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Risk, compensatory, and protective factors in problem gambling: The role of positive mental health characteristics

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HIGHLIGHTS

- Protective factors for problem gambling have received limited research attention.
- Alcohol/substance use, cognitions, high-risk situations, and motives played risk role.
- Positive mental health characteristics did not play a compensatory role.
- Several characteristics buffered the influence of motives and high-risk situations.
- Emotional support, personal growth/autonomy, and global affect are treatment targets.

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ABSTRACT

There is a limited evidence base from which to draw conclusions about compensatory and protective factors for problem gambling. The aim of this study was to explore the potential for positive mental health characteristics (general coping, emotional support, spirituality, interpersonal skills, personal growth and autonomy, and global affect) to play a compensatory role and protective role in problem gambling in a convenience sample of 499 Australian university students. Hazardous alcohol use, past-year substance use, gambling-related cognitions (interpretive bias, illusion of control, predictive control, gambling-related expectancies, and perceived inability to stop gambling), gambling high-risk situations (negative and positive reinforcement situations), and gambling motives (money, positive feelings, regulate internal state, and challenge) positively predicted problem gambling severity. None of the positive mental health characteristics negatively predicted problem gambling severity, suggesting that these factors did not play a compensatory role. However, emotional support, personal growth and autonomy, and global affect buffered the influence of gambling motives and high-risk situations, suggesting that these factors played a protective role. In contrast, spirituality displayed a direct positive predictive relationship with problem gambling severity, suggesting that it served to act as a risk factor in this sample. The identification of these modifiable risk and protective factors has implications for the development of effective prevention and intervention initiatives. Further longitudinal research employing population-representative samples is required to replicate these results and investigate relationship-, community-, and societal-level risk, compensatory and protective factors associated with the development of problem gambling.

1. Introduction

The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) has reclassified gambling disorder (formerly pathological gambling) as an addiction and related disorder, along with alcohol and other drug use disorders (American Psychiatric Association, 2013). In contrast, public health frameworks conceptualise gambling

problems across a continuum of risk, ranging from no risk, where no health or social problems have developed as a result of gambling behaviour, to extreme risk, where gambling behavior results in serious problems (Korn & Shaffer, 1999). Consistent with this framework, many jurisdictions employ the term problem gambling to describe all forms of gambling that result in adverse consequences for individuals, families, and communities (Neal, Delfabbro, & O'Neil, 2005).

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The goal of prevention science in the gambling field is to prevent or moderate problem gambling by counteracting risk factors and promoting protective factors (Coie et al., 1993). Risk factors are defined as antecedent conditions that are associated with an increase in the likelihood of onset, greater severity, and longer duration of problem gambling (Coie et al., 1993; Farrington & Ttofi, 2011; Kazdin et al., 1997; Kraemer et al., 1997). An expanded definition is an antecedent condition that can predict problem gambling after adjusting for other known risk factors (Loxley et al., 2004). In contrast, protective factors are often conceptualised as antecedent conditions that are associated with a decrease in the likelihood of onset, regardless of exposure to identified risk factors (Coie et al., 1993; Farrington & Ttofi, 2011; Kazdin et al., 1997; Kraemer et al., 1997; Lussier et al., 2014; Shead, Derevensky, & Gupta, 2010). In this context, protective factors have a negative main effect with problem gambling (Coie et al., 1993; Dickson, Derevensky, & Gupta, 2008; Lussier et al., 2014). Because these factors are not necessarily linearly related to problem gambling (Farrington & Ttofi, 2011), they have been referred to as compensatory factors (Dickson et al., 2008; Lussier et al., 2014) or promotive factors (Farrington & Ttofi, 2011) (herein referred to as compensatory factors). Protective factors can also operate by decreasing the probability of problem gambling in the presence of risk, such as by interacting with a risk factor to buffer or mitigate its effects (Coie et al., 1993; Dickson et al., 2008; Farrington & Ttofi, 2011; Loxley et al., 2004; Lussier et al., 2014) (herein referred to as protective factors).

1.1. Risk factors for problem gambling

A range of physiological, cognitive, psychiatric, behavioural, personality, and social risk factors for the development of problem gambling have been examined in the literature (Abbott, Volberg, & Williams, 1999; Browne et al., 2019; Canale, Vieno, Pastore, Ghisi, & Griffiths, 2016; Dechant, 2014; Dickson, Derevensky, & Gupta, 2002; Dowling et al., 2015, 2017, 2019; el-Guebaly et al., 2015; Francis, Dowling, Jackson, Christensen, & Wardle, 2015; Hardoon & Derevensky, 2002; Lorains, Cowlshaw, & Thomas, 2011; Lussier et al., 2014; Messerlian, Gillespie, & Derevensky, 2007; Raylu & Oei, 2004; Shead et al., 2010; Smith, Schmidt, Allensworth-Davies, & Saitz, 2010; Stewart & Zack, 2008; Williams et al., 2015; Dowling & Oldenhof, 2017), with a view to identifying modifiable variables that can be the target of prevention and treatment efforts. Specifically, both cross-sectional (Dickson et al., 2002; Dowling & Oldenhof, 2017; Dowling et al., 2015; Hardoon & Derevensky, 2002; Lorains et al., 2011; Lussier et al., 2014; Messerlian et al., 2007; Shead et al., 2010) and longitudinal research (Abbott et al., 1999; Dowling et al., 2017, 2019; el-Guebaly et al., 2015; Williams et al., 2015) has revealed several modifiable psychosocial factors that are consistently positively associated with the development of gambling problems, including depression, anxiety, hazardous alcohol use, past-year substance use, weekly tobacco use, and poor general health. There is also considerable cross-sectional evidence of associations between problem gambling and modifiable gambling-related variables, such as gambling attitudes, gambling-related cognitions, gambling high-risk situations, and gambling motives (money, coping, and enhancement) (Browne et al., 2019; Canale et al., 2016; Dechant, 2014; Francis et al., 2015; Hardoon & Derevensky, 2002; Messerlian et al., 2007; Raylu & Oei, 2004; Smith et al., 2010; Stewart & Zack, 2008). Many of these factors appear to meet the expanded definition of risk factors (Loxley et al., 2004), whereby they represent a special class of risk factors that continue to predict problem gambling after controlling for the influence of other known predictors (Dowling et al., 2017). These risk factors may have specific potential to be the targets of prevention or intervention efforts because they are modifiable factors that represent theoretically independent domains.

1.2. Compensatory and protective factors for problem gambling

Despite well-established associations between many of these risk factors and gambling problems, many people exposed to them never develop gambling problems, suggesting that there are factors that play a compensatory or protective role (Lussier et al., 2014). Only a small number of studies, however, have examined the role of compensatory or protective factors for problem gambling. There is, however, growing evidence that positive mental health, which is defined as ‘a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community’ (World Health Organization, 2004), play a compensatory role in the development of gambling problems. Positive mental health characteristics that have been negatively associated with problem gambling in cross-sectional studies include adaptive coping strategies, social support, spirituality or religious attendance, interpersonal skills or competence, personal autonomy or self-efficacy; and well-being or quality of life (Browne et al., 2019; Chalmers & Willoughby, 2006; Dickson et al., 2008; Lussier et al., 2007; Parker, Taylor, Eastabrook, Schell, & Wood, 2008; Shead et al., 2010; Dowling & Oldenhof, 2017). There are, however, few studies that have examined protective factors that operate by decreasing the probability of problem gambling in the presence of risk; and it is clearly more difficult to identify these protective factors than those that play a risk or compensatory role (Scholes-Balog, Hemphill, Toumbourou, & Dowling, 2015).

1.3. Study aims

There is a limited evidence base from which to draw conclusions about compensatory and protective factors for problem gambling. The identification of modifiable factors, such as positive mental health characteristics, that can be targeted to lower the risks for gambling problems is necessary for the development of effective prevention and intervention initiatives. The aim of this study is therefore to explore the potential for positive mental health characteristics (general coping, emotional support, spirituality, interpersonal skills, personal growth and autonomy, and global affect) to play a compensatory and protective role in problem gambling. Specifically, it is hypothesised that (1) modifiable psychosocial factors (depression, anxiety, hazardous alcohol use, past-year substance use, weekly tobacco use, poor general health) and gambling-related factors (attitudes, cognitions, high-risk situations, motives) will be positively associated with problem gambling severity (risk relationships); (2) positive mental health factors will be negatively associated with problem gambling severity (compensatory relationships); and (3) positive mental health characteristics will buffer the impact of the established risk factors (protective relationships).

2. Method

2.1. Participants

The study recruited a convenience sample of 499 Victorian university students (219 male, 280 female), with ages ranging from 18 to 56 years ($M = 23.1$, $SD = 5.7$) (Table 1). Inclusion criteria were only being aged 18 years and over and being enrolled in a Victorian university; and no exclusion criteria were applied. The majority of participants were born in Australia (66.3%) and reported that English was their first language (72.8%). The majority were domestic students (74.6%), were enrolled full-time (83.4%), were on-campus students (75.8%) and had no to slight money problems in the previous year (89.0%). Past-year gambling participation was reported by 75.0% of the sample, with private games (40.3%), bingo (39.0%), casino table games (32.3%), and electronic gaming machines (EGMs) (31.9%) the most commonly reported gambling activities. Participants reported gambling an average of 67.4 times ($SD = 213.3$) in the previous year, with the

Table 1
Sample characteristics.^a

	Total sample (N = 499)
Demographic characteristics	
Sex (male, %)	219 (43.9%)
Age (M, SD)	23.1 (5.7)
Country of birth (%)	
Australia	331 (66.3%)
China	63 (12.6%)
Vietnam	9 (1.8%)
India	17 (3.4%)
Malaysia	11 (2.2%)
First language (English, %)	346 (72.8%)
Student status (domestic student, %)	372 (74.6%)
Enrolment (full-time, %)	416 (83.4%)
Study mode (on campus, %)	363 (75.8%)
Past year money problems (%)	
No problems at all	185 (44.4%)
Slight problems only	186 (44.6%)
Definite problems	35 (8.4%)
Very severe problems	11 (2.6%)
Past-year gambling participation (%)	
Instant scratch tickets	52 (11.2%)
Sports betting	121 (26.1%)
Horse or greyhound racing	126 (27.2%)
Keno	119 (25.7%)
Casino table games	150 (32.3%)
Bingo	181 (39.0%)
Lotteries	60 (12.9%)
Electronic gaming machines	148 (31.9%)
Private games	187 (40.3%)
Other	36 (7.8%)
Past-year gambling frequency (M, SD)	
Instant scratch tickets	1.7 (25.3)
Sports betting	17.3 (77.7)
Horse or greyhound racing	18.4 (106.1)
Keno	4.0 (31.3)
Casino table games	9.1 (56.6)
Bingo	3.7 (26.0)
Lotteries	2.9 (36.5)
Electronic gaming machines	13.7 (66.2)
Private games	5.6 (22.9)
Other	0.0 (0.2)

^a Using raw data prior to multiple imputation. Sample sizes vary depending on missing data.

highest frequencies reported on EGMs, horse or greyhound racing, sports betting, and casino table games.

2.2. Measures

The survey comprised validated measures evaluating demographic characteristics (sex, age, country of birth, first language, international student status, full-time enrolment status, on-campus study mode, past-year money problems), problem gambling severity, hypothesised risk factors and positive mental health characteristics.

2.2.1. Problem gambling severity

The 9-item Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001) was employed to measure past-year problem gambling severity. Items are rated on 4-point scale; with response options ranging from (0) never to (3) almost always. Scores, which range from 0 to 27, can be employed to categorise problem gambling severity across the continuum of risk: non-problem gambling (scores of 0), low-risk gambling (scores of 1–2), moderate-risk gambling (scores of 3 to 7), and problem gambling (scores of 8 or more). The PGSI has shown very good internal consistency ($\alpha = 0.84$) and construct validity, as well as sensitivity and specificity compared with other measures of problem gambling severity (Ferris & Wynne, 2001).

2.2.2. Hypothesised risk factors

Hypothesised risk factors included depression, anxiety, hazardous alcohol use, past-year substance use, weekly tobacco use, poor general health, gambling attitudes, gambling cognitions, gambling high-risk situations, and gambling motives (Table 2). The measures assessing the hypothesised risk factors have demonstrated good psychometric properties, including high internal consistency, construct validity, concurrent validity, criterion-related validity, convergent validity, and predictive validity.

2.2.3. Positive mental health characteristics

The 47-item Positive Mental Health (PMH) Instrument (Vaingankar et al., 2011) was used to measure positive mental health characteristics. This measure comprises six subscales: General Coping (9 items; general coping styles in times of stress), Emotional Support (7 items; social support and affect), Spirituality (7 items; religious or spiritual beliefs), Interpersonal Skills (9 items; interpersonal and social skills), Personal Growth and Autonomy (10 items; the level of control respondents feel they have in their own lives), and Global Affect (5 items; wellbeing and quality of life). Participants respond to each item on a 6-point Likert scale, with varying response options. Scores are totalled for each subscale then divided by the number of items per subscale. Previous research suggests that the PMH Instrument subscales display good internal consistency ($\alpha = 0.89–0.94$) and construct validity (Vaingankar et al., 2011).

2.3. Procedure

This study was approved by the Deakin University Human Research Ethics Committee (2013-227). Participants were recruited through convenience and snowball sampling, including advertisements placed around university campuses, social media, approaching students on campus, university online message boards, and advertisements sent through student email accounts. Inclusion criteria included: being over 18 years of age, Australian residence, and enrolment at an Australian University. Following online consent, the online survey was delivered to participants via Qualtrics. Data was collected from July 2013 to September 2015. The first 240 participants were offered a AUD\$10 Coles Myer voucher; and all participants were entered into a draw to win one of two free mini iPads or one of 100 AUD\$10 gift vouchers.

2.4. Data analysis

Data cleaning and statistical analysis was conducted in Stata (v.15) (StataCorp, 2017). Multiple imputation using chained equations (Enders, 2010) was employed to account for the missing data (ranging from 0.0% to 16.4%). The imputation model included all variables used in the analyses and additional auxiliary variables (first language, overall happiness, work and social adjustment, international student status, social gambling motives and age). Model estimates are based on pooled estimates from 50 imputed datasets using Rubin's rules (Rubin, 2004). Due to a positively skewed distribution, PGSI scores were re-categorised into an ordinal variable (non-gambling/non-problem gambling, low-risk gambling, moderate-risk gambling, and problem gambling). Recommended cut-off scores for the PHQ (moderate to severe ≥ 10) (Spitzer, Kroenke, & Williams, 2000); GAD (moderate to severe ≥ 10) (Spitzer, Kroenke, Williams, & Löwe, 2006); AUDIT (≥ 8) (Saunders et al., 1993; Babor, Higgins-Biddle, Saunders, & Monteiro, 2020); and single-item screening test for drug use in primary care (≥ 1) (Smith et al., 2010) were employed in these analyses. These cut-offs have good sensitivity and specificity when compared to validated instruments (Saunders et al., 1993; Smith et al., 2010; Spitzer et al., 2000, 2006; Babor et al., 2020). The SF-1 was dichotomised: very good/good and fair/bad/very bad. All other risk factors (ATGS-8 total score, GRCS subscale scores, IGS-10 subscale scores, and RGQ subscale scores) and positive mental health characteristics (PMH Instrument subscale scores)

Table 2
Measures of hypothesised risk factors employed in this study.

Risk factor	Measure	Description of measure
Depression	Patient Health Questionnaire (PHQ) (Spitzer et al., 2000)	9-item questionnaire measuring the presence of depressive symptoms over the previous 2 weeks; 4-point scale from (0) <i>Not at all</i> to (3) <i>Nearly every day</i> .
Anxiety	Generalised Anxiety Disorder (GAD) (Spitzer et al., 2006)	7 item scale measuring the presence of anxiety-related symptoms over the previous two weeks; 4-point scale from (0) <i>Not at all</i> to (3) <i>Nearly every day</i> .
Hazardous alcohol use	Alcohol Use Disorders Identification Test (AUDIT) (Babor et al., 2020)	10-item scale measuring hazardous drinking; 8 items using a 5-point scale with various response options, mostly from (0) <i>Never</i> to (4) <i>Daily or almost daily</i> ; 2 remaining items using a 3-point scale: (0) <i>No</i> , (2) <i>Yes, but not in the last year</i> , and (4) <i>Yes, during the last year</i> .
Drug use and tobacco use	Single-item screening test for drug use in primary care (Smith et al., 2010)	Two separate items (illicit drug use/prescription medication misuse and tobacco use) measuring the frequency of use in the past year; categorical response options were employed in this study: <i>Never</i> ; <i>Less than once a week</i> ; <i>Once a week</i> ; <i>2–3 times a week</i> ; and <i>More often</i> .
General health	Short Form General Health Survey – single item (SF-1) (Gandek & Ware, 1993)	Single item measure derived from the SF-36 which is widely used in routine health surveys (DeSalvo et al., 2006): “In general, would you say your health is...”; response options ranging from (1) <i>Very bad</i> to (5) <i>Very good</i> .
Gambling attitudes	Attitudes Towards Gambling Scale (ATGS-8) (Wardle, Moody, Griffiths, Orford, & Volberg, 2011)	Unidimensional 8-item scale measuring combination of positive and negative attitudinal statements that some people have about gambling; 4 items reverse-scored so higher scores indicate more favourable attitudes towards gambling; 5-point scale from (1) <i>Strongly disagree</i> to (5) <i>Strongly agree</i> .
Gambling-related cognitions	Gambling-Related Cognitions Scale (GRCS) (Raylu & Oei, 2004)	23-item scale consisting of five subscales: interpretative bias (4 items), illusion of control (4 items), predictive control (6 items), gambling-related expectancies (4 items), and perceived inability to stop gambling (5 items); 7-point scale from (1) <i>Strongly disagree</i> to (7) <i>Strongly agree</i> .
Gambling high-risk situations	Short Form of the Inventory of Gambling Situations (IGS-10) (Smith et al., 2011)	10-item measure of frequency of gambling heavily in ten high-risk situations classified into two factors: negative reinforcement situations (difficulties with others; worry about debt; unpleasant, sad or bad feelings; testing control over gambling; temptations to gamble) and positive high-risk situations (social pressure; confidence about skills; winning; pleasant, happy or good feelings; need for excitement); 7-point scale from (1) <i>Never</i> to (7) <i>Daily</i> .
Gambling motives ^a	Reasons for Gambling Questionnaire (RGQ) (Wardle et al., 2011)	14-item scale with five factors (Francis et al., 2015): Money (2 items: chance to win big money or to make money), Positive feelings (4 items: gambling being a hobby or past-time, because it is fun and exciting and because of the sense of achievement on winning), Regulate internal state (3 items: regulating internal states such as tension and boredom and to relax); Social (2 items: gambling to be sociable or because it is something that one does with friends or family); and Challenge (3 items: challenge of the game, the competition and impressing others); 4-point scale from (1) <i>Never</i> to (4) <i>Often</i> .

^a NB: Social motives were not included in this study as research consistently indicates that these gambling motives are not associated with problem gambling status) (Francis et al., 2015; Stewart & Zack, 2008).

do not have validated cut-off scores and were therefore mean-centred prior to conducting the analyses. A series of linear (continuous variables), logistic regressions (binary variables), and ordinal logistic regressions (PGSI) were employed to examine sex differences in gambling severity, risk factors, and positive mental health characteristics. Given sex differences across these variables, all subsequent analyses controlled for sex.

Risk factors and positive mental health characteristics were regressed on to PGSI scores in a series of univariate ordinal logistic regression analyses. Multivariate models were then fitted to further explore the risk factors and positive mental health characteristics (testing these as compensatory factors) that were unique predictors of PGSI. Only significant predictors ($p < 0.05$) in the univariate regressions were included in these multivariate models. Finally, a series of moderated ordinal logistic regressions were employed to explore the associations between PGSI scores and each risk factor moderated by each positive mental health characteristic (testing these as protective factors). Due to the number of moderations explored, simple slopes analyses with pairwise comparisons of marginal means were performed to investigate significant interaction effects at $p < 0.03$ at low and high levels (one SD below and above the mean) of each factor. Simple slopes were then graphed on a log odds scale in R (v.6.1) (R Core Team, 2019), using the package ggplot2 (Wickham, 2016).

3. Results

3.1. Descriptive statistics

Descriptive statistics for each variable of interest are represented in Table 3. After imputation, 6.7% of the sample were classified in the

PGSI problem gambling category, 15.9% were classified in the moderate-risk gambling category, and 26.8% were classified in the low-risk gambling category. On the psychosocial risk factors, the sample was most likely to report hazardous alcohol use (40.2%), followed by past-year substance use (23.3%), weekly tobacco use (18.7%), anxiety symptoms (17.5%), depression symptoms (16.1%), and poor general health (16.0%). Male participants displayed higher problem gambling severity, hazardous alcohol use, past-year substance use, weekly tobacco use, gambling cognitions, gambling high-risk situations, and gambling motives; while female participants displayed higher anxiety, gambling attitudes, and emotional support. The measures employed in this study displayed good internal consistency.

3.2. Risk factors for problem gambling

A series of univariate ordinal logistic regression analyses (Table 4) revealed that hazardous alcohol use (OR = 2.10) and past-year substance use (OR = 1.55), all gambling cognitions (OR = 1.11–1.16), both gambling high-risk situations subscales (OR = 1.45–1.49), and all gambling motives subscales (OR = 1.59–2.18) positively predicted problem gambling severity. In contrast, gambling attitudes negatively predicted problem gambling severity (OR = 0.92). Depression, anxiety, weekly tobacco use, and poor general health were not significantly associated with problem gambling severity. A multivariate ordinal logistic regression analysis (Table 4) revealed that only predictive control cognitions (OR = 1.08), positive reinforcement situations (OR = 1.18), and challenge motives (OR = 1.59) remained independent positive predictors of problem gambling severity.

Table 3
Distribution and internal consistency of measures.^a

PGSI risk categories	Males (n = 219)	Females (n = 280)	p-value	Total sample (n = 499)	Internal consistency (α)
Non-problem gambling	31.8%	65.3%	< 0.001	50.5%	0.87
Low-risk gambling	32.8%	22.1%		26.8%	
Moderate-risk gambling	23.2%	10.2%		15.9%	
Problem gambling	12.2%	2.4%		6.7%	
Risk factors					
PHQ Depression (%)	13.6%	18.0%	0.226	16.1%	0.90
GAD Anxiety (%)	10.1%	23.3%	0.001	17.5%	0.91
AUDIT Hazardous alcohol use (%)	49.7%	32.8%	< 0.001	40.2%	0.85
Past-year substance use (%)	30.0%	18.1%	0.005	23.3%	
Weekly tobacco use (%)	26.0%	13.0%	0.001	18.7%	
SF-1 Poor general health (%)	17.2%	15.0%	0.554	16.0%	
ATGS-8 Attitudes towards gambling (M, SE)	26.0 (0.2)	27.3 (0.2)	< 0.001	26.7 (0.1)	0.73
GRCS Gambling cognitions (M, SE)					
Interpretative bias	10.4 (0.4)	7.8 (0.3)	< 0.001	9.0 (0.2)	0.83
Illusion of control	11.2 (0.4)	8.0 (0.3)	< 0.001	9.4 (0.2)	0.82
Predictive control	16.0 (0.5)	11.8 (0.4)	< 0.001	13.6 (0.3)	0.85
Gambling-related expectancies	10.4 (0.3)	8.0 (0.3)	< 0.001	9.1 (0.2)	0.78
Perceived inability to stop gambling	12.7 (0.4)	9.7 (0.4)	< 0.001	11.0 (0.3)	0.85
IGS-10 Gambling high-risk situations (M, SE)					
Negative reinforcement	8.1 (0.3)	6.1 (0.2)	< 0.001	7.0 (0.2)	0.89
Positive reinforcement	8.8 (0.3)	6.6 (0.2)	< 0.001	7.6 (0.2)	0.91
RGQ Gambling motives (M, SE)					
Money	3.7 (0.1)	2.7 (0.1)	< 0.001	3.1 (0.1)	0.70
Positive feelings	8.0 (0.2)	5.9 (0.2)	< 0.001	6.8 (0.1)	0.79
Regulate internal state	5.9 (0.2)	4.3 (0.1)	< 0.001	5.0 (0.1)	0.74
Challenge	6.5 (0.2)	4.9 (0.1)	< 0.001	5.6 (0.1)	0.77
PMH Positive mental health characteristics (M, SE)					
General coping	3.8 (0.1)	3.8 (0.1)	0.545	3.8 (0.1)	0.90
Emotional support	4.3 (0.1)	4.7 (0.1)	< 0.001	4.6 (0.1)	0.92
Spirituality	2.5 (0.1)	2.5 (0.1)	0.919	2.5 (0.1)	0.97
Interpersonal skills	4.5 (0.1)	4.7 (0.1)	0.013	4.6 (0.5)	0.93
Personal growth and autonomy	4.4 (0.1)	4.5 (0.1)	0.260	4.5 (0.1)	0.95
Global affect	4.5 (0.1)	4.4 (0.1)	0.242	4.5 (0.1)	0.90

PGSI: Problem Gambling Severity Index; PHQ: Patient Health Questionnaire; GAD: Generalised Anxiety Disorder; SF-1: Short Form General Health Survey (1 item); ATGS-8: Attitudes Towards Gambling Scale (8 item); GRCS: Gambling-Related Cognitions Scale; IGS-10: Inventory of Gambling Situations – Short Form; RGQ: Reasons for Gambling Questionnaire; PMH: Positive Mental Health Instrument.

^a Pooled proportions and means (standard errors) over 50 imputations.

3.3. The compensatory role of positive mental health characteristics

A series of univariate ordinal logistic regression analyses (Table 5) revealed that none of the positive mental health characteristics negatively predicted problem gambling severity, indicating that none of them displayed a compensatory role in problem gambling severity. Spirituality was a positive predictor of problem gambling severity (OR = 1.15), indicating that it displayed a risk relationship with problem gambling severity in this study.

3.4. The protective role of positive mental health characteristics

A series of moderated ordinal logistic regressions (Table 6) revealed that there were significant interactions ($p < 0.03$) between: (a) emotional support and positive reinforcement situations, money motives, and positive feelings motives; (b) personal growth and autonomy and negative reinforcement situations, money motives, positive feelings motives, and regulate internal state motives; and (c) global affect and negative reinforcement situations and positive reinforcement situations. There were no significant interactions between any risk factor and general coping or interpersonal skills. The protective role of spirituality was not investigated given that this variable positively predicted problem gambling severity.

Simple slopes analyses for the significant interaction effects revealed similar buffering effects for emotional support, personal growth and autonomy, and global affect in the presence of high levels of all of the risk factors (see Fig. 1 for an illustrative representation of these relationships). In these relationships, there were no significant differences in problem gambling severity for participants with low levels of

the risk factors when the level of emotional support ($p = 0.075$ – 0.186), personal growth and autonomy ($p = 0.154$ – 0.726), or global affect ($p = 0.249$ – 0.295) was low or high; however, when the levels of the risk factors were high, participants with high levels of emotional support ($p = 0.020$ – 0.032), personal growth and autonomy ($p < 0.001$ – 0.049), or global affect ($p = 0.004$ – 0.005) reported lower problem gambling severity than participants with low levels of these positive mental health characteristics.

4. Discussion

This study explored the potential for positive mental health characteristics to play a compensatory or protective role in the development of problem gambling. The hypothesis that the risk factors would be positively associated with problem gambling severity was partially supported. The hypothesis that positive mental health characteristics would be negatively associated with problem gambling severity (compensatory relationships) was not supported; while the hypothesis that these characteristics would buffer the impact of a range of established risk factors for problem gambling (protective relationships) was partially supported.

4.1. Risk factors for problem gambling

As expected, most of the factors conceptualised as risk factors in this study positively predicted problem gambling severity. Consistent with previous research (Abbott et al., 1999; Dickson et al., 2002, 2008; Dowling et al., 2015, 2017; el-Guebaly et al., 2015; Lorains et al., 2011; Messerlian et al., 2007; Dowling & Oldenhof, 2017), substance use

Table 4
Univariate and multivariate ordinal logistic regression analyses of risk factors predicting problem gambling severity^{a,b}.

Univariate analysis	OR	95% CI	p
PHQ Depression	1.15	0.66, 2.00	0.614
GAD Anxiety	1.07	0.63, 1.84	0.795
AUDIT Hazardous alcohol use	2.10	1.42, 3.12	< 0.001
Past-year substance use	1.55	1.01, 2.40	0.045
Weekly tobacco use	1.50	0.92, 2.45	0.100
SF-1 Poor general health	0.98	0.58, 1.64	0.940
ATGS-8 Gambling attitudes	0.92	0.86, 0.98	0.009
GRCS Gambling-related cognitions			
Interpretative bias	1.15	1.11, 1.20	< 0.001
Illusion of control	1.16	1.11, 1.21	< 0.001
Predictive control	1.11	1.08, 1.14	< 0.001
Gambling-related expectancies	1.16	1.11, 1.21	< 0.001
Perceived inability to stop gambling	1.11	1.08, 1.15	< 0.001
IGS-10 Gambling high-risk situations			
Negative reinforcement	1.49	1.38, 1.60	< 0.001
Positive reinforcement	1.45	1.36, 1.54	< 0.001
RGQ Gambling motives			
Money	2.18	1.89, 2.52	< 0.001
Positive feelings	1.61	1.49, 1.75	< 0.001
Regulate internal state	1.74	1.57, 1.92	< 0.001
Challenge	1.59	1.46, 1.74	< 0.001
Multivariate analysis			
AUDIT Hazardous alcohol use	1.22	0.76, 1.94	0.411
Past-year substance use	1.27	0.75, 2.15	0.379
ATGS-8 Attitudes towards gambling	1.03	0.95, 1.10	0.503
GRCS Gambling-related cognitions			
Interpretative bias	1.06	0.97, 1.16	0.215
Illusion of control	0.95	0.86, 1.06	0.383
Predictive control	1.08	1.01, 1.16	0.019
Gambling-related expectancies	0.96	0.88, 1.05	0.429
Perceived inability to stop gambling	0.95	0.88, 1.02	0.167
IGS-10 Gambling high-risk situations			
Negative reinforcement	1.08	0.94, 1.25	0.282
Positive reinforcement	1.18	1.05, 1.34	0.008
RCQ Gambling motives			
Money	1.19	0.94, 1.50	0.143
Positive feelings	1.14	0.97, 1.33	0.107
Regulate internal state	1.00	0.83, 1.20	0.970
Challenge	1.23	1.08, 1.40	0.002

OR = odds ratio; 95% CI = 95% confidence interval.

PGSI: Problem Gambling Severity Index; PHQ: Patient Health Questionnaire; GAD: Generalised Anxiety Disorder; SF-1: Short Form General Health Survey (1 item); ATGS-8: Attitudes Towards Gambling Scale (8 item); GRCS: Gambling-Related Cognitions Scale; IGS-10: Inventory of Gambling Situations – Short Form; RGQ: Reasons for Gambling Questionnaire.

^a Pooled estimates over 50 imputations, adjusted for sex.

^b Reference category for the dependent variable = non-problem gambling.

Table 5
Univariate ordinal logistic regression analyses of positive mental health characteristics in predicting problem gambling severity^{a,b}.

Univariate analysis	OR	95% CI	p
PMH Positive mental health characteristics			
General coping	1.07	0.90, 1.28	0.447
Emotional support	0.97	0.82, 1.16	0.763
Spirituality	1.15	1.02, 1.30	0.021
Interpersonal skills	0.90	0.74, 1.09	0.286
Personal growth and autonomy	0.93	0.78, 1.11	0.410
Global affect	0.94	0.76, 1.15	0.528

OR = odds ratio; 95% CI = 95% confidence interval.

PMH: Positive Mental Health Instrument.

^a Pooled estimates over 50 imputations, adjusted for sex.

^b Reference category for the dependent variable = non-problem gambling.

variables (hazardous alcohol use, past-year substance use) were positively associated with problem gambling severity. Theoretical explanations advanced to explain the association between substance use

disorders and problem gambling include the cross-substance coping response hypothesis, whereby substance use alleviates the aversive effects of gambling, and vice versa; positive reinforcement principles, whereby the positive effects of both behaviours are enhanced when they are engaged in simultaneously or acute cross-tolerance results in increased gambling involvement to provide alternative rewards; the cross-substance cue reactivity model, whereby gambling and substance use cues acquire conditioned stimulus properties as a result of their repeated pairings; and the attention allocation model, whereby substances restrict attention to only the most salient environmental and internal cues (known as alcohol myopia) (Dowling et al., 2017). Our understanding of the distribution of drinking, other substance use and gambling behaviour as they occur in real life would, however, be enhanced by further prospective naturalistic research investigating these episodes at the event level (Dowling et al., 2017).

Similarly, the findings that gambling cognitions (including interpretative bias, illusion of control, predictive control, gambling-related expectancies, and perceived inability to stop gambling), gambling high-risk situations (negative and positive reinforcement situations), and gambling motives (money, positive feelings, regulate internal state, and challenge motives) displayed positive relationships with problem gambling severity are also consistent with previous cross-sectional research (Browne et al., 2019; Dechant, 2014; Francis et al., 2015; Raylu & Oei, 2004; Smith, Stewart, O'Connor, Collins, & Katz, 2011; Stewart & Zack, 2008). Longitudinal research, however, is required to explore the temporal relationship between these factors and problem gambling. Of the risk factors examined in this study, only predictive control cognitions, positive reinforcement situations and challenge motives were independent positive predictors of problem gambling severity, indicating that these factors met the expanded definition in which risk factors represent theoretically independent domains (Loxley et al., 2004).

Several factors that were conceptualised as established risk factors for gambling (depression, anxiety, weekly tobacco use, and poor general health) were not significantly associated with problem gambling severity in this sample. Although these findings are inconsistent with the bulk of the literature (Dickson et al., 2002; Dowling et al., 2015, 2017, 2019; el-Guebaly et al., 2015; Hardoon & Derevensky, 2002; Lorains et al., 2011; Lussier et al., 2014; Messerlian et al., 2007; Shead et al., 2010; Williams et al., 2015; Dowling & Oldenhof, 2017), the effect sizes between these factors and problem gambling are often small and several studies have failed to identify a significant association between these factors and problem gambling (Dowling et al., 2017). For example, the findings of a systematic review of early risk and compensatory factors for problem gambling (Dowling et al., 2017) found non-significant longitudinal associations between many internalising symptoms (anxiety symptoms, psychological distress, negative affect, and suicidal ideation) and subsequent gambling problems. Moreover, although there were significant longitudinal associations between depression and tobacco use and subsequent problem gambling, the effect sizes were small and many of the included articles failed to identify a significant association between these psychosocial variables and subsequent problem gambling. Consistent with the pathways model of gambling problems in which problem gambling is conceptualised as a heterogeneous condition (Blaszczynski & Nower, 2002), it may be that the relationship between these factors and problem gambling occurs in a sub-sample of problem gamblers and that these associations can be “washed out” in estimates from full samples (Scholes-Balog et al., 2015). It may also be that some of the brief self-report screening instruments employed in this study to measure depression, anxiety, tobacco use, and general health failed to adequately represent the constructs under examination. The exact nature of these relationships may be clarified in future prospective research using person-centred methods, such as latent-class analysis or event-related approaches (Dowling et al., 2017).

In contrast to expectations, positive attitudes towards gambling

Table 6
Role of risk factors moderated by positive mental health characteristics in predicting problem gambling severity.^{a,b}

Risk factor	PMH General Coping		PMH Emotional Support		PMH Interpersonal Skills	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
PHQ Depression	1.33 (0.81, 2.20)	0.264	1.27 (0.82, 1.96)	0.276	0.84 (0.51, 1.40)	0.511
GAD Anxiety	1.27 (0.76, 2.14)	0.361	1.00 (0.67, 1.50)	0.990	0.87 (0.51, 1.51)	0.631
AUDIT Hazardous alcohol use	1.12 (0.78, 1.59)	0.540	0.90 (0.65, 1.26)	0.556	0.79 (0.53, 1.19)	0.259
Past-year substance use	0.89 (0.60, 1.33)	0.581	0.78 (0.50, 1.22)	0.282	0.83 (0.52, 1.31)	0.423
Weekly tobacco use	1.30 (0.82, 2.07)	0.271	0.97 (0.56, 1.66)	0.904	0.89 (0.53, 1.51)	0.672
SF-1 Poor general health	0.67 (0.41, 1.10)	0.115	0.90 (0.59, 1.39)	0.645	0.75 (0.45, 1.24)	0.258
ATGS-8 Gambling attitudes	0.99 (0.93, 1.04)	0.602	0.98 (0.93, 1.04)	0.570	1.10 (0.95, 1.07)	0.849
GRCS gambling cognitions						
Interpretative bias	1.02 (0.98, 1.06)	0.399	1.00 (0.96, 1.04)	0.934	0.99 (0.95, 1.04)	0.799
Illusion of control	1.02 (0.98, 1.06)	0.405	1.01 (0.97, 1.04)	0.712	0.99 (0.95, 1.04)	0.777
Predictive control	1.02 (0.99, 1.05)	0.231	1.01 (0.98, 1.03)	0.700	0.99 (0.96, 1.02)	0.587
Gambling-related expectancies	1.01 (0.97, 1.05)	0.745	0.98 (0.94, 1.02)	0.311	0.97 (0.93, 1.02)	0.262
Perceived inability to stop gambling	1.01 (0.98, 1.04)	0.497	1.00 (0.97, 1.03)	0.951	1.00 (0.96, 1.03)	0.857
IGS-10 gambling high-risk situations						
Negative reinforcement	0.99 (0.94, 1.05)	0.816	0.94 (0.89, 1.00)	0.034	0.96 (0.90, 1.03)	0.229
Positive reinforcement	1.00 (0.95, 1.06)	0.904	0.93 (0.88, 0.98)	0.008	0.96 (0.91, 1.02)	0.179
RGQ gambling motives						
Money	1.05 (0.93, 1.18)	0.449	0.86 (0.76, 0.97)	0.012	0.88 (0.77, 1.00)	0.059
Positive feelings	1.00 (0.94, 1.07)	0.969	0.92 (0.86, 0.98)	0.013	0.93 (0.85, 1.00)	0.055
Regulate internal state	0.98 (0.90, 1.06)	0.574	0.93 (0.86, 1.01)	0.079	0.91 (0.83, 1.00)	0.042
Challenge	0.99 (0.92, 1.07)	0.828	0.94 (0.88, 1.01)	0.095	0.96 (0.88, 1.04)	0.278
Risk factor						
	PMH Personal Growth and Autonomy		PMH Global Affect			
	OR (95% CI)	p	OR (95% CI)	p		
PHQ Depression	1.31 (0.83, 2.05)	0.248	1.46 (0.83, 2.54)	0.186		
GAD Anxiety	1.15 (0.73, 1.81)	0.559	1.31 (0.75, 2.28)	0.337		
AUDIT Hazardous alcohol use	0.95 (0.65, 1.38)	0.783	0.88 (0.56, 1.39)	0.591		
Past-year substance use	0.94 (0.60, 1.46)	0.781	0.85 (0.53, 1.37)	0.507		
Weekly tobacco use	1.19 (0.72, 1.96)	0.493	1.15 (0.65, 2.03)	0.636		
SF-1 Poor general health	0.86 (0.54, 1.38)	0.540	0.93 (0.57, 1.54)	0.784		
ATGS-8 Gambling attitudes	1.00 (0.94, 1.06)	0.886	1.07 (1.00, 1.15)	0.050		
GRCS gambling cognitions						
Interpretative bias	0.99 (0.95, 1.03)	0.612	0.97 (0.93, 1.02)	0.271		
Illusion of control	1.00 (0.96, 1.04)	0.874	0.97 (0.93, 1.03)	0.315		
Predictive control	1.00 (0.97, 1.03)	0.979	0.98 (0.95, 1.02)	0.298		
Gambling-related expectancies	0.98 (0.93, 1.02)	0.291	0.97 (0.91, 1.02)	0.203		
Perceived inability to stop gambling	1.00 (0.97, 1.03)	0.991	0.98 (0.94, 1.02)	0.422		
IGS-10 gambling high-risk situations						
Negative reinforcement	0.93 (0.87, 0.99)	0.022	0.90 (0.84, 0.97)	0.009		
Positive reinforcement	0.94 (0.89, 0.99)	0.032	0.91 (0.85, 0.98)	0.009		
RCQ gambling motives						
Money	0.84 (0.73, 0.97)	0.014	0.85 (0.73, 0.99)	0.038		
Positive feelings	0.90 (0.84, 0.97)	0.005	0.92 (0.84, 1.00)	0.041		
Regulate internal state	0.87 (0.79, 0.96)	0.005	0.90 (0.81, 1.00)	0.043		
Challenge	0.93 (0.86, 1.01)	0.076	0.94 (0.86, 1.03)	0.192		

OR = odds ratio; 95% CI = 95% confidence interval.

PGSI: Problem Gambling Severity Index; PHQ: Patient Health Questionnaire; GAD: Generalised Anxiety Disorder; SF-1: Short Form General Health Survey (1 item); ATGS-8: Attitudes Towards Gambling Scale (8 item); GRCS: Gambling-Related Cognitions Scale; IGS-10: Inventory of Gambling Situations – Short Form; RGQ: Reasons for Gambling Questionnaire.

^a Pooled estimates over 50 imputations, adjusted for sex.

^b Reference category for the dependent variable = non-problem gambling.

negatively predicted problem gambling severity in this study, suggesting that they played the role of a compensatory factor in this sample. Although this is inconsistent with the majority of the literature (Canale et al., 2016; Hardoon & Derevensky, 2002), there are some studies that have failed to find a significant relationship between these variables [e.g., (Dixon et al., 2016)]. The finding does not appear to be a function of the instrumentation employed, given that several other studies employing this measure have identified that positive gambling attitudes are associated with higher levels of gambling frequency and problem gambling severity [see (Canale et al., 2016)]. It may be that, at least in this sample of young adults, the negative relationship between positive attitudes towards gambling and problem gambling is recursive in nature, whereby the negative consequences of gambling increase as gambling behaviour intensifies, which in turn results in more negative attitudes towards gambling. This explanation has been applied to the consistent finding in the literature that negative gambling outcome expectancies, such as over-involvement and emotional impacts, are

unique contributors to the development of problem gambling (Gillespie, Derevensky, & Gupta, 2007; St-Pierre, Temcheff, Gupta, Derevensky, & Paskus, 2014; Wickwire, Whelan, & Meyers, 2010; Wohl, Anisman, & Matheson, 2006). Longitudinal research using large population-representative samples is necessary to clarify the nature of the relationship between gambling attitudes and the subsequent development of problem gambling.

4.2. Compensatory and protective factors for problem gambling

None of the positive mental health characteristics negatively predicted problem gambling severity in this study, suggesting that they do not play a compensatory role in the development of gambling problems. Although the PMH Inventory subscales have previously been associated with a range of other positive mental health measures, such as resilience, social support, coping, life satisfaction, mental wellbeing, and quality of life (Vaingankar et al., 2011), it may be that a multi-faceted

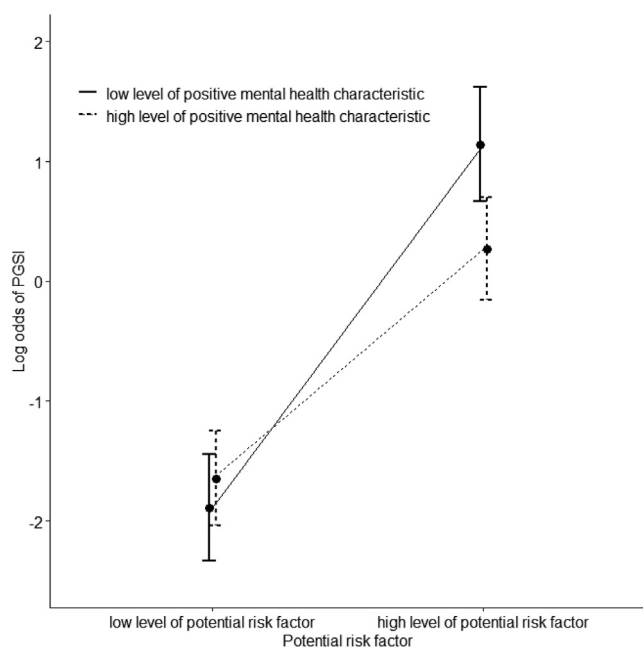


Fig. 1. Significant interaction effects between risk factors and PMH positive mental health characteristics.

evaluation of some of the mental health characteristics might be more useful to identify compensatory profiles for university students. Some of these characteristics (emotional support, personal growth and autonomy, and global affect), however, significantly interacted with gambling high-risk situations and motives in predicting problem gambling severity, suggesting that these characteristics play a protective role in the presence of risk. Specifically, emotional support buffered the effect of positive reinforcement high-risk situations, money motives, and positive feelings motives; personal growth and autonomy buffered the effect of negative reinforcement high-risk situations, money motives, positive feelings motives, and regulate internal state motives; and global affect buffered the effects of negative and positive reinforcement high-risk situations.

In contrast, spirituality displayed a direct positive predictive relationship with problem gambling severity, suggesting that it served to act as a risk factor in this sample. While the protective nature of religiosity and spirituality in the risk of alcohol and other substance use is well established (Chitwood, Weiss, & Leukefeld, 2008), there is some other evidence that religiosity positively predicts problem gambling severity; and that gambling-related cognitions may play a role in this relationship (Browne et al., 2019; Kim, Shifrin, Sztainert, & Wohl, 2018). It has been hypothesised that, in the context of gambling, people who are religious believe they can control the outcome of a game of chance through intervening good fortune or a higher power (Kim et al., 2018). Further investigation of the role of spirituality and religiosity, with more sophisticated instrumentation to measure these multi-dimensional constructs, as well as specific gambling cognitions, such as magical thinking and illusion of control, appears warranted.

Several other study findings are worth noting. First, general coping and interpersonal skills failed to significantly moderate the relationships between problem gambling severity and any of the established risk factors, indicating that they did not display a protective role in the presence of risk. It may be that these measures were not specific enough, with these constructs often being measured using multi-dimensional instruments. Alternatively, it may be that these characteristics buffer the influence of risk factors not examined in this study. This finding suggests that future research is required to explore the degree to which different aspects of coping (such as active coping, positive reappraisal, and planning) and interpersonal skills (such as

communication skills, emotional intelligence, and conflict resolution skills) buffer the relationship between risk factors and problem gambling. Second, the positive mental health characteristics examined in this study only buffered the effects of gambling high-risk situations and motives and failed to buffer the effects of the other established risk factors, including psychopathology, alcohol and other substance use, general health, gambling attitudes, and gambling cognitions. This highlights the need for future research to examine the role of other factors that may play a protective role in buffering the effects of these risk factors.

4.3. Study implications

Preventive interventions aim to disrupt the processes that contribute to the development of gambling problems by counteracting risk factors and reinforcing compensatory and protective factors (Coie et al., 1993). The findings from this study add to the growing literature that substance use, gambling cognitions, high-risk situations, and gambling motives are clear targets for intervention. Moreover, assessment of these factors can contribute to a functional analysis of gambling behaviour to facilitate targeted interventions to optimise client outcomes (Dowling, Merkouris, & Lorains, 2016). For example, there is some preliminary evidence that a motivation-matched intervention approach has some utility in the treatment of problem gambling (Stewart et al., 2016). Finally, the findings suggest that prevention and intervention initiatives should attempt to strengthen emotional support, personal growth and autonomy, and global affect as these positive mental health characteristics have the potential to buffer the influence of gambling motives and high-risk situations.

4.4. Study limitations

The findings of this study should be interpreted in the context of several limitations. First, the cross-sectional nature of the study precludes making causal inferences from the results. While cross-sectional studies provide some insight into the factors associated with problem gambling, prospective investigations have the potential to yield exceptionally powerful data relating to the processes by which risk, compensatory, and protective factors influence the emergence and course of problem gambling (Coie et al., 1993). Second, the use of a convenience sample of university students precludes the generalisability of the findings to the development of problem gambling in the general population. Third, we employed measures with cut-off scores that have not necessarily been fully validated in young adult or university student samples. Finally, this study investigated factors classified in the individual level of the socio-ecological model, a multi-level framework that considers the different contexts in which these factors exist (Dahlberg & Krug, 2006). There is a clear need for future research to explore risk, compensatory, and protective factors for problem gambling that are classified in the relationship, community, and societal levels of this model. The degree to which these factors interact with client demographic and gambling characteristics, such as sex, age, and type of gambling, is an additional area of investigation for future research on prevention and treatment on gambling disorder.

4.5. Conclusion

These limitations notwithstanding, this study provides important new insights regarding the role of protective factors that interact with established risk factors to mitigate their effects. Specifically, it highlights the potential for emotional support, personal growth and autonomy, and global affect to buffer the influence of gambling motives and high-risk situations. It also adds to the growing body of evidence that substance use, gambling cognitions, high-risk situations, and gambling motives play a risk role in the development of problem gambling. The identification of these modifiable risk and protective

factors has implications for the development of effective prevention and intervention initiatives. Further longitudinal research employing population-representative samples is required to replicate these results and investigate relationship-, community-, and societal-level risk, compensatory, and protective factors associated with the development of problem gambling.

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6. Contributors

ND conceptualised the study and supervised the collection of the data. SA conducted the statistical analysis of the data under the supervision of SM. ND wrote the first draft of the manuscript. All authors contributed to the manuscript and have approved the final manuscript.

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CRediT authorship contribution statement

N.A. Dowling: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing, Supervision, Project administration. **S. Aarsman:** Formal analysis, Writing - review & editing, Visualization. **S.S. Merkouris:** Conceptualization, Writing - review & editing, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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