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Negative and positive mental health characteristics of affected family members: Findings from a cross-sectional Australian general population gambling study

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ABSTRACT

Despite the impact of problem gambling on affected family members (AFMs), there are limited large-scale population level studies identifying the negative mental health (NMH) and positive mental health (PMH) characteristics of AFMs. Furthermore, no study has explored whether PMH characteristics are protective in the relationships between AFM status and NMH characteristics. This study involved secondary data analysis from the Third Social and Economic Impact Study of Gambling in Tasmania. Using a subsample of 1,869 adults (48.30 % male; $mean_{age}$ = 48.48; 4.67 % AFMs), this study aimed to explore whether: (1) AFM status is associated with NMH (depression, anxiety, panic, post-traumatic stress disorder, social anxiety, binge drinking, tobacco use, and drug use symptoms) and PMH (quality of life [QOL], personal growth/autonomy, interpersonal/social skills, coping skills) characteristics after separately controlling for sociodemographic, problem gambling severity, and other NMH characteristics; (2) PMH characteristics moderate (buffer) the relationships between AFM status and NMH characteristics; and (3) gender influences these relationships. AFM status, defined as exposure to family member gambling problems, significantly positively predicted NMH characteristics (depression, anxiety, panic, PTSD, and tobacco use symptoms) and negatively predicted QOL (physical, social) and planning coping. The strength of these relationships generally attenuated after controlling for various covariates. Gender did not moderate these relationships. Religious coping exacerbated the relationship between AFM status and panic disorder symptoms. These findings can inform the development of intervention initiatives for family members exposed to gambling problems. Future population-representative research is required using a range of affected other types, longitudinal study designs, and more comprehensive measures.

1. Introduction

Gambling-related harm is defined as any negative consequence from gambling that negatively impacts an individual, family, community, or population's health or wellbeing (Langham et al., 2016). Internationally, prevalence estimates for affected others (AOs) involving any significant others range from 5.1 % to 21.2 % (Castrén et al., 2021; Dowling et al., 2023; Hing et al., 2022; Lind et al., 2022; Salonen et al., 2015; Salonen et al., 2016; Salonen et al., 2014; Svensson et al., 2013), while estimates for the subset of affected family members (AFMs) estimates range from 2.0 % to 10.0 % (Castrén, et al. 2021; Lind at al., 2022; Salonen et al., 2015; Salonen et al., 2016; Salonen et al., 2014; Shiue, 2015; Wenzel et al., 2008). There is evidence that one person's gambling problems has direct negative impacts on at least six others, while low-risk and moderate-risk gambling affects one and three others, respectively (Goodwin et al., 2017). Research suggests that problem gambling AOs experience a 10 % to 36 % reduction in overall quality of life (QOL), with slightly lower, but non-negligible, estimates for lower-risk gambling (Browne et al., 2017; Rockloff et al., 2019). A recent taxonomy organises gambling harm to AOs across seven domains: relationship disruption, conflict or breakdown, emotional or psychological distress, financial harm, decrements to health, reduced performance at work or

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study, cultural harm, and criminal activity (Langham et al., 2016). Indeed, the contemporary Stress-Strain-Coping-Support model (SSCS) (Orford et al., 2010; Orford et al., 2005) assumes that the chronic stress resulting from the gambling problems of family members results in AFM strain, including reduced health and wellbeing.

1.1. Negative mental health characteristics of AOs

A recent scoping review (Dowling et al., 2022) organised the AO harm literature according to measures with no direct reference to gambling (non-attributable harm) and measures with direct reference to gambling (attributable harm). Attributable harm measurement relies on AO insight and willingness to acknowledge gambling-related harms, while non-attributable harm measurement may evaluate harm from non-gambling sources, although efforts to account for these sources reduces this possibility (Dowling et al., 2022; Quilty et al., 2015). Across various study designs and AO samples, the review found AOs reported both types of harm across multiple domains, but evidence was less consistent for studies utilising standardised non-attributable measures. However, harm identification in AOs has generally been derived from small treatment-seeking samples so these findings may not be generalisable to the broader AO population.

While negative mental health (NMH) characteristics, such as symptoms of depression, anxiety, panic, trauma, psychological distress, and substance use, align with the SCSS model "strain" component (Orford et al., 2017), few large-scale population studies have examined these harms for AOs or AFMs. These studies, which focus on non-attributable harm (Dowling et al., 2023; Salonen et al., 2014; Svensson et al., 2013; Wenzel et al., 2008; Dowling et al., 2022), generally report elevated rates of mental health problems (i.e., psychological distress), depression, anxiety, hazardous drinking, binge drinking, tobacco use, and substance use in mixed-gender, male, or female samples of AOs and their AFM subset. Although one study found that gender does not moderate any of the relationships between AO status and NMH characteristics (Dowling et al., 2023), another study found that AO status was associated with hazardous alcohol use only for males and smoking daily only for females (Salonen et al., 2014). Another study also found no significant differences in anxiety symptoms between AFMs and non-AFMs (Wenzel et al., 2008).

Ambiguity remains regarding the significance of these relationships after controlling for sociodemographic characteristics and other potential sources of harm (e.g., problem gambling severity, other NMH characteristics). One study revealed that AO status remained positively associated with anxiety symptoms and tobacco use after separately controlling for all of these factors, but that the associations of AO status with depressive symptoms, binge drinking, and drug use attenuated to non-significance after controlling for other NMH characteristics (Dowling et al., 2023). Some studies attempting to control for such factors have found that mental health problems (i.e., psychological distress) remained significant for male, female, and mixed-gender AFMs/AOs (Lind et al., 2022; Svensson et al., 2013), while others found that mental health problems were no longer significant for these groups (Salonen et al., 2014; Shiue, 2015). Similarly, hazardous alcohol use remained significant for male and mixed-gender AFMs/AOs (Lind et al., 2022; Salonen et al., 2014; Svensson et al., 2013), but was attenuated for females (Svensson et al., 2013). Finally, one study found that smoking daily remained significant for female AOs (Salonen et al., 2014). In addition to their equivocal findings, the generalisability is limited as most of these studies were conducted in Nordic countries, and they provide limited information on which factors are responsible for any attenuation due to simultaneous entry of covariates.

1.2. Positive mental health characteristics of AOs

Despite this, many AOs or AFMs never develop these NMH characteristics, suggesting there are protective factors for some family members and friends. Indeed, the SCSS model suggests that the severity of AFM strain is influenced by their coping skills and social support (Orford et al., 2010; Orford et al., 2005). Positive mental health (PMH) is a state of wellbeing where individuals realise their potential, manage stress, and contribute to their community (World Health Organization, 2001). In a small number of population-level studies, mixed-gender samples of AOs have reported significantly lower PMH characteristics, including life satisfaction, personal wellbeing and social support than non-AOs, even after controlling for sociodemographic factors and problem gambling severity (Svensson et al., 2013; Tulloch et al., 2023).

Similarly in smaller treatment-seeking samples, AOs and AFMs generally report lower social support than non-AOs (Orford et al., 2017; Rodda et al., 2020), albeit with some equivocal findings for AFMs (Estevez et al., 2020). AOs and AFMs often employ gambling-related coping strategies (e.g. supporting the gambler to change) before seeking further support (Côté et al., 2018; Hing et al., 2013; Rodda et al., 2020). The literature on general coping styles is inconsistent, with findings revealing that AFMs use less task-oriented coping (problem-solving, planning) (Krishnan & Orford, 2002), higher problem-solving, wishful thinking, and emotional expression (Estevez et al., 2020), and similar levels of emotion- or avoidance-oriented coping (distraction) (Goghari et al., 2020). Finally, decreases in psychological distress following AFM treatment have been associated with increased self-efficacy, positive beliefs, and coping (Hodgins et al., 2007; Krishnan & Orford, 2002; Makarchuk et al., 2002; Rychtarik & McGillicuddy, 2006). To date, however, no study has examined the moderating role of PMH characteristics on the relationships between AO/AFM status and gambling-related harm.

1.3. Study aims

Understanding the NMH and PMH characteristics experienced by AFMs can guide intervention development for these under-served populations (Salonen et al., 2014; Dowling et al., 2022; Estevez et al., 2020; Dowling et al., 2009). While the current literature includes studies extending to a more broad definition of AO (i.e. friends, neighbours, colleagues) (Langham et al., 2016; Dowling, et al., 2022), this study employs secondary data analyses to explore the NMH and PMH characteristics within the AFM subgroup, using standardised measures of non-attributable harm in a large-scale Australian adult sample. It was hypothesised that: (1) AFM status will positively predict NMH characteristics (depression symptoms, anxiety symptoms, panic disorder symptoms, post-traumatic stress disorder symptoms, social anxiety symptoms, binge drinking, tobacco use, drug use) and negatively predict PMH characteristics (QOL, personal growth and autonomy, interpersonal skills, coping skills) after separately controlling for sociodemographic characteristics, problem gambling severity, and other NMH characteristics; and (2) PMH characteristics will moderate (buffer) the relationships between AFM status and these NMH characteristics. Given current equivocal findings, a secondary aim was to explore the degree to which gender moderates the relationships between AFM status and NMH/PMH characteristics.

2. Method

2.1. Participants and procedure

Data were collected using Computer Assisted Telephone Interviewing (CATI) surveys for the Third Social and Economic Impact Study (SEIS) of Gambling in Tasmania (ACIL Allen Consulting et al., 2014). The study was approved by the University of Melbourne's Human Research Ethics Committee (project 1340411), with the current data analysis approved via an exemption from ethical review granted by Deakin University's Human Research Ethics Committee (project 2020–410). Participants comprised a subsample of 1,887 Tasmanian adults (~38 % of the overall sample) from a larger population-

Table 1
Sample descriptive statistics.[a]

Sociodemographic/ Gambling Characteristics	Non-AFMs *(95.33 %)*	AFMs *(4.67 %)*	Total Sample *(100.00 %)*
Gender (male) *(%)*	48.67 %	40.64 %	48.30 %
Age *(%)*			
18–24 years	10.73 %	9.37 %	10.66 %
25–44 years	30.56 %	45.27 %	31/24 %
45–64 years	36.80 %	37.12 %	36.81 %
65 + years	21.92 %	8.24 %	21.28 %
Household Structure *(%)* [d]			
Without children in household	48.41 %	37.48 %	47.90 %
Children in household	42.47 %	55.36 %	43.07 %
Other	8.70 %	7.16 %	8.63 %
Employment Status (full-time, part-time, casual) *(%)* [d]	56.79 %	68.25 %	57.32 %
Gross Annual Income (≤Median Income) [b] *(%)* [d]	49.69 %	47.76 %	49.60 %
Country of Birth (Australia) *(%)* [d]	88.43 %	94.02 %	88.69 %
Main Language (English) *(%)* [c d]	98.76 %	100.00 %	98.82 %
Highest Level of Education *(%)* [d e]			
Low (less than compulsory education)	24.69 %	21.12 %	24.53 %
Medium (compulsory education only)	47.75 %	59.28 %	48.29 %
High (beyond compulsory education)	27.06 %	19.60 %	26.71 %
Socioeconomic Status M *(SD)* [f]	3.97 (2.60)	3.19 (2.32)	3.93 (2.60)
PGSI Problem Gambling Severity *(%)*			
Non-gambling/non-problem gambling	87.63 %	80.34 %	87.29 %
Low-risk gambling	8.03 %	8.71 %	8.06 %
Moderate-risk gambling	3.31 %	9.60 %	3.60 %
Problem gambling	1.04 %	1.35 %	1.06 %

Note. PGSI = Problem Gambling Severity Index.
[a]Descriptive statistics are based on weighted, raw data prior to multiple imputation. Sample sizes vary depending on missing data.
[b]Median income = $49,296 (ABS, 2011b) – citation reflects year of data collection.
[c]Cell size precluded regression analyses therefore main language was not carried forward into any analyses.
[d]Percentages do not add up to 100 % due to missing data.
[e]Education categories are consistent with Tasmanian Government guidelines (Tasmanian Government, 2023).
[f]Determined using the postcode and matched to the Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) from 2011 census data (ABS, 2011a) to reflect year of data collection. Higher scores indicating more advantage.

representative sample (n = 5000). The sub-sample comprised all participants with past-year gambling on electronic gaming machines and all participants reporting low-risk, moderate-risk, or problem gambling, as well as a randomly selected 1 in 3 participants reporting non-problem gambling/non-gambling. After excluding respondents who did not indicate their AFM status, the final sample comprised 1,869 respondents aged 18–94 years (M = 48.48, SD = 18.63). Table 1 displays sample descriptive statistics based on weighted data identifying that 4.67 % identified as AFMs.

Respondents of the population-representative survey were selected using a disproportionate stratified sample design, with over-sampling in eight local government areas. This dual-frame design comprised a randomly generated landline sample (n = 3,500) and a list-based mobile phone sample (n = 1,500) (Dowling et al., 2016; Jackson et al., 2014). Landline respondents were selected using the youngest-male method or youngest-female method when no males were present. The mobile phone sample included any eligible person (i.e. ≥ 18 years old, English speaking, Tasmanian resident) who answered the phone. The surveys were conducted between 16 September and 27 October in 2013, with an average duration of 15 minutes and a final response rate of 27.2 %.

2.2. Measures

Respondents reported sociodemographic characteristics (gender, age, household structure, employment status, gross annual income, country of birth, main language spoken at home, highest level of education, post-code). AFM status was determined using a single item: *In the past 12 months, has a family member had an issue with gambling?* (binary response option). Past-year problem gambling severity, which was employed as a covariate, was measured using the 9-item Problem Gambling Severity Index [PGSI; (Ferris & Wynne, 2001a, 2001b)]. The NMH and PMH characteristics measures are displayed in Tables 2 and 3, respectively.

2.3. Data weighting

Data for the overall sample were weighted using a two-stage approach: (a) post-stratification weight for sample disproportion and survey response weights across age, gender, educational attainment, country of birth, location, and telephone status using independent population benchmarks; and (b) data weight for in-scope people and landline connections, plus a pre-weight for overlapping landline and mobile phone selections, adjusted according to population parameters. This weighting was adjusted for the subsample of respondents used in this study, aligning with population benchmarks. PGSI status was also a benchmark, ensuring consistent sample distribution.

2.4. Data analysis

Statistical analyses employed Stata version 13 (StataCorp, 2013), utilising complex survey analysis to accommodate the survey design. Missing data (0.00–16.48 %) was managed using multiple imputations with chained equations (Enders, 2022), which included variables relevant to the analysis and auxiliary variables (e.g., AFM status, NMH/PMH characteristics, PGSI problem gambling severity, sociodemographic characteristics, weighting variable) (Rubin, 2018). Rubin's rules (Rubin, 2004) were employed, with model estimates based on pooled estimates of 35 imputed datasets. Due to non-normal distributions, clinical cut-off scores were used to dichotomise all NMH measures (see Table 2), while PMH characteristics remained continuous as there are no available cut-off scores.

A series of binary logistic and linear regression analyses (with robust estimators) were conducted to explore whether AFM status predicted NMH/PMH characteristics ($p < 0.05$), as follows: (1) Model 1:

Table 2
Measures of NMH characteristics.

NMH Characteristics	Measure
Depression Symptoms	The Patient Health Questionnaire-2 (PHQ-2) (Kroenke et al., 2003) was used to screen for symptoms of depression over the past 2 weeks. Responses rated on a 4-point scale ranged from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 6, with a score of 3 or more indicating a positive screen for major depressive disorder. The PHQ-2 has demonstrated good to excellent internal consistency (α = 0.77–0.83), and good to excellent sensitivity (0.64–0.91) and good specificity (0.78–0.85) (Ahn et al., 2019; Carey et al., 2016; Maroufizadeh et al., 2019; Plummer et al., 2016).
Anxiety Symptoms	The Generalised Anxiety Disorder-2 (GAD-2) (Kroenke et al., 2007) was used to screen for symptoms of general anxiety disorder over the past 2 weeks. Reponses are rated on a 4-point scale ranging from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 6, with a score of 3 or more indicating a positive screen for GAD. The GAD-2 has demonstrated excellent internal consistency (α = 0.81–0.86), and acceptable sensitivity (0.71–0.76) and specificity (0.69–0.81) (Ahn et al., 2019; Plummer et al., 2016; Staples et al., 2019).
Panic Disorder Symptoms	The 2-item version of the Autonomic Nervous System Questionnaire (ANS) (Stein et al., 1999) was used to measure the presence of panic symptoms in the past 6 months. Positive endorsement of either items indicate a positive screen for a panic disorder. The ANS has demonstrated excellent sensitivity (0.94–1.00), but lower specificity (0.25–0.59) (Stein et al., 1999).
Post-Traumatic Stress Disorder (PTSD) Symptoms	The 4-item Primary Care Posttraumatic Stress Disorder Screen (PC-PTSD) (Prins et al., 2004) was used to screen for past-month PTSD symptoms. Positive endorsement of three or more items indicates a positive screen for PTSD. The PC-PTSD has demonstrated a sensitivity of 0.78 and a specificity of 0.87 (Prins et al., 2004).
Social Anxiety Symptoms	The 3-item Social Phobia Inventory (Mini SPIN) (Connor et al., 2001) was used to screen for symptoms of social anxiety disorder. Rated on a 5-point scale ranging from 0 (not at all) to 4 (extremely), total scores range from 0 to 18, with scores of 6 or higher indicating a positive screen for generalised social anxiety disorder. The Mini SPIN has demonstrated excellent sensitivity (0.89) and specificity (0.90) (Connor et al., 2001).
Binge drinking	Binge drinking was assessed using the third question (AUDIT-3) of a modified version of the 3-item Alcohol Use Disorders Identification Test Consumption (AUDIT-C) (Bush e al., 1998). The version employed was modified for Australian alcohol use, as recommended by the AUDIT manual (Babor et al., 1992). Binge drinking was defined as 7 or more (for men) and 5 or more (for women) standard drinks on one occasion two to three times a month or more (Dawe et al., 2007). Categorical response options included: (1) every day; (2) 4–6 times a week; (3) 2–3 times a week; (4) weekly; (5) 2–3 times a month; (6) monthly or less; (7) not in the last 12 months; and (8) never. The third question of the AUDIT-C has yielded sensitivity of 0.77–0.90 and specificity of 0.53–0.77 based on National Health Surveys (Dawson, 1994).
Tobacco use and drug use	Tobacco use and drug use were measured using two adaptations of the single-item screening test for drug use in primary care (Smith et al., 2010). Categorical response options included: (1) every day; (2) 4–6 times a week; (3) 2–3 times a week; (4) weekly; (5) 2–3 times a month; (6) monthly or less; (7) not in the last 12 months; and (8) never. This single item has demonstrated excellent sensitivity (0.86–0.96) and specificity (0.89–0.96) in measuring past-year substance use (Smith et al., 2010).

unadjusted; (2) Model 2: adjusted for sociodemographic factors; (3) Model 3: adjusted for sociodemographic factors and PGSI problem gambling severity; and (4) Model 4: adjusted for sociodemographic factors, PGSI problem gambling severity, and other NMH characteristics. Similarly, to explore whether PMH characteristics buffered the relationships between AFM status and NMH characteristics, and if gender moderated the relationships between AFM status and NMH/PMH characteristics, a series of moderated binary logistic and linear regression analyses were conducted, as per Model 1. Simple slopes analyses with pairwise comparisons of marginal means were conducted to explore significant interaction effects ($p < 0.01$). Simple slopes were then graphed on a log odds scale in R (v.6.1) (Team, 2021.), using the package ggplot2 (Wickham, 2016). The magnitude of effect sizes were interpreted as small (OR = 0.59 and 1.68; β=<0.20), medium (OR = 0.29 and 3.47; $\beta = 0.20$–0.49), or large (OR = 0.14 and 6.71; β=≥0.50).

3. Results

3.1. AFM status predicting NMH characteristics

Descriptive statistics for NMH characteristics are displayed in Table 4, broken down by AFM status. AFM status positively predicted PC-PTSD PTSD symptoms, PHQ depression symptoms and ANS panic disorder symptoms in Models 1–3, with these relationships attenuated to non-significance in model 4. AFM status positively predicted GAD-2 anxiety symptoms and tobacco use in Model 1, with these relationships attenuated to non-significance in the subsequent models. No significant relationships were found between AFM status and Mini SPIN social anxiety, AUDIT-3 binge drinking use, and drug use in any model. Significant effect sizes were of small magnitude (*OR* = 1.90–3.37).

3.2. AFM status predicting PMH characteristics

Descriptive statistics for PMH characteristics are displayed in Table 5, broken down by AFM status. Across all models, AFM status significantly negatively predicted Brief-COPE planning coping. While AFM status significantly negatively predicted WHO-QOL-BREF physical QOL in Models 2 and 3, and significantly positively predicted WHO-QOL-BREF social relationships in Model 4, these relationships were non-significant in all other models. No significant relationships were revealed between AFM status and the remaining PMH characteristics. Significant effect sizes were of small magnitude (β = -0.07–0.07).

3.3. PMH characteristics moderating the relationship between AFM status and NMH characteristics

Table 6 (see supplementary material) reveals one significant interaction ($p < 0.01$) between AFM status and Brief COPE religious coping when predicting ANS panic disorder symptoms. Simple slopes analyses (see Fig. 1) revealed no significant difference in the probability of screening positive for ANS panic disorder symptoms at low levels of Brief COPE religious coping ($p = 0.878$–0.90), whereas AFMs were more likely to screen positive for ANS panic disorder symptoms than non-AFMs at high levels of Brief COPE religious coping ($p = 0.000$–0.005).

3.4. Gender moderating the relationships between AFM status and NMH and PMH characteristics

Tables 7 and 8 (see supplementary material) reveal no significant interactions ($p < 0.01$) between AFM status and gender when predicting NMH or PMH characteristics, respectively.

4. Discussion

This study used a population-level sample from Tasmania to expand the AO literature by exploring whether AFM status, defined as exposure to family member gambling problems, predicts NMH characteristics, while separately controlling for sociodemographic characteristics and other potential sources of harm. It is also the first population-level study to examine the influence of PMH characteristics on non-attributable gambling-related harm.

Table 3
Measures of PMH characteristics.

PMH Characteristics	Description of measure
Quality of Life (QOL)	The brief World Health Organisation Quality of Life (WHO-QOL-BREF) (World Health Organization, 1998) was used to measures QOL across four domains: "Physical Health" (7 items), "Psychological Health" (6 items), "Social Relationships" (3 items), and "Environment" (8 items). Respondents were presented with five-point scales (slightly varied across items) to rate how often each item applied to them over the past four weeks. The sum of the items multiplied by four are averaged to obtain the subscale scores. The WHO-QOL-BREF has demonstrated good psychometric properties, specifically displaying good discriminant validity and good internal consistency across subscales (α = from 0.66 to 0.84 across the four domains) (World Health Organization, 1998).
Personal Growth and Autonomy / Interpersonal/social Skills	The Positive Mental Health Instrument (PMHI) (Vaingankar et al., 2011) was used to assess Personal Growth and Autonomy (10 items) and Interpersonal/Social Skills (9 items). Respondents were required to describe themselves using a 6-point scale ranging from 1 (not like me at all) to 6 (exactly like me). Subscale scores are obtained by calculating the mean scores on the relevant items. These subscales of the PMHI have demonstrated excellent internal consistency: Personal Growth and Autonomy (α = 0.93) and Interpersonal/Social Skills (α = 0.89) (Vaingankar et al., 2011).
Coping Skills	Seven of the fourteen subscales from the 28-item Brief Coping Orientation to Problems Experienced (Brief-COPE) scale (Carver, 1997) were used to measure coping skills, each containing two items. The subscales chosen, which were selected because they had acceptable reliabilities in on a validation study (Carver, 1997), included: "Active Coping" (attempt to eliminate the stress using active steps); "Planning" (thinking about the optimal way to cope with the stressor); "Positive Reframing" (dealing with the negative emotions rather than the stressor itself); "Religion" (using religion to deal with the stressor); "Emotional Support" (seeking reassurance, compassion, and sympathy to deal with the stressor); "Instrumental Support" (seeking support which is more tangible [e.g. information or advice] to deal with the stressor); and "Self-Distraction" (dealing with the stressor by focusing one's attention away from it). Respondents were required to rate each item on a scale ranging from 1 (I haven't been doing this at all) to 4 (I've been doing this a lot). Scores on each scale range from 2 to 8, with higher scores indicating more frequent coping use. Previous research has demonstrated acceptable internal consistencies for these subscales (α = 0.64–0.82) (Carver, 1997). The structure of the measure has appeared generally consistent with the original version of the COPE, as demonstrated by a factor analysis (Carver, 1997).

4.1. NMH characteristics

This study found that family members exposed to gambling problems report various NMH characteristics, but these relationships attenuate after adjusting for sociodemographic or other NMH factors. Specifically, AFMs had increased odds of PTSD, depression and panic disorder symptoms compared to non-AFMs in Models 1–3, however adjusting for NMH characteristics attenuated these relationships. While most of the relationships between AFM status and NMH characteristics demonstrated small effect sizes, PTSD symptoms demonstrated the highest effect sizes across Models 1–3, whereby the odds of PTSD symptoms for AFMs were 210 % to 237 % compared to non-AFMs. This finding extends the PTSD literature that AO and AFM trauma is linked to gambling issues in non-population-representative samples (Dowling et al., 2022) and these groups experience significant trauma-related symptoms (e.g., flashbacks, nightmares) (Gupta & Stevens, 2021; Landon et al., 2018; Mathews & Volberg, 2013) and rates of PTSD similar to generalised anxiety (Dannon et al., 2006). As this is the first population level study to explore AFM PTSD symptoms, these novel findings suggest an important area for AFM interventions. Moreover, gender did not moderate this relationship, suggesting that PTSD can be an intervention target for both male and female AFMs.

While this study's association between AFM status and other internalising symptoms (depression, anxiety, and panic disorder symptoms) contrasts with some prior large-scale research for anxiety (Salonen et al., 2014), it is consistent with most findings from population-level studies linking AO and AFM status to mental health problems (i.e. psychological distress), anxiety, and depression (Dowling et al., 2023; Lind et al., 2022; Salonen et al., 2014; Svensson et al., 2013; Wenzel et al., 2008). This study also found that AFMs reported increased odds of tobacco use in unadjusted models, consistent with prior population-representative research (Dowling et al., 2023; Salonen et al., 2014; Svensson et al., 2013; Wenzel et al., 2008; Dowling et al., 2022). Consistent with previous research (Dowling et al., 2023), this study suggests gender does not moderate these relationships, indicating these NMH characteristics are evident in both male and female AFMs. This study extended these findings by demonstrating that the relationships relating to anxiety symptoms and tobacco use attenuated to non-significance after controlling for sociodemographic factors. Similarly, the relationships relating to PTSD, depression and panic disorder symptoms attenuated to non-significance in the final models, suggesting that other NMH characteristics account for these symptoms. Although this attenuation in association is consistent with some previous literature (Salonen et al., 2014; Svensson et al., 2013), these findings highlight the need for more population-level research to explore these complex relationships specific to AFMs.

Across all models, there were no significant relationships between AFM status and social anxiety symptoms, binge drinking, or drug use. While some research indicates elevated hazardous alcohol and other substance use in AOs and AFMs (Salonen et al., 2014; Svensson et al., 2013; Wenzel et al., 2008; Dowling et al., 2022), previous general population studies suggest that the AO type (i.e., intimate partner, family, friend) may influence substance use patterns (Castrén et al., 2021; Lind et al., 2022; Salonen et al., 2014). Future population-level research is therefore needed to explore these associations across various AO types. Similarly, while decreased social functioning (i.e., embarrassment/shame amongst family/social supports, social withdrawal/isolation) has been reported in previous non-population level studies (Klevan et al., 2019; Dickson-Swift et al., 2005), this study suggests that these impacts may not emerge as social anxiety symptoms. It appears, however, that further research examining these constructs is required, given this study utilised brief screening tools, which have lower sensitivity and specificity regarding the experience of NMH characteristics compared to longer standardised instruments.

4.2. PMH characteristics

This study identified some PMH characteristics that may protect family members exposed to gambling problems from gambling harms, all of which were identified in both male and female AFMs. Specifically, AFMs were less likely to employ planning coping skills compared to non-AFMs across all models. While largely unexplored, other studies suggest that problem gambling first-degree relatives exhibit lower use of task-oriented coping skills (i.e. planning) under stress compared to controls (Goghari et al., 2020). Given the positive outcomes linked to planning coping styles in a range of stressful situations (Compas et al., 1988; Sandler et al., 1994), the current findings suggest a possible target for AFM interventions.

This study revealed that AFMs reported higher social QOL than non-AFMs in Model 4 only, with non-significant relationships revealed for Models 1–3 before controlling for other NMH characteristics. The unexpected direction of this relationship may be explained by prior

Table 4
Descriptive Statistics and Univariate Binary Logistic Regressions with AFM status Predicting NMH Characteristics [ab].

NMH Characteristics (%)	α [c]	Non-AFM	AFM	Total sample	OR [95 % CI] – Model 1	aOR [95 % CI] – Model 2	aOR [95 % CI] – Model 3	aOR [95 % CI] – Model 4
PHQ-2 Depression Symptoms	NA	11.58 %	22.42 %	12.09 %	**2.21 [1.12–4.33]** *	**2.40 [1.17, 4.92]** *	**2.34 [1.13, 4.83]** *	1.75 [0.82, 3.79]
GAD-2 Anxiety Symptoms	NA	12.19 %	22.41 %	12.67 %	**2.08 [1.05–4.11]** *	1.85 [0.89, 3.83]	1.73 [0.82, 3.68]	0.89 [0.41, 1.94]
ANS Panic Disorder Symptoms	NA	28.63 %	44.22 %	29.35 %	**1.97 [1.07–3.66]** *	**1.93 [1.05, 3.57]** *	**1.90 [1.03, 3.48]** *	1.46 [0.63, 3.39]
PC-PTSD PTSD Symptoms	0.79	8.15 %	23.06 %	8.84 %	**3.37 [1.68–6.75]** **	**3.13 [1.47, 6.70]** **	**3.10 [1.46, 6.56]** **	2.20 [0.92, 5.26]
Mini-SPIN Social Anxiety Symptoms	0.75	09.88 %	16.90 %	10.21 %	1.85 [0.83–4.15]	1.58 [0.69, 3.60]	1.47 [0.61, 3.53]	0.94 [0.37, 2.38]
AUDIT-3 Binge Drinking	NA	18.97 %	29.65 %	19.47 %	1.80 [0.88–3.67]	1.78 [0.86, 3.65]	1.68 [0.80, 3.53]	1.63 [0.80, 3.36]
Tobacco Use	NA	20.69 %	35.74 %	21.39 %	**2.13 [1.08—4.21]** *	1.73 [0.85, 3.56]	1.72 [0.83, 3.56]	1.42 [0.68, 2.97]
Drug Use	NA	18.03 %	24.38 %	18.33 %	1.46 [0.77–2.77]	1.53 [0.78, 3.01]	1.57 [0.80, 3.12]	1.39 [0.68, 2.84]

Note. α = Cronbach's alpha reliability coefficient; OR = odds ratio; 95 % CI = 95 % confidence interval. ***Significant at $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.**
OR (Model 1): unadjusted model; aOR (Model 2): adjusted for gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, and socioeconomic status; aOR (Model 3): gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, socioeconomic status, and PGSI problem gambling severity; aOR (Model 4): gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, socioeconomic status, PGSI problem gambling severity, PHQ-2 depression symptoms, GAD-2 anxiety symptoms, ANS panic disorder symptoms, PC-PTSD PTSD symptoms, Mini-SPIN social anxiety symptoms, AUDIT-3 binge drinking, tobacco, drug use (excluding the NMH characteristic being predicted in each analysis).
PHQ: Patient Health Questionnaire-2; GAD-2: Generalised Anxiety Disorder-2; ANS: Autonomic Nervous System Questionnaire; PC-PTSD: Primary Care Posttraumatic Stress Disorder Screen; Mini-SPIN: Social Phobia Inventory; AUDIT-3: Alcohol Use Disorders Identification Test Consumption.
[a]Pooled proportions and estimates over 35 imputations.
[b]Weighted data.
[c]Coefficient alpha calculated using raw data. NA indicates insufficient number of items to calculate alpha.

research (Chan et al., 2016), which suggests AFMs who employ withdrawal coping (i.e., withdrawing from their family member) are more likely to minimise the harmful impacts experienced compared to those who employ other styles of coping. It is possible that disconnecting emotionally from the family member and the associated gambling-related harm allows AFMs to nurture their social relationships, thereby increasing their social QOL. Moreover, it may be that NMH characteristics served to act as negative confounders in Model 4. When these variables were not considered in the earlier models, the true significant relationship between AFM status and social QOL may have been masked, whereby the unadjusted estimate was pushed closer to the null hypothesis (Mehio-Sibai et al., 2005). In contrast, their inclusion in Model 4 may have isolated the relationship between AFM status and social QOL, thereby removing their potential influence and obtaining a more accurate understanding of this relationship.

In contrast to non-population level research indicating reduced AO overall and health-related QOL (Browne et al., 2017; Rockloff et al., 2019; Chan et al., 2016; Cunha et al., 2015), this study found no significant associations between AFM status and psychological or environmental QOL. Moreover, the association between AFM status and physical QOL was weakly significant in Models 2 and 3, but was attenuated in Model 4, suggesting that NMH characteristics explain, at least partially, this relationship. The difference in QOL measurement (overall/health related QOL vs domain-specific QOL) may explain these findings, suggesting nuances when examining at domain level. Future population-level research employing domain-specific measures is required to better understand the impact of gambling harm on the QOL of AFMs.

Finally, this study revealed no association between AFM status and personal growth and autonomy, interpersonal/social skills, or any of the remaining coping skills, including various social supports. Extending previous research in non-population representative samples (Dowling et al., 2022), these findings may be explained by evidence that AOs/AFMs tend to seek emotional and practical support from family, friends, support groups, and online forums (Dowling et al., 2022; Rodda et al., 2020; Hing et al., 2013; Krishnan & Orford, 2002; Gupta & Stevens, 2021; Klevan et al., 2019; Järvinen-Tassopoulos, 2020; Leung et al., 2010; Patford, 2007a, 2007b, 2007c, 2009; Wood & Wood, 2009).

4.3. Interaction Effects: Buffering influence of PMH characteristics

Religious coping moderated the relationship between AFM status and panic disorder symptoms. Unexpectedly, AFMs were more likely to experience panic symptoms than non-AFMs at higher levels of this PMH characteristic. While these findings contrast the SCSS model (Orford et al., 2010; Orford et al., 2005), they support prior research which has demonstrated spirituality/religious coping as a risk factor, rather than a buffer against adverse consequences, such as problem gambling severity; (Dowling et al., 2021) and mental health outcomes (Sternthal et al., 2010). Negative religious coping (i.e., "God is punishing me") and feeling deserted by one's spiritual community can increase anxiety in medical patients (Boscaglia et al., 2005; Pargament et al., 2004; Wollin et al., 2003). Religious coping elements (e.g. negative coping, congregational criticism, social attendance beliefs) may contribute to panic disorder symptoms in AFMs. It is, however, important to note that this study lacked information about the specific religions of the respondents, highlighting the need for future research to explore the nuanced relationships between different types of religious coping on the relationships between AFM status and NMH characteristics.

4.4. Study limitations

This study has several limitations for consideration. First, this study employed a measure of exposure to family member gambling problems rather than gambling-related harm, posing challenges in estimating AFM prevalence, as many exposed family members deny experiencing gambling-related harm (Dowling et al., 2023). However, this type of measurement does allow for the exploration of factors that put family members exposed to gambling problems at risk of NMH characteristics and protect them from the development of these characteristics. Second, the study's cross-sectional design and lack of temporal sequence prevents inferring causation, highlighting the need for further research to determine causal connections and consider potential bidirectional relationships. Third, while demonstrating good psychometric properties (Ahn et al., 2019; Carey et al., 2016; Carver, 1997; Connor et al., 2001; Maroufizadeh et al., 2019; Plummer et al., 2016; Prins et al., 2004; Staples et al., 2019; Stein et al., 1999; Vaingankar et al., 2011; World

Table 5
Descriptive Statistics and Univariate Linear Regressions AFM status predicting PMH Characteristics [ab].

PMH Characteristics	α [c]	Non-AFM M *(SE)*	AFM M *(SE)*	Total sample M *(SE)*	B [95 % CI], β – Model 1	B [95 % CI], β – Model 2	B [95 % CI], β – Model 3	B [95 % CI], β – Model 4
WHO-QOL-BREF Quality of Life								
Physical	0.83	16.24 (0.09)	15.39 (0.43)	16.20 (0.09)	−0.85 [-1.72, 0.02], −0.06	**−0.94 [-1.79, −0.10], −0.07***	**−0.87 [-1.71, −0.03], −0.04***	−0.35 [-1.03, 0.32], −0.01
Psychological	0.78	16.40 (0.08)	15.71 (0.36)	16.37 (0.08)	−0.70 [-1.42, 0.02], −0.06	−0.59 [-1.32, 0.14], −0.05	−0.48 [-1.17, 0.20], −0.04	0.07 [-0.45, 0.59], 0.01
Social Relationships	0.63	16.68 (0.10)	17.04 (0.41)	16.70 (0.10)	0.36 [-0.46, 1.18], 0.03	0.34 [-0.51, 1.19], 0.03	0.44 [-0.36, 1.24], 0.03	**0.84 [0.10, 1.58], 0.07***
Environment	0.71	16.74 (0.07)	16.17 (0.32)	16.71 (0.07)	−0.57 [-1.20, 0.07], −0.06	−0.45 [-1.09, 0.19], −0.05	−0.39 [-1.01, 0.24], −0.04	−0.00 [-0.56, 0.54], −0.00
PMHI Personal Growth and Autonomy	0.86	4.83 (0.02)	4.69 (0.12)	4.83 (0.02)	−0.15 [-0.39, 0.09], −0.05	−0.13 [-0.38, 0.11], −0.04	−0.12 [-0.36, 0.12], −0.04	−0.02 [-0.24, 0.19], −0.01
PMHI Interpersonal/ Social Skills	0.84	4.96 (0.02)	4.98 (0.09)	4.96 (0.02)	0.02 [-0.17, 0.21], 0.01	0.00 [-0.19, 0.20], 0.00	0.01 [-0.18, 0.20], 0.00	0.05 [-0.15, 0.25], 0.02
Brief-COPE Coping Skills								
Active	NA	6.77 (0.04)	6.58 (0.17)	6.76 (0.04)	−0.20 [-0.54, 0.15], −0.03	−0.25 [-0.62, 0.12], −0.04	−0.23 [-0.60, 0.13], −0.04	−0.23 [-0.61, 0.15], −0.04
Planning	NA	6.67 (0.05)	6.27 (0.19)	6.65 (0.05)	**−0.40 [-0.79, 0.02], −0.06***	**−0.47 [-0.87, −0.07], −0.07***	**−0.45 [-0.84, −0.06], −0.07***	**−0.49 [-0.89, −0.09], −0.07***
Positive Reframing	NA	6.44 (0.05)	6.25 (0.21)	6.43 (0.05)	−0.19 [-0.62, 0.24], −0.03	−0.23 [-0.64, 0.17], −0.03	−0.21 [-0.62, 0.19], −0.03	−0.22 [-0.61, 0.17], −0.03
Religion	NA	3.55 (0.07)	3.39 (0.31)	3.55 (0.07)	−0.16 [-0.79, 0.47], −0.02	−0.03 [-0.63, 0.58], −0.00	−0.00 [-0.61, 0.60], −0.00	−0.06 [-0.67, 0.55], −0.01
Emotional Support	NA	6.21 (0.05)	5.89 (0.27)	6.19 (0.05)	−0.32 [-0.86, 0.21], −0.04	−0.37 [-0.85, 0.11], −0.05	−0.36 [-0.84, 0.12], −0.05	−0.27 [-0.76, 0.21], −0.04
Instrumental Support	NA	5.80 (0.05)	5.48 (0.23)	5.79 (0.05)	−0.33 [-0.79, 0.14], −0.04	−0.41 [-0.83, 0.02], −0.06	−0.38 [-0.80, 0.04], −0.05	−0.36 [-0.80, 0.07], −0.05
Self-Distraction	NA	5.34 (0.06)	5.34 (0.21)	5.34 (0.06)	−0.00 [-0.43, 0.43], −0.00	−0.11 [-0.54, 0.33], −0.01	−0.13 [-0.56, 0.30], −0.02	−0.22 [-0.63, 0.19], −0.03

Note. α = Cronbach's alpha reliability coefficient; B = unstandardised beta; β = standardised beta; 95 % CI = 95 % confidence interval of unstandardised beta. *Significant at $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$.
Model 1: unadjusted model; Model 2: adjusted for gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, and socioeconomic status; Model 3: gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, socioeconomic status, and PGSI problem gambling severity; (Model 4): gender, age, household structure, employment status, gross annual income, country of birth, highest level of education, socioeconomic status, PGSI problem gambling severity, PHQ-2 depression symptoms, GAD-2 anxiety symptoms, ANS panic disorder symptoms, PC-PTSD PTSD symptoms, Mini-SPIN social anxiety symptoms, AUDIT-3 binge drinking, tobacco, drug use (excluding the NMH characteristic being predicted in each analysis).
WHO-QOL-BREF Quality of Life: World Health Organisation Quality of Life (Brief); PMHI: Positive Mental Health Instrument; Brief-COPE: Brief Coping Orientation to Problems Experienced.
[a]Pooled means (standard errors) and estimates over 35 imputations.
[b]Weighted data.
[c]Coefficient alpha calculated using raw data. NA indicates insufficient number of items to calculate alpha.

Health Organization, 1998), the brief screening tools employed in this study are non-diagnostic and may not capture the complexities of NMH characteristics. Fourth, it is important to note that the secondary data used in this study was collected in 2013, potentially limiting its representativeness in the context of evolving gambling modalities (i.e. online) and other events such as COVID-19. Therefore, more research is needed to capture the current circumstances of these nuanced relationships. Finally, this study utilised a relatively small sub-sample of the total Tasmanian SEIS population-representative sample, although data weights were applied to enhance its representativeness. Future research should therefore consider using longitudinal study designs, gold-standard tools to measure non-attributable harms and AO/AFM status, and larger, fully population-representative samples.

4.5 Study Implications and Conclusion

Despite its limitations, this research using a large population-level sample, extends the growing literature on the NMH (depression, anxiety, panic, PTSD, and tobacco use symptoms) and PMH characteristics (social QOL, physical QOL, planning coping skills) experienced by AFMs. By separately controlling for sociodemographic, gambling symptom severity, and other NMH characteristics, this study provides some guidance on their degree of influence on these relationships. It also identifies the moderating role of religious coping on the relationships between AFM status and panic disorder symptoms. These findings can guide interventions for AFMs, including evidence-based therapies for depression, anxiety, panic, PTSD, and tobacco use (APS, 2018; Cuijpers et al., 2011; Cuijpers et al., 2014; NICE, 2011; Health, 2013; Minozzi et al., 2016; NICE, 2022; Pompoli et al., 2016;). Incorporating cognitive-behavioural techniques, a gold standard problem-focused intervention (APS, 2018; NICE, 2022), may be particularly helpful in increasing AFM planning coping skills. Family interventions may also be appropriate given the potential impact of parental gambling problems on subsequent child mental health (Slopen et al., 2012). Further population-representative research is needed on the experience and pathways of gambling-related harm encompassing both AFMs and extending to more broadly defined AOs.

CRediT authorship contribution statement

K. Spence: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Data curation,

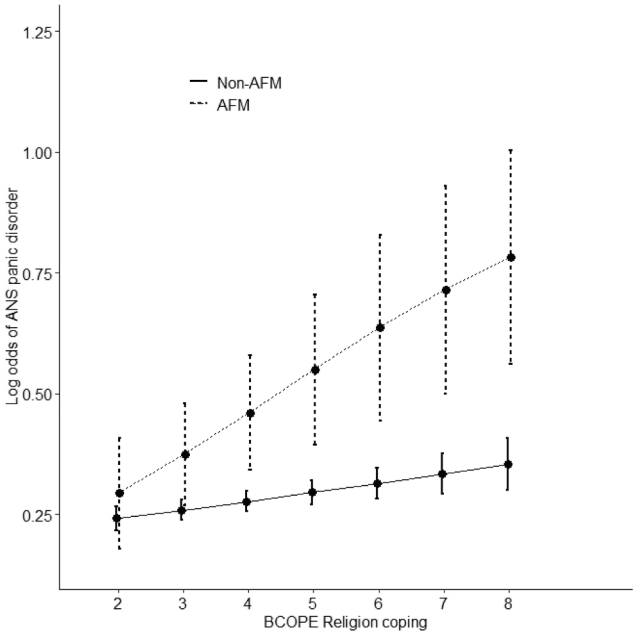

Fig. 1. Simple slopes analyses for Brief COPE religious coping when predicting ANS panic disorder symptoms. ANS: Autonomic Nervous System Questionnaire.

Conceptualization. **S.S. Merkouris:** Conceptualization, Data curation, Formal analysis, Methodology, Project Administration, Higher Degree by Research supervision. **A.C. Jackson:** Funding Acquisition (Third Tasmanian SEIS), Writing – review & editing. **A.J. Wade:** Funding Acquisition (Third Tasmanian SEIS), Project Administration, Writing – review & editing. **N.A. Dowling:** Funding Acquisition (Third Tasmanian SEIS), Methodology, Project Administration, Higher Degree by Research supervision, Writing – review & editing.

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.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.addbeh.2024.107998.

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