How gambling problems relate to health and wellbeing in Australian households: Evidence from the Household Income and Labour Dynamics of Australia Survey

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ABSTRACT

Gambling harms can impact the health and wellbeing of both individuals who gamble and those close to them. While harms occur across a spectrum of gambling risk levels, most research is conducted on people close to those gamblers who have severe problems. This study examined the health and wellbeing of people living with gamblers across the entire spectrum of gambling risk levels, via secondary analysis of the nationally-representative Household Income and Labour Dynamics in Australia Survey (HILDA). The subsample of interest comprised 13,698 respondents without a gambling problem of their own, aged between 15 and 84, and who lived in households where all residents completed the Problem Gambling Severity Index (PGSI). Health and wellbeing were measured via the SF-6D, the SF-36, and subjective wellbeing measures. Compared to those living in non-problem gambling households, participants living in problem-gambling households reported significantly lower mean SF-6D scores, lower scores on the SF-36 mental health domain, and significantly less satisfaction with both their financial situation and with feeling part of their local community. Participants living in moderate-risk gambling households also reported less satisfaction with their financial situation than those in non-problem gambling households. Conclusions: The results indicate that measurable impacts to the health and wellbeing of those living with gamblers occur predominantly at the more severe end of the risk level spectrum, except for financial dissatisfaction, which is also evident in those residing with gamblers categorised as moderate-risk.

1. Introduction

A current focus of gambling research is exploring gambling-related harms and identifying their range of impact (Brown et al., 2021; Langham et al., 2016; Lind et al., 2022). Gambling-related harms can be experienced when excessive time or money is spent on gambling and are described as 'adverse consequence due to an engagement with gambling that leads to a decrement in the health and wellbeing of an individual, family unit, community or population' (Langham et al., 2016, p. 4). Harms occur across multiple domains, including financial and relationship problems, emotional impacts, impacts to health, work and study, and involvement in criminal activity (Langham et al., 2016). Financial harms are often the first consequence of excessive gambling losses and can have an immediate impact, as well as having a cascading effect on other harms such as relational and emotional problems

(Langham et al., 2016; Mathews & Volberg, 2013). These harms can affect individuals who gamble and those close to them; often termed "concerned significant others" (CSOs; Castrén et al., 2021; Dowling et al., 2014; Lind et al., 2022; Riley et al., 2018).

Gambling-related harms, by definition, are associated with decrements to the health and wellbeing of CSOs. Commonly reported impacts on health and wellbeing are emotional or psychological distress (Castrén et al., 2021; Chan et al., 2016; Dowling et al., 2016; A. Salonen et al., 2016; Svensson et al., 2013), symptoms of depression or mood disorders (Dannon et al., 2006; Wenzel et al., 2008), feelings of anger and guilt (Lorenz & Yaffee, 1988), alcohol or substance abuse (Svensson et al., 2013; Wenzel et al., 2008), poor self-assessed health (Chan et al., 2016), physical symptoms associated with anxiety (Lorenz & Yaffee, 1988) and reduced subjective wellbeing (Tulloch, Hing, et al., 2021). However, research on CSO health and wellbeing is primarily conducted with

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treatment-related populations, or populations who identify as being harmed by another person's problem gambling (Tulloch, Browne, et al., 2021). The study populations used in the aforementioned papers are generally associated with respondents who are close to people with more severe gambling problems. Thus, it is currently unclear if these harms are also experienced by those close to gamblers experiencing a less severe gambling problem.

A public health approach stresses the importance of measuring the harms associated with gambling across the entire spectrum of gamblers (Korn et al., 2003). Researchers such as Canale et al. (2016) and Browne and Rockloff (2018) found that, in those who gamble, harms are not limited to those with a severe problem. Approximately 6.8% of the Australian adult population are categorised as at-risk (i.e. categorised as low- or moderate-risk gamblers by the PGSI [Ferris & Wynne, 2001]), compared to around 1.1% categorised as problem gamblers (Armstrong & Carroll, 2017). If only 1 in 5 of the at-risk individuals experienced harm, then this group would account for a larger proportion of harmed gamblers in the population than problem gamblers. Indeed, Browne and Rockloff (2018) found that, except for some very severe and rare harms, a greater proportion of the population aggregate harms could be attributed to at-risk gamblers than to problem gamblers. The harms experienced by people with less severe gambling problems are also associated with a variety of health, wellbeing and quality of life decrements; although these tend to be less severe than those experienced by problem gamblers (Blackman et al., 2019; Hilbrecht & Mock, 2019; Moayeri, 2020). For example, using disability weights, Browne et al. (2017) calculated the aggregate impact of gambling-related harms on quality of life, finding that while the severity of impact was greatest in those categorised as problem gamblers, at-risk gamblers also experienced some significant quality of life decrements. Overall, while the health and wellbeing impacts associated with at-risk gamblers are more clearly understood, little is known about CSOs outside those associated with more severe gambling problems. It is possible that wellbeing impacts might also be found in people who have close relationships with at-risk gamblers.

The number of CSOs impacted by each problem gambler has been estimated at around six, and at-risk gamblers at about three (Goodwin et al., 2017). Despite the lower number of CSOs impacted by at-risk gamblers, the higher prevalence of at-risk (6.8%) relative to problem gamblers (1.1%) implies a greater number of people potentially exposed. These people may be experiencing health and wellbeing decrements caused, or aggravated by, gambling-related harms occurring at subclinical levels. Increasing our knowledge of the impacts on CSOs across the spectrum of gambling risk levels will inform and assist policymakers and researchers in understanding the severity of gambling problems associated with the measurable impact on CSOs' health and wellbeing at the population level. In addition, this would allow for better targeting of policy for the greatest harm reduction benefits for both the person who gambles and those close to them.

1.1. Aims and objectives

The current study uses secondary analysis of a population-representative Australian survey. It examines the health and wellbeing of people living in households with others experiencing different severities of gambling problems. That is, people living in the same household as others categorised by the PGSI as 'non-problem,' 'low-risk', 'moderate-risk' and 'problem' gamblers. Specifically, the paper will extend existing research by aiming to understand if measurable health and wellbeing impacts are limited to only people living in the same households as gamblers with more severe problems (i.e., categorised as problem gamblers), or if they extend to those living in at-risk gamblers' households (i.e., others categorised as low- or moderate-risk gamblers).

2. Methods

2.1. Study design and participants

The study analyses data from Wave 18 of the Household Income and Labour Dynamics in Australia Survey (HILDA; Department of Social Services & Melbourne Institute of Applied Economic and Social Research, 2019), the most recent wave to include a problem gambling screen. HILDA began in 2001 and is an ongoing Australian longitudinal survey collecting social and economic information. Full details are presented elsewhere (Summerfield et al., 2019; Watson & Wooden, 2012). In summary, Wave 1 began with a large national probability sample of 7,682 Australian households, collecting data from all individuals within the household. Sample selection was via a stratified three-stage cluster design, covering all Australian households (except very remote; 0.8%; Australian Institute of Health and Welfare, 2019). The original sample was extended to include new household members as household compositions changed, and in Wave 11, it was topped up with an extra 2,153 households. In most cases, interviews were conducted face-to-face, except for gambling-related questions, which participants completed privately via a paper-based questionnaire. The 2018 HILDA sample comprised 23,237 participants. Of these, participants did not fit eligibility for the current study if they were under 15 years of age ($N = 4,831$), they or their other household members had not completed the gambling-related questions ($N = 3,679$), or they had a gambling problem themselves ($N = 1,029$). Of those who did not complete the gambling related questions, approximately 34% did not participate in the survey that year (non-responding person), 53% did not complete the Self Completion Questionnaire (containing, amongst others, gambling questions), and 13% refused or did not respond to the gambling questions. The final sample of interest comprised 13,698 participants, who resided across 7,852 households (54.1% female, ages ranged between 15 and 84, mean age 46.3 years). Excluding children, respondents excluded due to lack of gambling variables were significantly younger ($m = 42.2$ years; $f(2,18403) = 68.97$, $p < .001$) than either those excluded due to their own gambling problems ($m = 46.6$ years) or the included group ($m = 46.3$ years), however, there was no significant gender difference ($X^2(2) = 6.032$, $p = .51$).

2.2. Measures

HILDA collects a broad range of measures; those relevant to this study are briefly described. A range of socio-demographic characteristics were assessed with questions probing age, gender, marital status, education, employment, and household income and debt. **Problem gambling severity** was assessed via the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). The PGSI is well-validated (Cronbach's alpha = 0.84; Ferris & Wynne, 2001) and consists of nine questions used to measure gambling problems and identify symptoms of potentially harmful gambling behaviours. Total summed scores range between 0 and 27, and from these respondents are classified as either 'non-problem gamblers' (total score of 0), 'low-risk gamblers' (scores of 1 or 2), 'moderate-risk gamblers' (scores of 3 to 7), or 'problem gamblers' (scores 8 +).

Household categorisation was derived from the PGSI category of the person with the most severe gambling problem in the household, with each household classified as either a 'non-problem gambling household', a 'low-risk gambling household', a 'moderate-risk gambling household' or a 'problem gambling household'. For example, if a household included a person categorised as a 'problem gambler' and one classified as a 'moderate-risk gambler', that household was categorised as a 'problem gambling household'. Similarly, if a 'moderate risk gambler' and two 'non-problem gamblers' lived in the same household, this was categorised as a 'moderate-risk gambling household'. Within these households, the study looked exclusively at people who did not have any level of gambling problem themselves (i.e., only those who

scored '0' on the PGSI). This enabled the comparison of only people who did not have personal gambling problems across different levels of gambling-risk households. All participants were asked to complete the PGSI, as such, scores of '0' reflect both non-gamblers and non-problem gamblers, as we were not able to distinguish between the two.

HRQoL was assessed via the SF-36 (Ware & Sherbourne, 1992), a 36-item measure of functional health and wellbeing, validated for use in Australian populations (Butterworth & Crosier, 2004). All items (except for one asking respondents about health changes over the past year) are aggregated into eight multi-item scales and then transformed into a 0–100 scale with 0 representing the worst health status and 100 the best. The scales measure physical functioning, role-physical (interference with work or other daily activities due to physical health), bodily pain, general health, vitality, social functioning (interference with normal social activity), role-emotion (interference with work or other daily activities due to emotional problems), and mental health (symptoms associated with anxiety and depression and, conversely, measures of positive affect). Australian norms are provided by the Australian Bureau of Statistics (1995). Health state utility was measured by the SF-6D. This health index health state score is derived from the SF-36 and ranges from 0 (worst health state) to 1 (best health state). The SF-6D has been shown to have good psychometric characteristics (Baxter et al., 2015; Norman et al., 2013). HILDA calculates these utility values using both the UK and Australian weights (Norman et al., 2013; Walters & Brazier, 2003).

Life satisfaction was assessed using a single-item question that asked respondents, "All things considered, how satisfied are you with your life?" to gauge their global wellbeing. Responses are rated on an 11-point scale from 0 (totally dissatisfied) to 10 (totally satisfied). **Domains of wellbeing** were assessed via questions that asked people to rate how "satisfied or dissatisfied you are with some of the things happening in your life". Participants were then shown a list which covered "Your employment opportunities", "Your financial situation", "The amount of free time you have", "The home in which you live", "Feeling part of your local community", "The neighbourhood in which you live", "How safe you feel" and "Your health". Satisfaction with a partner was assessed via the question, "How satisfied are you with your relationship with your partner?". Participants responded on an 11-point scale from 0 (totally dissatisfied) to 10 (totally satisfied). Most respondents reported within the "satisfied" range of the scale, which is typical of these measures (OECD, 2013).

2.3. Statistical analysis

The initial analyses use bi-variate statistical techniques to describe and explore the population utilised in the study (individuals with no gambling problem of their own) by the level of gambling risk experienced by others in their household. The SF-36 and life satisfaction scores are not normally distributed, having moderate negative skews ranging from -1.69 to -0.50. However, previous analysis suggests that, particularly in larger samples, the use of parametric statistical techniques with a standard normal error distribution are relatively robust and yield accurate results (Torrance et al., 2009; Walters & Campbell, 2005). These techniques have previously been used with HILDA data (e. g., Livingston, 2009; Renzaho et al., 2010). Accordingly, ANOVA was used to assess group differences between participants across each gambling household category for all SF-36 and life satisfaction domains. Welch was used where noted where the assumption of variance was violated, and Turkey's HSD was used to assess differences between more than two groups. Following the bi-variate analyses, a series of multiple regressions were used to further examine the relationship between health and wellbeing and gambling problems in the household. The regressions continued to use the same population of interest; participants with no gambling problem of their own (i.e., a PGSI score of 0). The level of 'gambling household risk' was included as a predictor in the regressions, as were some socio-demographic control variables commonly associated with health and wellbeing (gender, age, health,

income, employment, and marital status). This model enabled a greater understanding of the unique impact the level of gambling problems in the household had on the health and wellbeing of the participant. Linearity was assessed via plots of studentized residuals against the predicted values. There was independence of residuals, as assessed by the Durbin-Watson statistic and no evidence of multicollinearity, assessed by tolerance values greater than 0.1. Missing data were removed listwise. Given the use of multiple tests in the study, we applied a Bonferroni correction and used adjusted alpha levels for our interpretations.

2.4. Ethics

The HILDA study was approved by the Human Research Ethics Committee of The University of Melbourne, and informed consent was obtained for all participants. In addition, approval for secondary analysis was granted by Central Queensland University Human Research Ethics Committee (#22878).

3. Results

Participants in this study comprise only those categorised as non-problem gamblers (including non-gamblers) by the PGSI. Of the 13,698 participants in this study, 93.7% resided in a non-problem gambling household, 3.5% in low-risk gambling households, 1.9% in moderate-risk gambling households, and 0.9% in problem gambling households. Some demographic characteristics of these groups are shown in Table 1. Those living in problem gambling households tend to be significantly younger than in other groups, and those in low-risk and problem gambling households were more likely to be female. Those in non-problem gambling households were less likely to have never married and more likely to be widowed. They were more likely to have completed further education but had lower household incomes.

Fig. 1 illustrates HRQoL across each level of household gambling. There was a significant difference across gambling risk groups, F $(3,13124) = 7.40$, $p < .001$. Post-hoc tests revealed participants living in problem gambling households reported significantly lower SF-6D health states than those in non-problem gambling households.

Table 2 details the domains of SF-36 HRQoL measures, for participants across each of the household gambling risk levels, and Fig. 2 displays clustered means and error bars for these variables. There was a significant difference across gambling risk groups in the mental health domain. Post-hoc tests indicated that mental health was significantly poorer for people in problem gambling households than those in non-problem gambling households. No statistically significant differences were found across the remaining domains.

Table 3 outlines domains of satisfaction across each level of household gambling risk and clustered means and errors bars are displayed in Fig. 3. There were significant differences across gambling risk groups in satisfaction with financial situation and feeling part of your local community. Post-hoc tests showed participants living in problem gambling households reported significantly lower mean satisfaction scores than those in non-problem gambling households in two domains: their financial situation and feeling part of their local community. Significantly lower satisfaction levels with their financial situation were also found in participants in moderate-risk gambling households compared to those in non-problem gambling households. No other significant differences were found.

Multiple regressions were conducted to control for non-gambling factors commonly associated with HRQoL (gender, age, health conditions, marital status, income, education, and employment). As shown in Table 4, compared to living in a non-problem gambling household, living in problem gambling households significantly predicted SF-6D and satisfaction with feeling part of the local community, but not the SF-36 mental health scale. After controlling for demographic variables, living in any at-risk or problem gambling household all significantly

Table 1
Participant characteristics by household gambling risk.

	Household gambling risk			
	Non-problem gambling household	Low-risk gambling household	Moderate-risk gambling household	Problem gambling household
N	12,838	475	264	121
Age - Mean (*SD*)	46.6 (19.1)	43.0 (18.7)	42.9 (18.4)	39.3 (16.9) ***
Gender				
Female	53.5%***	62.3%***	60.60%	66.1%***
Male	44.50%	37.70%	39.40%	33.90%
Marital Status				
Never Married	22.0%**	26.20%	27.10%	28.90%
Married/ Cohabiting	60.00%	62.50%	59.40%	57.00%
Separated/ Divorced	12.70%	8.20%	11.60%	11.60%
Widowed	5.2%**	3.00%	2.00%	2.50%
Education				
Did not complete high school	23.3%***	28.00%	33.10%	25.60%
Completed high school	14.90%	17.40%	13.90%	21.50%
Completed further education	61.8%***	54.70%	53.00%	52.50%
Employment				
Part time employment	21.0%***	26.30%	29.20%	19.80%
Full-time employment	42.70%	40.20%	41.60%	44.60%
Unemployed	3.00%	4.10%	3.20%	5.00%
Retired	21.40%	15.90%	14.00%	9.90%
Other	12.0%***	13.50%	12.00%	20.70%
Household Income - Mean	$133,806 ***	$166,791	$164,563	$145,438
(*SD*)	($137,593)	($174,473)	($161,621)	($95,101)
Household Debt - Mean	$216,325	$252,432	$290,646	$269,416
(*SD*)	($406,426)	($436,982)	($495,246)	($493,599)

Note: Participants in the sample are all classified as 'non-problem gamblers'. ***$p < .001$, **$p < .01$, *$p < .05$.

predicted lower satisfaction with their financial situation, with the financial effects greater in those living in problem gambling households.

4. Discussion

To our knowledge, this is the first article to explore the relationships between the severity of gambling problems and the health and wellbeing of others within the household. We aimed to understand if measurable health and wellbeing impacts were limited only to people living in the same households as gamblers with severe problems or if they extended to those living in at-risk gamblers' households. This enabled us to extend existing research by exploring the impacts of gambling-related harms outside treatment-seeking or problem gambling populations. Additionally, by examining the health and wellbeing of only people who were either non-problem gamblers or non-gamblers, the study effectively controlled for own-gambling problems, which are relatively common in CSOs (Mazar et al., 2018; Meisel et al., 2013).

The study found a consistent linear trend for lower health and wellbeing associated with increased gambling problems in the household. With HRQoL, living in a problem gambling household was associated with significantly worse health states than living in non-problem gambling households. Participants living in a problem gambling household also reported significantly worse mental health functioning in the SF-36, a sub-scale that measures feelings of nervousness and/or

depression. These mean differences were within the range to be considered clinically and socially meaningful (Ware et al. 1994; cited in Butterworth & Crosier, 2004; Walters & Brazier, 2003). Unlike results that have been found in people with their own gambling problems (Blackman et al., 2019; Browne et al., 2017; Hilbrecht & Mock, 2019; Moayeri, 2020), there were no significant differences in mean HRQoL scores in participants living in low- or moderate-risk gambling households compared to non-problem households. However, further analysis indicated that after controlling for other contributors to HRQoL, associations with living in problem gambling households remained significant for health state (SF-6D), but not the mental health sub-scale of the SF-36. Living in low-risk gambling households was a significant predictor of health state scores after controlling for other variables. As illustrated by the error bars in Fig. 1, it may be that some differences are not detectable given the available sample size, and within-group variability caused by the number of other contributors to health and wellbeing. The magnitude of the effect of living in problem gambling households on HRQoL is approximately two to three times greater than low-risk or moderate \-risk households. This ratio is similar to that found in people who gamble (Browne et al., 2017). Overall, these findings may reflect that living in households with severe, but not necessarily low to moderate gambling problems, contributes to ill-health via factors identified in previous research. These include increased stress and guilt, in turn leading to poorer sleep (Landon et al., 2018) and headache, bowel and stomach issues (Lorenz & Yaffee, 1988). Serious gambling problems may be specifically associated with unhealthy lifestyles, such as alcohol and tobacco use by both gamblers and CSOs (Morisano et al., 2009; A. H. Salonen et al., 2015; Svensson et al., 2013).

Concerning subjective feelings of wellbeing, the study found significantly lower satisfaction with their financial situation was experienced in moderate-risk and problem gambling households, with a larger effect in problem-gambling households. This is despite these groups having significantly higher household incomes than non-problem gambling households, and no significant difference in household debt. This finding supports the understanding around gambling harms as detailed in Langham et al.'s conceptual framework (2016), with financial problems most directly related to gambling and often appearing in people experiencing less severe gambling problems. A CSO's dissatisfaction with their financial situation can then contribute to increased stress as well as relational and psychological health issues (e.g., Järvinen-Tassopoulos, 2020). Browne and Rockloff (2018), found relatively serious financial harms are commonly experienced by low- and moderate-risk gamblers, but that more severe health and social impacts were largely limited to problem gamblers. Finally, financial harms can have a long-term impact on those experiencing them ('legacy' harms; Langham et al., 2016). As such, this problem may continue to affect the CSOs long after the gambling problem is resolved or they have left the household, and thus may have a long-term impact on a CSO's wellbeing.

Living in a problem gambling household was also significantly associated with lower satisfaction with feeling part of the local community. The scores and mean differences reported in 'feeling part of the community' are similar to those reported between people experiencing very high psychological distress compared to those who are not (Reeve et al., 2016) and those currently experiencing material deprivation versus not (The Melbourne Institute, 2020). High levels of preoccupation with gambling, or dealing with the issues caused by another's gambling, may act to supplant other activity, and dissolve bonds with one's community/neighbourhood. Feelings of shame, stigma and guilt, often experienced by CSOs (Järvinen-Tassopoulos, 2020), may also be causing a barrier between themselves and those around them. The combined findings of dissatisfaction with finances and dissatisfaction with feeling part of the local community have been associated with a transition into loneliness (Baker, 2012), which has its own serious health and wellbeing implications (Leigh-Hunt et al., 2017).
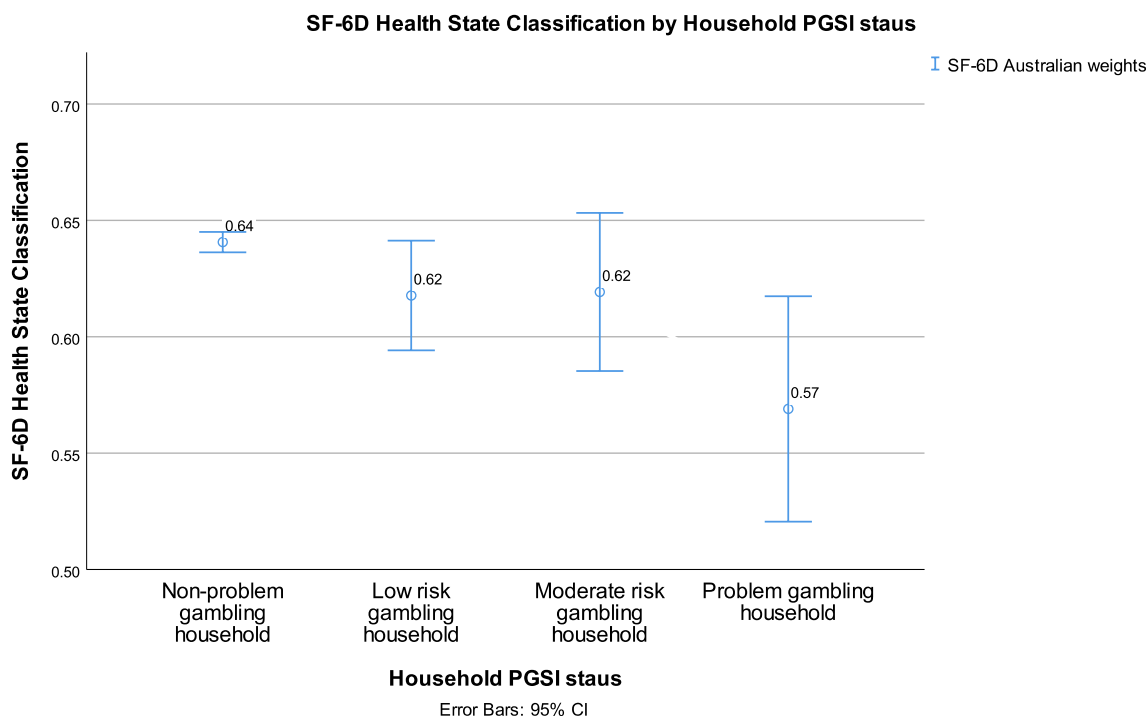
SF-6D Health State Classification by Household PGSI staus

Fig. 1. Mean SF-6D Health State Classification by Household PGSI status.

Table 2
Domains of SF-36 across household gambling risk.

	Household Gambling Risk												*ANOVA P*-value
	Non problem gambling household			Low-risk gambling household			Moderate-risk gambling household			Problem gambling household			
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	
SF-36 Domain													
Mental health	12,206	73.17a	17.57	460	72.70a	17.34	248	70.55ab	18.67	120	67.77b	20.79	**0.005**ˆ
Social functioning	12,242	81.72a	23.98	460	80.71a	23.87	251	80.53a	25.15	121	73.45b	28.80	0.012ˆ
Physical functioning	12,018	83.21a	23.96	450	81.29a	25.78	247	83.08a	22.67	120	75.52b	28.24	0.012ˆ
Role-emotion	12,000	81.29a	34.30	450	83.15a	32.06	247	79.62b	35.98	119	70.87b	40.37	0.020ˆ
Bodily pain	12,046	71.96a	23.90	452	69.25	25.14	250	72.58	25.69	120	67.83	25.80	0.044ˆ
General health	12,152	66.78	21.09	455	65.07	20.86	247	64.46	22.50	118	63.89	21.41	0.053
Vitality	12,202	58.15	20.31	460	57.44	18.81	248	55.71	21.34	120	55.43	20.54	0.111
Role physical	12,004	78.57	36.57	452	78.28	36.05	247	80.97	34.52	119	75.21	39.93	0.561ˆ

Note: Participants in the sample are all classified as 'non-problem gamblers'. ANOVAs were run for each domain. Statistically significant in bold, significance based on Bonferroni adjusted alpha levels of 0.00625 per test. Groups that have the same subscripts across a row are not significantly different from each other. If a group has two subscripts, then it is not statistically significantly different to either of the other groups; ˆ Welch.

4.1. Limitations

The results of this study should be interpreted in light of several limitations. First, caution must be taken in the overall interpretation of these results due to the limitations regarding power. Serious gambling problems are relatively uncommon in general population samples; therefore, the study may lack the statistical power necessary to detect some small effects. Health and wellbeing are impacted by a wide range of factors including societal and personal characteristics, genetic and demographic variables (Dolan et al., 2008; Geerling & Diener, 2020), so any single contributor tends to exert a small impact, relative to total variation. For this reason, future work would benefit from using non-population representative stratified samples and attempting to control for as many other influences on HRQoL as possible, to reduce unexplained variance. No significant differences were identified between either category of at-risk households (low- or moderate-risk) and non-problem gambling households but this may be (again) due to issues of low power. Bias may have been introduced into the study, due to the using particular sub-sample of HILDA respondents (whose household

completed the PGSI and who didn't have a gambling problem themselves). However, there were no gender differences and only a small age difference between the included and excluded groups, and it was unfeasible to include participants where the entire household's gambling risk levels were unknown. Finally, the bi-directional nature of the relationship between gambling problems and health and wellbeing means that while associations were found, both causal directions are possible.

4.2. Conclusions

The overall results seem to indicate a step-change in the health and wellbeing impacts of harm to CSOs, between moderate-risk and problem gambling households. At the population level, it appears that it is at the more severe end of the gambling-risk spectrum that a CSO (and not experiencing gambling problems of their own) starts to experience measurable negative impacts on their wellbeing. As an exception, some financial impacts on wellbeing appear to be associated with less severe problems. CSOs are often unaware of gambling problems until they are

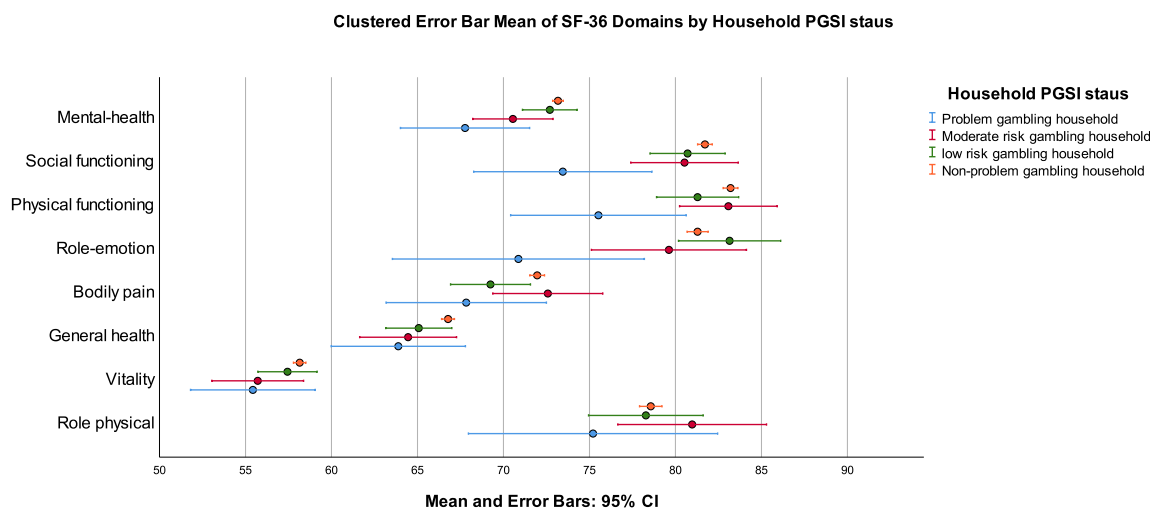**Clustered Error Bar Mean of SF-36 Domains by Household PGSI staus**

Fig. 2. Clustered error bar means of SF-36 Domains by Household PGSI status.

Table 3
Domains of subjective wellbeing across household gambling risk.

	Household Gambling Risk												ANOVA P-value
	Non problem gambling household			Low-risk gambling household			Moderate-risk gambling household			Problem gambling household			
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	
How satisfied are you with…													
your financial situation	12,828	6.83a	2.13	475	6.63ab	2.23	264	6.48b	2.16	121	5.66c	2.39	**<0.001^**
feeling part of your local community	12,807	6.85a	2.12	475	6.80a	2.08	264	6.58a	2.19	120	5.76b	2.57	**<0.001^**
the amount of free time you have	12,829	6.87a	2.39	475	6.82a	2.25	264	6.87a	2.49	121	6.12b	2.53	0.008^
the neighbourhood in which your live	12,821	7.89a	1.65	475	7.84a	1.70	264	8.02a	1.53	121	7.32b	2.10	0.012^
your partner	9130	8.37	1.93	353	8.15	2.27	198	8.05	2.18	83	7.88	2.33	0.015^
your life	12,833	8.00a	1.38	474	7.96ab	1.45	264	7.84ab	1.48	121	7.63b	1.69	0.034^
your health	12,837	7.18	1.91	475	7.22	1.92	264	7.05	2.02	121	7.03	1.90	0.541
how safe you feel	12,832	8.38	1.43	475	8.37	1.41	263	8.41	1.44	121	8.20	1.56	0.548
the home in which you live	12,828	8.13	1.63	475	8.17	1.60	264	8.11	1.61	121	7.88	2.10	0.573^
your employment opportunities	10,271	7.22	2.24	402	7.22	2.16	230	7.17	2.27	104	7.12	2.17	0.955

Note: Participants in the sample are all classified as 'non-problem gamblers'. ANOVAs were run for each domain of satisfaction. Statistically significant in bold, significance based on Bonferroni adjusted alpha levels of 0.005 per test. Groups that have the same subscripts across a row are not significantly different from each other. If a group has two subscripts, then it is not statistically significantly different to either of the other groups; ^ Welch.

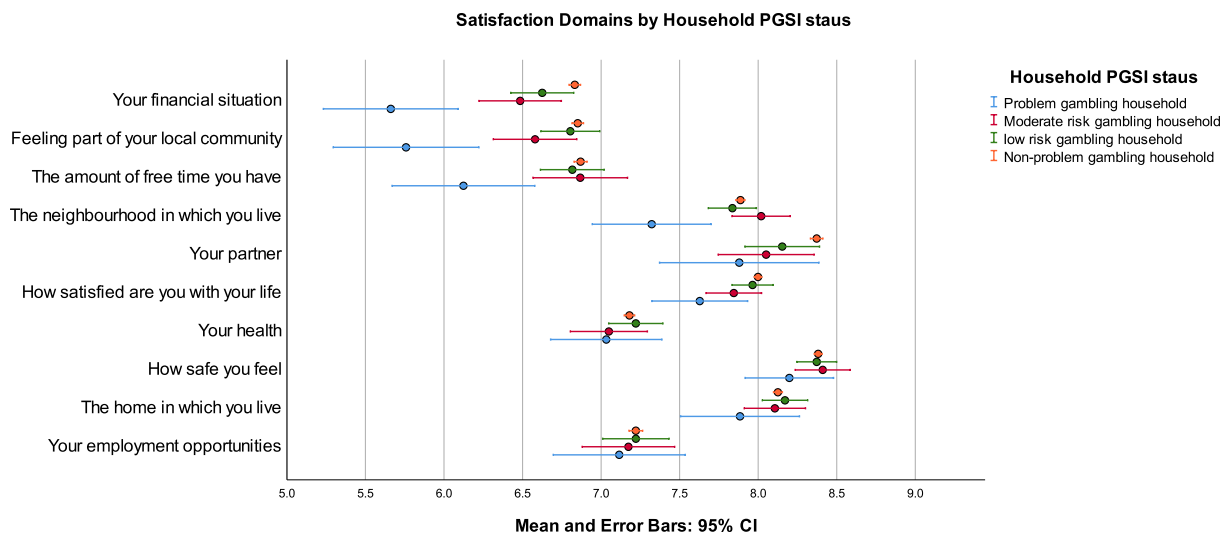**Satisfaction Domains by Household PGSI staus**

Fig. 3. Clustered error bar means of Satisfaction Domains by Household PGSI status.

Table 4

Multiple regression analysis for predictors of SF-6D, SF-36 mental health subscale, satisfaction with financial situation and satisfaction with feeling part of the local community.

Predictors	SF-6D			SF-36 Mental Health Subscale			Satisfaction with financial situation			Satisfaction with feeling part of local community		
	B	SEB	Beta	B	SEB	Beta	B	SEB	Beta	B	SEB	Beta
Gender (Male = 1, female = 2)	−0.03	0.00	−0.06***	−2.39	0.30	−0.07***	−0.01	0.04	−0.00	0.19	0.04	0.05***
Age	0.00	0.00	−0.03*	0.20	0.01	0.022***	0.02	0.00	0.153***	0.02	0.00	0.15***
Health - long term health condition (No = 0, Yes = 1)	0.24	0.01	0.43***	10.21	0.35	0.26***	0.68	0.04	0.15***	0.56	0.04	0.12***
Household Income	0.01	0.00	0.12***	0.65	0.07	0.09***	0.23	0.01	0.27***	0.56	0.04	0.12***
Marital Status (reference category: married/cohabiting)												
never married	−0.01	0.01	−0.02	−2.27	0.43	−0.05***	0.05	0.05	0.01	−0.03	0.05	−0.01
separated/divorced	−0.02	0.01	−0.03**	−1.07	0.47	−0.03***	−0.53	0.06	−0.08***	−0.30	0.06	−0.05***
widowed	−0.02	0.01	−0.02	−0.02	0.75	0.00	0.36	0.09	0.04***	−0.02	0.09	−0.00
Education (reference category: completed high school)												
Did not complete high school	−0.03	0.01	−0.05***	−1.04	0.50	−0.03	−0.02	0.06	−0.00	−0.02	0.05	−0.00
Completed further education	−0.01	0.01	−0.01	−0.13	0.44	0.00	0.01	0.05	0.00	0.03	0.05	0.01
Employment (reference category: full-time employment)												
part-time employment	0.02	0.01	0.03***	1.15	0.38	0.03**	0.07	0.05	0.01	0.20	0.05	0.04***
unemployed	−0.04	0.01	−0.02**	−5.77	0.87	−0.06***	−1.43	0.10	−0.17***	−0.37	0.11	−0.03**
retired	−0.01	0.01	−0.01	2.24	0.55	0.05***	1.00	0.07	0.19***	0.48	0.07	0.09***
Gambling household risk (reference category: non problem)												
Low risk gambling household	−0.03	0.01	-0.02**	0.10	0.79	0.001	−0.25	0.09	−0.02**	−0.04	0.10	−0.00
Moderate risk gambling household	−0.03	0.01	-0.02	−1.95	1.07	−0.02	−0.37	0.13	−0.02**	−0.27	0.13	−0.02
Problem gambling household	−0.07	0.02	-0.03***	−3.60	1.52	−0.02	−1.02	0.18	−0.05***	−0.95	0.19	−0.04***
Model Statistics	$R^2 = 0.272$			$R^2 = 0.125$			$R^2 = 0.161$			$R^2 = 0.056$		
	$F = 307.66$			$F = 122.05$			$F = 164.11$			$F = 50.93$		
	$P < .001$			$P < .001$			$P < .001$			$P < .001$		

Note: Participants analysied in the sample are all classified as 'non-problem gamblers'. Significance based on Bonferroni adjusted alpha levels of 0.01 per test, ** Correlation is significant at the 0.001 level (2-tailed), *** Correlation is significant at < 0.001.

quite serious (Kourgiantakis et al., 2013; Riley et al., 2018), so CSOs may experience dissatisfaction with their financial situation before they are aware that gambling may be causing those financial issues within the household. Dissatisfaction in this area could be explored as a way to identify CSOs associated with less severe gambling problems in order to offer support. Additionally, financial counselling might be useful for both moderate risk and problem gamblers to support both them and their families.

Without limiting the impact of the harms experienced by CSOs of at-risk gamblers, it does appear that the bulk of the measurable effects on health and wellbeing found in this study was experienced by people living in households where others are suffering from more severe gambling problems. Policy considerations and investments should focus on strategies that prevent gambling harms in order to reduce the health and wellbeing burden across the entire community, while also targeting help and assistance to those close to people with severe gambling problems.

CRediT authorship contribution statement

Catherine Tulloch: Conceptualization, Data curation, Formal analysis, Writing – original draft. **Nerilee Hing:** Supervision, Writing – review & editing. **Matthew Browne:** Supervision, Writing – review & editing. **Matthew Rockloff:** 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

The authors do not have permission to share data.

References

Armstrong, A., & Carroll, M. (2017). *Gambling activity in Australia*. Melbourne: Australian Gambling Research Centre, Australian Institute of Family Studies.

Australian Bureau of Statistics. (1995). *National health survey: SF-36 population norms*. https://www.ausstats.abs.gov.au/ausstats/free.nsf/0/AF34940625286915CA257225000495F3/$File/43990_1995.pdf.

Australian Institute of Health and Welfare. (2019). *Rural & remote health*. https://www.aihw.gov.au/reports/rural-remote-australians/rural-remote-health/contents/profile-of-rural-and-remote-australians.

Baker, D. (2012). *All the lonely people: Loneliness in Australia, 2001-2009*. https://australiainstitute.org.au/wp-content/uploads/2020/12/IP9-All-the-lonely-people_4.pdf.

Baxter, S., Sanderson, K., Venn, A., Otahal, P., & Palmer, A. J. (2015). Construct validity of SF-6D health state utility values in an employed population. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation, 24*(4), 851–870. https://doi.org/10.1007/s11136-014-0823-4

Blackman, A., Browne, M., Rockloff, M., Hing, N., & Russell, A. (2019). Contrasting effects of gambling consumption and gambling problems on subjective wellbeing. *Journal of Gambling Studies, 35*(3), 773–792. https://doi.org/10.1007/s10899-019-09862-z

Brown, M., Rawat, V., Tulloch, C., Murray-Boyle, C., & Rockloff, M. (2021). The evolution of gambling-related harm measurement: Lessons from the last decade. *Environmental Research and Public Health, 18*, 4395. https://doi.org/10.3390/ijerph18094395

Browne, M., Greer, N., Rawat, V., & Rockloff, M. (2017). A population-level metric for gambling-related harm. *International Gambling Studies, 17*(2), 163–175. https://doi.org/10.1080/14459795.2017.1304973

Browne, M., & Rockloff, M. J. (2018). Prevalence of gambling-related harm provides evidence for the prevention paradox. *Journal of Behavioral Addictions, 7*(2), 410–422. https://doi.org/10.1556/2006.7.2018.41

Butterworth, P., & Crosier, T. (2004). The validity of the SF-36 in an Australian National Household Survey: Demonstrating the applicability of the Household Income and

Labour Dynamics in Australia (HILDA) Survey to examination of health inequalities. *BMC Public Health, 4*, 44. https://doi.org/10.1186/1471-2458-4-44

Canale, N., Vieno, A., & Griffiths, M. D. (2016). The extent and distribution of gambling-related harms and the prevention paradox in a British population survey. *Journal of Behavioral Addictions, 5*(2), 204–212. https://doi.org/10.1556/2006.5.2016.023

Castrén, S., Lind, K., Hagfors, H., & Salonen, A. H. (2021). Gambling-related harms for affected others: A Finnish population-based survey. *Environmental Research and Public Health, 18*, 9564. https://doi.org/10.3390/ijerph18189564

Chan, E., Dowling, N., Jackson, A., & Shek, D. (2016). Gambling related family coping and the impact of problem gambling on families in Hong Kong. *Asian Journal of Gambling Issues and Public Health, 6*(1), 1. https://doi.org/10.1186/s40405-016-0009-9

Dannon, P. N., Lowengrub, K., Aizer, A., & Kotler, M. (2006). Pathological gambling: Comorbid psychiatric diagnoses in patients and their families. *The Israel Journal of Psychiatry and Related Sciences, 43*(2), 88–92. https://www.ncbi.nlm.nih.gov/pubmed/16910370.

Department of Social Services, & Melbourne Institute of Applied Economic and Social Research. (2019). *"The Household, Income and Labour Dynamics in Australia (HILDA) Survey, GENERAL RELEASE 18 (Waves 1-18)*. https://doi.org/10.26193/IYBXHM, ADA Dataverse, V5.

Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology, 29*(1), 94–122. https://doi.org/10.1016/j.joep.2007.09.001

Dowling, N., Rodda, S., Lubman, D., & Jackson, A. (2014). The impacts of problem gambling on concerned significant others accessing web-based counselling. *Addictive Behaviors, 39*(8), 1253–1257. https://doi.org/10.1016/j.addbeh.2014.04.011

Dowling, N., Suomi, A., Jackson, A., & Lavis, T. (2016). Problem gambling family impacts: Development of the Problem Gambling Family Impact Scale. *Journal of Gambling Studies / Co-Sponsored by the National Council on Problem Gambling and Institute for the Study of Gambling and Commercial Gaming, 32*(3), 935–955. https://doi.org/10.1007/s10899-015-9582-6

Ferris, J., & Wynne, H. (2001). *The Canadian Problem Gambling Index: Final report*. Canadian Centre on Substance Abuse. Retrieved from www.ccgr.ca/en/projects/resources/CPGI-Final-Report-English.pdf.

Geerling, D., & Diener, E. (2020). Effect size strengths in subjective well-being research. *Applied Research in Quality of Life, 15*(1), 167–185. https://doi.org/10.1007/s11482-018-9670-8

Goodwin, B. C., Browne, M., Rockloff, M., & Rose, J. (2017). A typical problem gambler affects six others. *International Gambling Studies, 17*(2), 276–289. https://doi.org/10.1080/14459795.2017.1331252

Hilbrecht, M., & Mock, S. E. (2019). Low-risk, moderate-risk, and recreational gambling among older adults: Self-complexity as a buffer for quality of life. *Applied Research in Quality of Life, 14*(5), 1205–1227. https://doi.org/10.1007/s11482-018-9648-6

Järvinen-Tassopoulos, J. (2020). The impact of problem gambling: Are there enough services available for families with children? *Public Health, 184*, 28–32. https://doi.org/10.1016/j.puhe.2020.03.020

Korn, D., Gibbins, R., & Azmier, J. (2003). Framing public policy towards a public health paradigm for gambling. *Journal of Gambling Studies / Co-Sponsored by the National Council on Problem Gambling and Institute for the Study of Gambling and Commercial Gaming, 19*(2), 235–256. https://doi.org/10.1023/a:1023685416816

Kourgiantakis, T., Saint-Jacques, M.-C., & Tremblay, J. (2013). Problem gambling and families: A systematic review. *Journal of Social Work Practice in the Addictions, 13*(4), 353–372. https://doi.org/10.1080/1533256X.2013.838130

Landon, J., Grayson, E., & Roberts, A. (2018). An exploratory study of the impacts of gambling on affected others accessing a social service. *International Journal of Mental Health and Addiction, 16*(3), 573–587. https://doi.org/10.1007/s11469-017-9785-4

Langham, E., Thorne, H., Browne, M., Donaldson, P., Rose, J., & Rockloff, M. (2016). Understanding gambling related harm: A proposed definition, conceptual framework, and taxonomy of harms. *BMC Public Health, 16*, 80. https://doi.org/10.1186/s12889-016-2747-0

Leigh-Hunt, N., Bagguley, D., Bash, K., Turner, V., Turnbull, S., Valtorta, N., & Caan, W. (2017). An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health, 152*, 157–171. https://doi.org/10.1016/j.puhe.2017.07.035

Lind, K., Castrén, S., Hagfors, H., & Salonen, A. H. (2022). Harm as reported by affected others: A population-based cross-sectional Finnish Gambling 2019 study. *Addictive Behaviors*, 107263. https://doi.org/10.1016/j.addbeh.2022.107263

Livingston, M. (2009). Effects of alcohol consumption in spousal relationships on health-related quality of life and life satisfaction. *Journal of Studies on Alcohol and Drugs, 70*(3), 383–390. https://doi.org/10.15288/jsad.2009.70.383

Lorenz, V. C., & Yaffee, R. A. (1988). Pathological gambling: Psychosomatic, emotional and marital difficulties as reported by the spouse. *Journal of Gambling Behavior, 4*(1), 13–26. https://doi.org/10.1007/BF01043525

Mathews, M., & Volberg, R. (2013). Impact of problem gambling on financial, emotional and social well-being of Singaporean families. *International Gambling Studies, 13*(1), 127–140. https://doi.org/10.1080/14459795.2012.731422

Mazar, A., Williams, R. J., Stanek, E. J., Zorn, M., & Volberg, R. A. (2018). The importance of friends and family to recreational gambling, at-risk gambling, and problem gambling. *BMC Public Health, 18*(1). https://doi.org/10.1186/s12889-018-5988-2

Meisel, M. K., Clifton, A. D., Mackillop, J., Miller, J. D., Campbell, W. K., & Goodie, A. S. (2013). Egocentric social network analysis of pathological gambling. *Addiction, 108*(3), 584–591. https://doi.org/10.1111/add.12014

Moayeri, F. (2020). A reference set of Health State Utility Values for gambling problem behaviour, a survey of the Australian general population: Implications for future healthcare evaluations. *Expert Review of Pharmacoeconomics & Outcomes Research, 20*(1), 115–124. https://doi.org/10.1080/14737167.2019.1610397

Morisano, D., Bacher, I., Audrain-McGovern, J., & George, T. P. (2009). Mechanisms underlying the comorbidity of tobacco use in mental health and addictive disorders. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie, 54*(6), 356–367. https://doi.org/10.1177/070674370905400603

Norman, R., Church, J., van den Berg, B., & Goodall, S. (2013). Australian health-related quality of life population norms derived from the SF-6D. *Australian and New Zealand Journal of Public Health, 37*(1), 17–23. https://doi.org/10.1111/1753-6405.12005

OECD. (2013). Overview and recommendations. In *OECD Guidelines on Measuring Subjective Well-being*. OECD Publishing, Paris.

Reeve, R., Marjolin, A., Muir, K., Powell, A., Hannigan, N., Ramia, I., & Etuk, L. (2016). *Australia's Social Pulse Full Report*. https://www.csi.edu.au/research/project/australias-social-pulse/.

Renzaho, A., Wooden, M., & Houng, B. (2010). Associations between body mass index and health-related quality of life among Australian adults. *Quality of Life Research, 19*(4), 515–520. https://doi.org/10.1007/s11136-010-9610-z

Riley, B. J., Harvey, P., Crisp, B. R., Battersby, M., & Lawn, S. (2018). Gambling-related harm as reported by concerned significant others: A systematic review and meta-synthesis of empirical studies. *Journal of Family Studies, 27*(1), 1–19. https://doi.org/10.1080/13229400.2018.1513856

Salonen, A., Alho, H., & Castrén, S. (2016). The extent and type of gambling harms for concerned significant others: A cross-sectional population study in Finland. *Scandinavian Journal of Public Health, 44*(8), 799–804. https://doi.org/10.1177/1403494816673529

Salonen, A. H., Alho, H., & Castrén, S. (2015). Gambling frequency, gambling problems and concerned significant others of problem gamblers in Finland: Cross-sectional population studies in 2007 and 2011. *Scandinavian Journal of Public Health, 43*(3), 229–235. https://doi.org/10.1177/1403494815569866

Summerfield, M., Bright, S., Hahn, M., La, N., Macalalad, N., Watson, N., Wilkins, R., & Wooden., M. (2019). *HILDA User Manual – Release 18*. Melbourne Institute: Applied Economic and Social Research, University of Melbourne. https://melbourneinstitute.unimelb.edu.au/_data/assets/pdf_file/0008/3247289/HILDA-User-Manual-Release-18.0.pdf.

Svensson, J., Romild, U., & Shepherdson, E. (2013). The concerned significant others of people with gambling problems in a national representative sample in Sweden - A 1 year follow-up study. *BMC Public Health, 13*(1). https://doi.org/10.1186/1471-2458-13-1087

The Melbourne Institute. (2020). *Living in Australia: A snapshot of Australian society and how it is changing over time*. https://melbourneinstitute.unimelb.edu.au/_data/assets/pdf_file/0005/3126038/LivingInAus-2019.pdf.

Torrance, N., Smith, B. H., Lee, A. J., Aucott, L., Cardy, A., & Bennett, M. I. (2009). Analysing the SF-36 in population-based research. A comparison of methods of statistical approaches using chronic pain as an example. *Journal of Evaluation in Clinical Practice, 15*(2), 328–334. https://doi.org/10.1111/j.1365-2753.2008.01006.x

Tulloch, C., Browne, M., Hing, N., Rockloff, M., & Hilbrecht, M. (2021). How gambling harms the wellbeing of family and others: A review. *International Gambling Studies*. https://doi.org/10.1080/14459795.2021.2002384

Tulloch, C., Hing, N., Browne, M., Rockloff, M., & Hilbrecht, M. (2021). The effect of gambling problems on the subjective wellbeing of gamblers' family and friends: Evidence from large-scale population research in Australia and Canada. *Journal of Behavioral Addictions, 10*(4), 941–952. https://doi.org/10.1556/2006.2021.00077

Walters, S. J., & Brazier, J. E. (2003). What is the relationship between the minimally important difference and health state utility values? The case of the SF-6D. *Health and Quality of Life Outcomes, 1*, 4. https://doi.org/10.1186/1477-7525-1-4

Walters, S. J., & Campbell, M. J. (2005). The use of bootstrap methods for estimating sample size and analysing health-related quality of life outcomes. *Statistics in Medicine, 24*(7), 1075–1102. https://doi.org/10.1002/sim.1984

Ware, J. E., Jr, & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Medical Care, 30*(6), 473–483. https://www.ncbi.nlm.nih.gov/pubmed/1593914.

Watson, N., & Wooden, M. (2012). The HILDA Survey: A case study in the design and development of a successful household panel study. *Longitudinal and Life Course Studies, 3*(3), 369–381. http://www.llcsjournal.org/index.php/llcs/article/view/208/0.

Wenzel, H. G., Øren, A., & Bakken, I. J. (2008). Gambling problems in the family - A stratified probability sample study of prevalence and reported consequences. *BMC Public Health, 8*. https://doi.org/10.1186/1471-2458-8-412