variables, a moderated mediation was conducted, with the results detailed in Figure 1. The independent variable was the PHQ-ADS, the dependent variable was problem gambling, the mediators were negative urgency, positive urgency, and lack of premeditation, and the moderator was methamphetamine-related harms.

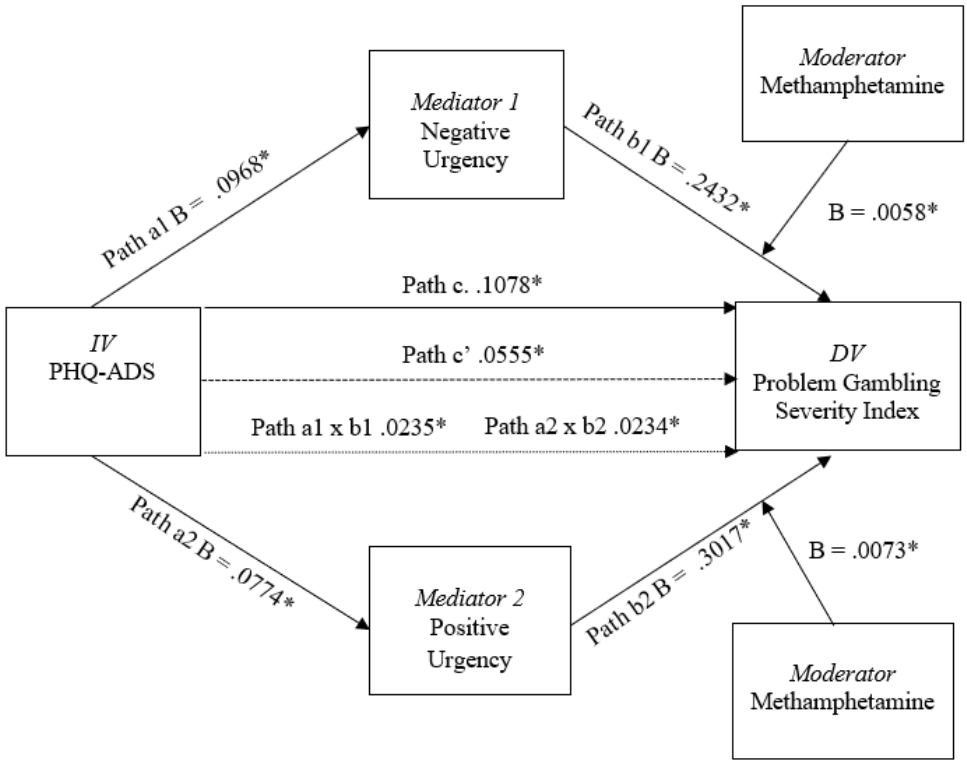

Figure 1. Coefficients for the moderated mediation pathways between depression/anxiety and problem gambling through negative and positive urgency moderated by methamphetamine use.

Note. * $p < .05$

The analysis revealed that both negative and positive urgency significantly mediated the relationship between depression/anxiety and problem gambling severity, whereas this was not observed for lack of premeditation. Furthermore, these indirect effects were conditioned upon the level of methamphetamine use, as indicated by significant interaction terms for Negative Urgency × WHO-Methamphetamine (B = .0058, SE = .0028, p = .0379) and Positive Urgency × WHO-Methamphetamine (B = .0073, SE = .0027, p = .0059). The index of moderated mediation was significant for both mediators, suggesting that the strength of mediation varied as a function of methamphetamine use.

The analysis utilised a regression-based framework via the PROCESS macro, which does not generate conventional structural equation model fit indices such as CFI or RMSEA. Accordingly, model adequacy was evaluated using the proportion of variance explained and the statistical significance of direct and indirect effects. The final model accounted for 21.8% of the variance in problem gambling severity (PGSI), with all direct and indirect paths of interest reaching statistical significance. Indirect effects were estimated using 5,000 bootstrapped samples, with 95% confidence intervals that did not include zero, indicating robust mediation. At higher levels of methamphetamine use, the indirect effects of both

Negative Urgency (B = .0430, BootSE = .0088, 95% CI [.0256, .0606]) and Positive Urgency (B = .0432, BootSE = .0065, 95% CI [.0306, .0560]) on PGSI were stronger. The direct effect of depression and anxiety symptoms on problem gambling was significant (B = .0555, SE = .0078, $p < .001$). The conditional indirect effects through negative urgency and positive urgency were significant across levels of methamphetamine-related harms, with the effects for high methamphetamine harms being notably stronger than for non-users. In contrast, the indirect effect through lack of premeditation was not moderated by methamphetamine-related harms, as the interaction term was not significant ($p = .27$).

The conditional effect of negative urgency on problem gambling at the mean level of methamphetamine use was B = .2432, SE = .0632, $p < .0001$, which increased at one standard deviation above the mean (B = .3122, SE = .0470, $p < .0001$) and further at one standard deviation below the mean (B = .4446, SE = .0705, $p < .0001$). A similar pattern emerged for positive urgency, with effects increasing with higher levels of methamphetamine use ($p < .0001$). In summary, the hypothesis was partially supported, as a moderating relationship was observed for methamphetamine but not for alcohol or cannabis.

Discussion

Consistent with the hypotheses, higher risk problematic gambling was associated with increased symptoms of negative emotional states (i.e. depression and anxiety), higher levels of emotional impulsivity, and specific harms associated with methamphetamine use. Notably, the relationship between negative emotional states and problematic gambling was mediated by various forms of impulsivity, highlighting the role that impulsivity plays between negative emotions and gambling related harms. Furthermore, the findings revealed that methamphetamine use intensifies the relationship between emotional impulsivity and problematic gambling for both positive and negative urgency. A similar moderating relationship was not observed for alcohol or cannabis, suggesting the relationship between emotional impulsivity and gambling is variably impacted by different substances. Collectively, the results indicate the relationship between negative emotional states, emotional impulsivity and problematic gambling is well established, however the additional impact of substance use is contingent on the type of substance and related harms.

Emotions, Impulsivity and Problematic Gambling

The present findings support the previously identified mediating relationship between negative emotional states, impulsivity, and problematic gambling (Wang et al., 2023). This aligns with research suggesting that people prone to negative urgency may be more likely to engage in problematic gambling as a coping mechanism when experiencing negative emotional states (Cowlishaw et al., 2016; Jauregui et al., 2016). While previous research has predominantly focused on negative emotions,

it was notable that positive urgency demonstrated an equivalent relationship with problematic gambling to negative urgency (Billieux et al., 2021). Several studies have upheld the five-factor structure of the SUPPS-P, and therefore the strong positive correlation observed here indicates both negative and positive emotions may precipitate impulsive behaviour including gambling in this population (Cyders et al., 2014; Lynam et al., 2007; Rochat et al., 2018). While negative emotional states as measured by the PHQ-ADS were most strongly correlated to negative urgency, a moderate correlation was also observable for positive urgency. This may indicate that even for people experiencing significant depression symptoms, positive emotions remain a part of their experience and can be associated with additional problematic impulsivity, including problematic gambling (Beard et al., 2016; Billieux et al., 2021; Kroenke et al., 2016).

By contrast, a mediating relationship was not observed for the remaining factors of the SUPPS-P between negative emotional states and problematic gambling. Lack of premeditation demonstrated weaker correlations with negative emotional states and harms associated with methamphetamine and gambling, suggesting the relationship between lack of premeditation on substance use and gambling is not emotionally driven (Cyders et al., 2014; Reid et al., 2014). The unique variance predicted by lack of premeditation in the hierarchical regression suggests that non-emotional impulsivity may additionally contribute to gambling related harm through disinhibition or other means such as exposure to gambling related cues (Cyders et al., 2014; Reid et al., 2014). By contrast, both lack of perseverance and sensation seeking were largely unrelated to variables outside the SUPPS-P, excepting a weak correlation between sensation seeking and harms relating to both gambling and methamphetamine. Sensation seeking demonstrated a similar pattern to that observed for lack of premeditation, while being even more distal to emotional experience. The utility of lack of perseverance as a predictor variable in this population appears limited on available evidence. Based on the observed results, both positive and negative emotional experiences appear to be a central driver of problematic gambling, with an additional contribution of lack of premeditation (Cyders et al., 2014; Reid et al., 2014; Rochat et al., 2018).

Problematic Gambling, Impulsivity and Substance Use

How substance use impacts the relationship between negative emotional states, emotional impulsivity, and problematic gambling varies based on the substance in question. While a weak relationship between alcohol and/or cannabis related harms and gambling related harms was observed, methamphetamine appears to intensify the influence of emotional impulsivity on gambling behaviours, being stronger for positive urgency than negative urgency. This indicates that the combination of high emotional impulsivity and methamphetamine use creates a heightened risk for increased gambling harms for both positively and negatively valenced emotional states (Brodeur et al., 2023; Punia et al., 2021; Wang et al., 2023).

People who use methamphetamine may experience heightened emotional responses and impaired decision-making, leading to increased risk taking and thus greater gambling related harms (Dong et al., 2022). With Wang et al. (2023) observing that problematic methamphetamine use generally precedes the onset of problematic gambling, this suggests that people who use methamphetamine may progressively engage in further risk-taking behaviours as they experience increasing harms associated with methamphetamine use. This is concerning as the compounding effects of harms across mental health, substance use, and gambling are likely to become increasingly severe (Dong et al., 2022; Wang et al., 2023).

Regarding other substances, Punia et al. (2021) assert a link between cannabis and gambling, while Brodeur et al. (2023) note a paucity of research exploring the relationship between gambling and cannabis use. The present findings did not observe a meaningful relationship between gambling and cannabis. This was unexpected, as cannabis and methamphetamine related harms demonstrated comparable relationships with the various factors of the SUPPS-P, so too for the relationship with depression and anxiety symptoms. The point of divergence observed was principally between gambling related harms, with methamphetamine demonstrating a markedly stronger relationship. This suggests that while cannabis interacts with emotional impulsivity in ways that are meaningful, it may not extend to the relationship with gambling harms (Brodeur et al., 2023; Punia et al., 2021). Likewise, the strength of correlation between alcohol-related harms and other variables suggests that alcohol interacts with emotional impulsivity but does not significantly exacerbate gambling-related harms in the same way (Coskunpinar et al., 2013; Hides et al., 2021).

Implications for Treatment

The results support a growing approach toward treatment ideally addressing mental health concerns, substance use concerns, and gambling related concerns concurrently, particularly given the frequency with which they co-occur (Carver & Johnson, 2018; Hides et al., 2021). While this may appear overwhelming, addressing the common factor of impulsivity allows treatment providers to provide brief yet impactful interventions that address the underlying drivers of problematic behaviours, thereby containing clinical complexity (Smith & Cyders, 2016; Hides et al., 2021). Promising results have been demonstrated in several studies employing this approach to treatment (Hides et al., 2021). Assisting clients to develop more adaptive responses to both strong negative and positive emotional states; in essence, to develop more adaptive emotion regulation and distress tolerance skills presents as critical (Smith & Cyders, 2016). This foundation can be additionally bolstered by harm-reduction skills specific to presenting concerns, be they related to mental health, gambling, or substance use (Coskunpinar et al., 2013; Hides et al., 2021).

The present study aligns with previous research highlighting the role of methamphetamine as particularly concerning for gambling related harms

(Cowlishaw et al., 2014; Manning et al., 2017; Moreira et al., 2023). Particularly for services focused on alcohol and other drug treatment, observing for gambling related harms in people who use methamphetamine presents as critical. The temporal relationship observed by Wang et al. (2023) suggests that problematic gambling often follows problematic use of methamphetamine, indicating the need for this to be followed up regularly to ensure harms are appropriately monitored. Similarly for services focused on supporting individuals impacted by gambling related harms, being alert to the impact of methamphetamine use presents as equally valuable, despite occurring less frequently (Wang et al., 2023).

Limitations and Future Directions

Due to the cross-sectional design, the impact of treatment could not be observed, and it remains possible that the relationships observed between variables at baseline present differently at follow-up, particularly following treatment. Additionally, while the impact of polysubstance use was outside the scope of the present study, it was observed that many clients reported harms associated with multiple substance types. Exploring if the relationship between problematic gambling varies as a function of polysubstance use, and what substance interactions are associated with the greatest risk of gambling related harms would be a valuable future contribution. The findings should also be interpreted with caution with respect to different cultural contexts, as they may not be generalisable to populations outside Australia. Comparative studies in various geographic and cultural settings could provide further validation of the results. While the presence of negative emotions was measured via the PHQ-9 and GAD-7, the presence of positive emotions was not. Including a measure of positive and negative emotions such as the Positive and Negative Affect Schedule (PANAS) could facilitate a deeper exploration of the nexus between positive and negative urgency, and positive and negative emotions (Watson, Clark, & Tellegen, 1988). Optimally, applying proven interventions to address the proposed underlying factors of impulsivity could determine if addressing these leads to a reduction in harms associated with depression and anxiety, substance use, and gambling.

Conclusions

This study highlights the significant mediating role of emotional impulsivity in the relationship between negative emotional states and problematic gambling. Both negative and positive urgency were key mediators, indicating that strong emotional responses, regardless of valence, contribute to impulsive gambling behaviours. Methamphetamine use emerged as a significant moderator, intensifying the impact of emotional impulsivity on gambling severity. In contrast, alcohol and cannabis did not show the same moderating effect, suggesting that the risks associated with substance use in gambling are substance specific. These findings emphasise the need for integrated treatment approaches that

address emotional impulsivity and substance-specific risks, particularly methamphetamine use, to mitigate gambling-related harms. Future research should explore these relationships longitudinally and across diverse populations to enhance generalisability and treatment efficacy. In conclusion, understanding the interplay between emotional states, impulsivity, and substance use is crucial for developing effective interventions for problematic gambling.

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Statement of Competing Interests

None.

Author's contributions

All authors contributed to the study conception, design, and literature review. Data collection and data analysis were performed by N.K. and H.S. The first draft of the manuscript was written by N.K., H.S., and R.W., with G.D. and S.Z. contributing to revisions and improvements. All authors read and approved the final manuscript.

Ethics Approval

Human research ethics exemption was granted by the University of Queensland Human Research Ethics Committee (2023/HE001205) on 17/07/2023 for the project titled 'Alcohol and other drug moderators of the relationship between negative emotional states, emotional impulsivity, and problematic gambling.

Research Promotion

This study explored how emotional impulsivity contributes to gambling harm and how this relationship is intensified by methamphetamine use. Findings highlight that both negative and positive emotional impulsivity predict gambling problems, with methamphetamine uniquely moderating this link. The results have implications for integrated treatment approaches in AOD and gambling services.

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