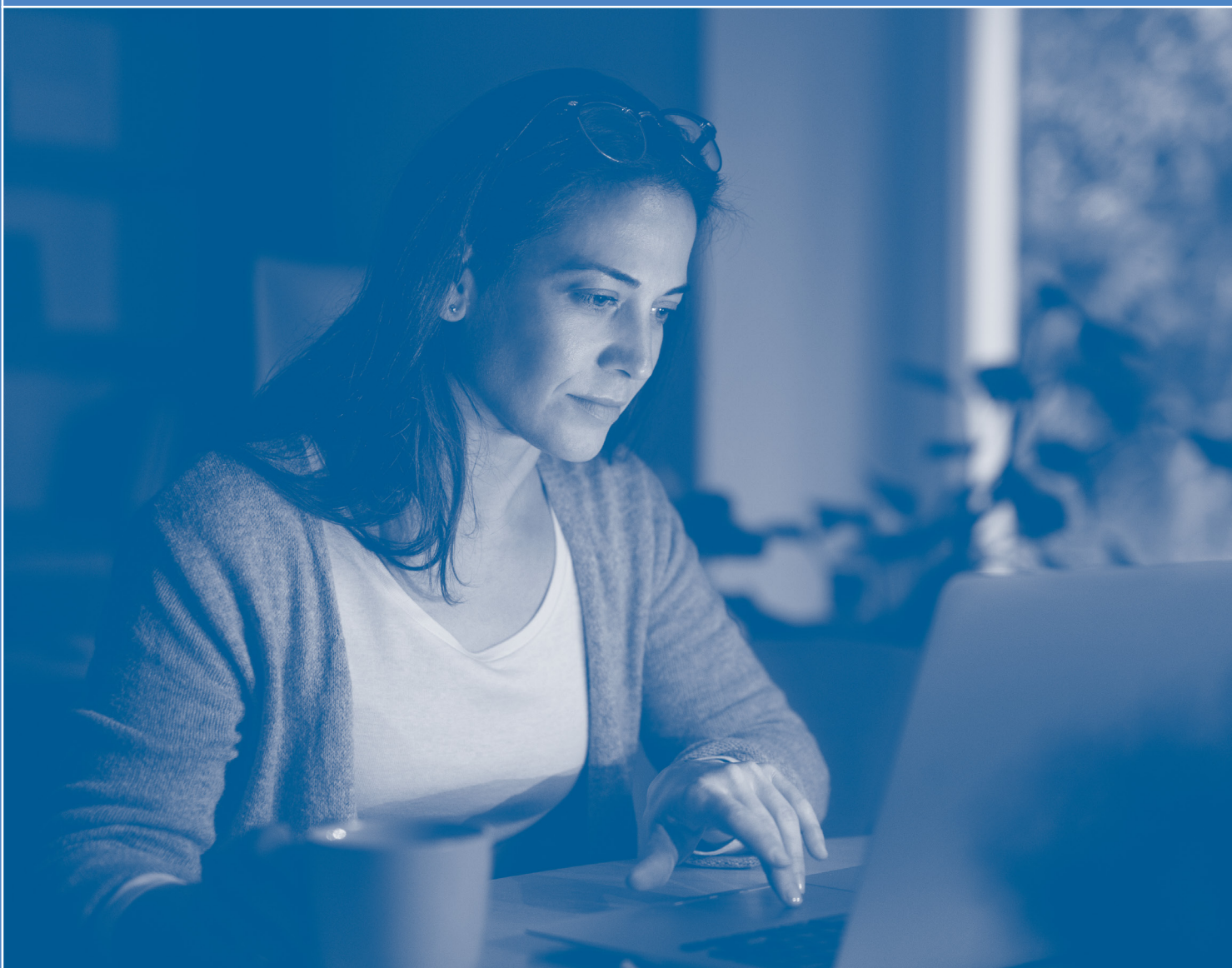# The Gambling Harms Scales: Instruments to assess impact to gamblers and affected others that are benchmarked to health utility

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The Gambling Harms Scales:
Instruments to assess impact to gamblers and affected others that are benchmarked to health utility

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Executive summary

This work was funded by the Victorian Responsible Gambling Foundation to further our understanding of gambling related harm (GRH), to provide a firm conceptual foundation for measuring this construct, and to develop and validate new tools designed for use in population prevalence surveys and research.

Each chapter of the report builds on the next, so this summary follows the same structure to present the key findings and then summarises the key conclusions and recommendations. The reader is directed to each of the constituent chapters for further technical details and discussion.

Chapter 1. The evolution of gambling-related harm (GRH) measurement: Lessons from the last decade

The last 10 years have seen an increased focus on the measurement of GRH. This has mirrored a similar trend towards taking the public health approach to gambling seriously, rather than merely paying it lip-service. In this chapter we consider the recent history of GRH measurement in light of these developments. When applied to gambling, the public health perspective yields several key insights germane to the objective of assessing GRH:

- 'Harms' are negative consequences arising from gambling that lead to a significant and meaningful decrement to an individual's health and quality of life. Accordingly, health and quality of life, often valued in terms of *health utility*, represents the key source of validation for any harm measure.

- Harms are conceptually distinguishable from behavioural addiction, uncontrolled gambling, or 'problem' gambling. These concepts largely describe *risk factors* for excessive time and money spent on gambling (the mechanism of harm), whereas harms relate to the *impact* of this excessive investment.

- GRH can occur along a wide spectrum of severity, is not necessarily limited to problem gamblers, or those meeting criteria for a clinical disorder. Because severity and prevalence are inversely related, this suggests that the 'prevention paradox' may apply: the larger group at lower risk of harm may contribute the bulk of harm at the population level.

- Specific harm symptomatology arising from excessive gambling occurs across all domains of life (financial, relationships, psychological, etc.), and is diverse and contingent on the personal situation of the person affected. Nevertheless, it shows strong clustering / covariation with respect to a single gradient of impact.

- Although several instruments have been developed to measure GRH, the Short Gambling Harms Screen (SGHS), developed in 2018, is by far the most commonly applied in research and prevalence surveys, and has now been translated into several languages. It is also one of the very few measures validated against another measure of harm, which includes published psychometric properties, and all studies investigating its properties have supported its reliability and validity.

- The SGHS has been criticised on the grounds of face validity. It has been proposed that some of the nominated harm symptoms might either be inconsequential in nature or reflect rational opportunity costs that do not truly impact health utility.

- Because of the stigma attached to gambling problems, respondents might over-attribute experienced symptoms to gambling, thereby causing an upward bias if raw scores are interpreted naively.

Chapter 2. A framework for indirect elicitation of the public health impact of gambling problems

For authorities and researchers concerned with minimising GRH, it is crucial to build on a strong measurement framework. It is necessary to measure harm comprehensively, specifically and accurately, and for the scores on that measure to be clearly interpretable and comparable in terms of a standard metric. The SGHS is the most widely adopted and best substantiated GRH instrument to-date. However, it is subject to the following limitations:

- It has not been formally evaluated using public health methods

- Concerns have been voiced regarding the content: incomplete coverage of all harm domains and inclusion of items that appear on the face to reflect potentially mild impacts of gambling

- A similar measure does not yet exist for affected others.

In this chapter we outline a general framework for validating GRH measures such as the SGHS, and anchoring such scales to health utility, that addresses concerns raised about this instrument:

- From a methodological point of view, ideally we would validate GRH instruments via experiment, with random allocation of participants to unharmed and harmed conditions, and gauge the causal effect of harms on relevant outcomes such as health utility. Such an approach is obviously ethically and practically unfeasible.

- An approach used in public health is for experts or independent assessors to evaluate case studies or condition descriptions of experienced GRH, and to elicit evaluations of impact with respect to health utility. This was the approach previously undertaken in a VRGF project. However, this is subject to claims of biased evaluations, due to subjective attribution of negative outcomes to gambling, method variability due to choice of protocol, and response framing or bias (e.g. due to stigma) on the part of evaluators.

- An alternative approach is to evaluate the association of GRH symptomology and health utility decrements via statistical association. In this framework, selection-effects, e.g. demographic variables that are risk factors for experiencing GRH, are accounted for via propensity score weighting. Comorbidities, that may confound the effect on GRH on health utility, are controlled for in a multivariate model. This is sometimes described as *indirect elicitation* in the public health literature.

- This approach is not vulnerable to any of the concerns that might be levelled at direct elicitation of health and wellbeing impacts. No subjective attributions of impact to gambling are required. Any upward bias in reporting of harms, or any item content that does not reflect 'genuine' harm, will be revealed in the (lack of) association of the instrument and the external benchmark of health utility.

- This approach demands inclusion of relevant majority propensity and comorbidity variables in both stages of the model. There is a well-established literature on both risk factors and comorbidities on gambling. This chapter collates and summarises this literature to inform the design of the next stage of research.

- In applying such an approach to a screen for gambling problems or harm, robust estimates of health utility decrements attributable to differing degrees of GRH can be obtained.

Chapter 3. Benchmarking gambling screens to health-state utility: The PGSI and the SGHS estimate similar levels of population gambling-harm

This chapter reports on applying the framework described in the previous chapter to two existing measures employed to evaluate GRH.

- The two main instruments currently in use to evaluate the personal and population impact of GRH are the Problem Gambling Severity Index (PGSI) and the SGHS.

- Although bivariate associates have been reported previously with benchmarks such as wellbeing, they have not previously been evaluated with respect to health utility. Furthermore, they have not been evaluated using propensity score matching and control for comorbidities.

- Because health utility, assessed using instruments such as the SF-6D, is scored on a true metric between zero (a life not worth living) and one (optimal health and wellbeing), it can be aggregated over individuals and time in order to quantify the total impact of gambling. Furthermore, such benchmarking helps to settle debates as to whether a given score (e.g. moderate risk gamblers on the PGSI) is associated with measurable decrements to health and wellbeing.

- Data collection occurred during late 2020 and early 2021. During this period the state of Victoria was primarily affected by multiple Covid-19 lockdowns, which meant no access to venue-based gambling. With permission from the funder, in order to keep the results from being affected by the lockdowns, Victorians were excluded from sampling.

- The analysis was conducted on 2603 gamblers, 1546 (59 per cent) of whom scored zero on the SGHS and 1331 (51 per cent) of whom scored zero on the PGSI. These gamblers formed the reference or control groups with which to estimate health decrements for those scoring 1+ (the 'affected' groups).

- Cases in both groups were propensity score weighted with respect to known risk factors, selected based on reducing the Akaike Information Criteria (AIC). This balanced the groups with respect to age, gender, country of birth, education, unemployment status, personal and household income, and mothers' highest education achieved.

- Multivariate causal models were fit to the weighted data, predicting SF-6D utility scores from either the SGHS or the PGSI, while controlling for alcohol consumption, age, gender, country of birth, being on a sick or disability pension, recreational drug use, tobacco consumption and a past-year clinical diagnosis of mood disorder, anxiety disorder, personality disorder, or any other psychological disorder.

- Because the PGSI is generally interpreted in terms of three ordered categories (low-risk, moderate-risk or problem gambler), the SGHS was treated similarly in the causal model: 1-2 (low harm), 3-5 (moderate-harm), and 6+ (high harm).

- For the PGSI, we estimated decrements of -.005, -.051 and -.099. For the SGHS, we estimated decrements to health utility of -.020, -.062, and -.109. Each of these decrements for the SGHS was statistically significant. PGSI moderate-risk and problem gamblers, but not low-risk gamblers, showed a significant decrement relative to non-problem gamblers.

- When these decrements are applied to existing prevalence estimates for Victoria, similar estimates for total impact in terms of Disability Adjusted Life Years (DALYs) are obtained. Using the PGSI, the largest impact at the population level is attributable to moderate-risk gamblers, accounting for 52.6 per cent of the burden. Using the SGHS, the largest impact is attributable to those in the low-harm group (42.2 per cent), although the impact is relatively evenly distributed across the three harm bands.

Chapter 4. The 20-item Gambling Harms Scale (GHS-20): Benchmarked to health utility using propensity weighting and control for comorbidities

A key goal of this project was to develop an extended version of the SGHS, to include more moderate-severe harm symptomatology, and provide better coverage of the domains of harm. This chapter reports on the development of a 20-item measure. The items comprising the Gambling Harms Scale 20 (or GHS-20), was designed to be a superset of the SGHS, which is renamed the GHS-10. The GHS-20 was designed with reference to health utility and employed similar propensity score matching and control for comorbidities for item selection. In a final step, we evaluate the relationship of the GHS-20 with health utility, and provide administration and scoring instructions for both the GHS-10 and GHS-20.

- A total of 31 candidate harm items were selected for evaluation, based on prior research documenting the prevalence and severity of items, and aiming for decent representation of each harm domain.

- The same dataset as described in Chapter 3 was used to select items and evaluate the new scale.

- All candidate items showed moderate to strong mutual correlations, and the set demonstrated very strong unidimensionality, confirming prior findings regarding the internal consistency of gambling harm symptomatology.

- Loadings of candidate items on the latent harm factor were strong and homogeneous, and they covered a spectrum of severity ranging from "reduced spending on recreational activities" to having "had experiences with violence (including family/domestic violence)"

- Items were selected based on the primary criteria that they provided unique explanatory information in predicting scores on any one of the subscales of the WHOQOL-BREF quality of life measure or the SF-6D, after propensity score weighting and removing variance attributable to comorbidities.

- Six of the ten items previously selected for the SGHS were re-identified using this alternative method, i.e. providing unique explanatory information in explaining health and wellbeing.

- A further four items were selected based on ensuring coverage of all ten original SGHS items.

- The new 20-item scale (GHS-20) is very strongly correlated with the GHS-10 (SGHS) at .98, and moderately strongly correlated with the PGSI (.78). Both the GHS-10 and GHS-20 display moderate negative bivariate correlations with the SF-6D and WHOQOL-BREF (between -.30 and -.38).

- The GHS-20 has strong unidimensionality, although a small proportion of covariance can be attributed to three subfactors: time and preoccupation, emotional affect, and finances.

- The GHS-20 was benchmarked to health utility. Scores in the 1-2 range and all higher ranges were associated with significant decrements, relative to unharmed gamblers (GHS score = 0).

- A curvilinear marginal relationship between GHS-20 scores and health utility was apparent. Accordingly, we applied a generalised additive model (GAM) to yield a scoring table. Administration and health-utility scoring instructions are provided. A similar method was applied to the GHS-10, so that consistent decrement estimates can be obtained with this measure, albeit at a lower precision.

Chapter 5. The 10-item and 20-item Gambling Harms Scale for Affected Others (GHS-10-AO, GHS-20-AO): Benchmarked to health utility using propensity weighting and control for comorbidities

The lack of a gambling harm measure for concerned significant others or 'affected others' (AOs) represents a significant gap in the literature. A dedicated measure for these individuals is required, since there is strong evidence that the specific symptomatology applicable to AOs is different to that of gamblers. Accordingly, to complement the GHS-10 and GHS-20, this chapter reports on a similar item selection and benchmarking approach that was applied to a survey of AOs.

- 24 candidate items were chosen from the 'harms checklist', based on meeting criteria for population prevalence among AOs, as informed by prior research.

- A total of 2018 individuals were surveyed, based on having a close relationship with someone who gambles. Of these, 1446 (71.7 per cent) reported at least one of the 24 harms. The remainder formed the baseline group.

- Similar to the items evaluated for gamblers, relatively homogenous mutual correlations were observed between candidate items (mean = .48). Internal consistency and unidimensionality were also high.

- Although the principal factor accounted for the vast majority of mutual covariate, some minor clustering (all eigenvalues below zero) was observed around four subfactors. These subfactors were related to item content and can be characterised as: psychological and emotional distress, time reallocation from other life commitments, relationship stress, and financial impacts.

- Although loadings on the latent factor were homogenous, a broad range of severities was observed, ranging from feelings of distress, to having had experiences of violence.

- In an identical procedure as that applied to the GHS for gamblers (summarised above), items were selected based on explaining unique decrements in health and wellbeing, after balancing groups with respect to propensity to experience harm, and removing variance attributable to comorbidities.

- A total of 18 items yielded non-zero decrements. These were ranked and the first 10 were selected to comprise the GHS-10-AO, and a further two were selected based on domain coverage to comprise the GHS-20-AO.

- The AO measures show excellent psychometric properties, including a split-half correlation of .89 between the GHS-10-AO and the extra 10 items included in the GHS-20-AO.

- Similar to the GHS for gamblers, both AO scores show a significant and slightly convex relationship to health utility, as identified by a GAM in the causal estimation stage.

- Administration and GAM-derived scoring instructions are provided in an appendix.

Chapter 6. Does the lived experience of gambling accord with quantitative self-report scores of gambling related-harm?

The preceding stages have addressed almost all conceivable objections to the validity of assessing GRH using the GHS family of instruments. However, problem gambling instruments have historically been validated using a clinical evaluation in order to determine whether positively identified gamblers appear to meet diagnostic criteria. Thus, a purely quantitative evaluation of the scales leaves open the possibility that some discrepancy might be identified via interview, that might not be apparent purely from closed-form survey responses. This chapter reports on the outcome of open ended interviews conducted with a stratified sample of gamblers in each of four harm bands. This can be understood as an in-depth qualitative check of our quantitative findings. Importantly, because the qualitative evaluation was done prior to development of the GHS-20, stratification was done on the SGHS (GHS-10). However, in the sample interviewed, the rank-ordering of GHS-10 scores and GHS-20 scores is almost identical (r=.97). Therefore, the results of this evaluation apply to both instruments.

- We recruited approximately an equal number of individuals across four harm 'bands', as identified by the SGHS (now GHS-10): 0 (no harm), 1-2 (low harm), 3-5 (moderate harm) and 6-10 (high harm). Because of the strong consistency of the GHS-10 and GHS-20, this ordering of scores into bands is virtually identical for both instruments.

- A total of 30 interviews were conducted.

- Interviews were designed to be open-ended, encompassing all aspects of the individual's relationship with gambling. Questioning and eliciting was carefully done so as to be neutral so as not bias the respondent. Recorded interview transcripts were then analysed in Nvivo via thematic analysis, with respect to the harm bands.

- Gamblers in the no harm group described no issues with their gambling. They characterised it as simply another leisure activity that did not create any difficulties, and was a source of enjoyment for them. They described positive social effects and a fun activity that could be undertaken with their partner, family and friends.

- Gamblers in the low harm group also described positive social effects, but sometimes characterised them in a negative way, such as a relief from loneliness. Gambling was generally within their budget, but they described occasional feelings of regret over other activities such as eating out or saving for a holiday from which their gambling diverted funds. Feelings such as 'being disappointed in myself' over a gambling spend were sometimes mentioned.

- Gamblers in the moderate harm group reported noticeably more negative experiences than the lower two bands. They still reported positive socialisation and entertainment effects, but sometimes reported occasional serious impacts, such as an empty bank account, needing to borrow money, or having to get an advance on a pension. A range of negative emotional impacts and rumination was reported, as well as occasional health and work/study harms.

- Gambling in the high harm group reported serious and chronic financial harms, strong negative emotional responses to losses, as well as detachment and friction with their families. Health impacts were also commonly reported, and some gamblers described detrimental impacts to their work.

- The results strongly support the validity of the GHS-10 and GHS-20 in discriminating gamblers experiencing progressively greater levels of harm from gambling. While expressions of regret over gambling were relatively mild in the low harm group, only those interviewed in the zero harm group expressed no regrets about their gambling whatsoever.

Chapter 7. Differences in the lived experience of affected others' (AO) levels of gambling-related harm, depending on life circumstances and the nature of the relationship

Chapter 7 describes a similar qualitative evaluation of the GHS-AO scales to that described in Chapter 6. Similarly, recruitment for this stage occurred before finalisation of the 10- and 20-item scales, and was done based on a preliminary version developed in a prior study: the 'SGHS-CSO'. Nonetheless, as per Chapter 6, the overlap in content, combined with the internal consistency of measures, is such that the rank ordering of scores in the interview is virtually identical. The rank order correlation between the SGHS-CSO and GHS-10-AO and GHS-20-AO was .93 and .94, respectively. Thus, as for the scales for gamblers, this evaluation is applicable to the new measures.

- Impacts to AOs are almost certainly heavily moderated by the strength of the social connection and type of relationship (e.g. spouse versus cousin). This makes evaluating harm to AOs intrinsically more challenging than harm to gamblers.

- A total of 30 individuals were invited to participate in interviews, stratified with respect to bands on the SGHS-CSO: 0 (no harm), 1-2 (low), 3-5 (moderate) and high (6-10). We attempted to obtain a mix of relationship types in each band, but small cell sizes (7-8 interviews per band) was a limitation of this stage.

- We found differential themes depending on relationship type. Friends and colleagues with a more distal and more healthy relationship with the gambler, as well as a more secure life situation, tended to describe less harm. Family members described intergenerational patterns of harm, and the impact of comorbid health-related behaviours. In the last resort, distancing oneself from the gambler tended to reduce AO harm. For spouses/partners, harm was exacerbated by a less secure household financial position, shared control of finances, and lack of access to broader support networks and services.

- With respect to the harm bands, the results closely paralleled the themes found for the gamblers themselves.

- Both friends and family members in the no-harm band recounted no significant impacts from their relationship with the gambler. They attributed this to the gambler themselves appearing to experience no major issues.

- In the low harm group, some impacts were described, such as a colleague being sometimes late to deliver on mutual projects due to gambling, or a family member borrowing money without paying it back. For family members, this led to reports of relationship friction, a diminishing of trust and closeness, and psychosomatic symptoms associated with stress and worry. Some partners described significant excessive gambling losses, but that their household financial situation was strong enough to be able to bear them without major problems.

- In the moderate harm group, more serious relationship difficulties were described, which sometimes led to a severing of ties. However, respondents noted other concurrent health behaviours (e.g. drinking) that sometimes made it difficult to isolate the effects of the gambling. More significant financial impacts were also described that impacted on all aspects of family life. Lessor impacts were described by non-family members, except in the case where the gambler was a close friend, leading to impacts such as being drawn into excessive gambling themselves, or significant worry about the gambler's welfare.

- Friends and colleagues in the high harm band tended to narrate experiences that were relatively mild, when compared to family members, even in the moderate harm category. These mainly

centred around the unreliability and unpredictability of a close friend, and the impositions that were sometimes experienced. The one case where narrated impacts were relatively severe was due to the narrator being in a relatively precarious financial position, making the impositions difficult to bear.

- Most interviewed family members in the high harm band described significant disruptions across all domains of life, including major financial impacts. However, in a couple of cases, the narrated harm was less severe than might be suggested by the quantitative score.

- In sum, narrative accounts broadly followed a pattern of increasing severity with harm band. However, they were less consistently associated with the quantitative score, which implies there may be differential response framing, depending on the relationship with the gambler.

Chapter 8. Elicitation of disability weights from narrative accounts associated with differing levels of gambling-related harm

The statistical method of estimating health utility decrements described in Chapters 3-5 is our preferred approach for validating and scoring the quantitative instruments. However, given the infeasibility of a 'gold standard' randomised controlled trial to evaluate the causal impact of GRH on health and wellbeing, it is important to bring to bear all possible sources of evidence. This chapter describes an implementation of an alternative methodology to serve as a further independent check of the findings of this study. It involved providing the narrative transcripts from the interviews described in Chapters 6-7 to a group of experts. These experts were blinded to the purported 'harm band' the transcripts are associated with, and their evaluations of impact were elicited using a variety of protocols. If the quantitative measures are valid, then transcripts linked to higher harm bands ought to be associated with a monotonic increase in evaluated impact to health and wellbeing.

- The Time Trade Off (TTO), the Standard Gamble (SG) and the Visual Analogue Scale (VAS) are established measures used in public health to estimate disability weights (DW); i.e. decrements to health utility associated with a given description.

- To take advantage of significant prior work done on estimating DW for a wide variety of conditions, we included a fourth ranking protocol. This involved presenting experts with an ordered list of conditions for which DWs exist, and asking them to place the condition associated with each GRH band at the most reasonable rank. The elicited DW was then approximated as the midpoint between the surrounding two conditions.

- This direct elicitation of DWs is usually undertaken after experts are provided with a single condition description devised by researchers, which describes the typical experience of living with a given condition at a given severity (e.g. moderate alcohol use disorder). In the present study, experts were asked to study the set of transcripts for each band, and for gamblers / AO, and evaluate the typical life experience described. This grounds the evaluation directly to the narrative reports provided by the affected individuals. Experts were 'blinded' in that they received no information about the harm band labels.

- A total of 60 interview transcripts (30 gamblers, 30 people with a close relationship with a gambler) were evaluated by six independent experts (three gambling researchers and three clinicians). All had significant relevant research and/or clinical expertise. Employing the same four harm bands used in prior stages, and the four elicitation methods, this led to a total of 192 elicited health utility ratings.

- Calculated means and medians, and estimated OLS and robust regressions all showed the same result: elicited DWs increased monotonically with increasing harm band.

- The differences were statistically significant, including the difference between the low harm band and the no harm band. Elicited decrements for each band were, low: 0.084, moderate: 0.187, high: 0.221.

- There was no statistically significant interaction between hand band and AO versus gambler status. In other words, decrements appeared to increase at the same rate with respect to the GHS for both gamblers and AOs.

- As expected, direct elicited DWs were systematically higher than those inferred by statistical analysis, since they are vulnerable to potential response framing effects, over-attribution and are not adjusted for comorbidities.

- This independent evaluation confirmed the validation results from Chapters 3-5. Narrative accounts associated with increasing GHS scores were evaluated by experts to have DWs that are monotonically increasing, and statistically significantly different from the no harm band.

Conclusions and recommendations

In order to properly understand and reduce gambling-related harm (GRH), we require a clear understanding of what it is exactly that we are trying to reduce. In other words, policy and research on GRH must rest on the foundation of a robust and comprehensive measurement framework. Since gambling harms primarily arise from financial losses, of which behavioural dependence is one cause, gambling harm can be treated in economic terms, or in clinical terms. However the most meaningful way to approach the impacts is in terms of public health: i.e., an impact to the health and wellbeing of the people affected. In sum, the rational consumption and ethical provision of an entertainment good should not incur an unreasonable financial cost, nor hurt the people who consume it or those close to them. This is the key advantage of a harm-focused metric over screening for pathology: it results in a focus on people who are being harmed as a result of engagement with gambling.

Accordingly, the present project was fully centred around screening for gamblers and affected others (AOs) who are harmed by gambling, and most crucially, quantifying the degree to which they are harmed. The SGHS (now GHS-10) was already a very reliable and strongly validated screen for gambling harm. We have extended this work by creating a more detailed longer version, the GHS-20, as well as parallel screens tailored to AOs. Our benchmark was the public health SF-6D instrument, which is the most widely accepted index of health utility, capturing global health and wellbeing. This served two purposes. First, it is the most theoretically relevant external criterion or benchmark to validate a gambling harm measure, since harm by definition implies a decrease in health and wellbeing. Second, it is a true metric, in the sense that differing levels of impact across individuals and conditions are comparable on this scale. This means that individuals experiencing differing levels of harm severity can be aggregated to create a single comprehensive index of population impact. The external benchmark, and dimensional (as opposed to categorical) approach taken by this work means that we can put to rest tedious arguments about what the 'bar' for gambling harm should be. Experienced health and wellbeing over a given period of time is a continuous scalar value, and decrements to it are also scalar.

The centrepiece contribution of this work is the development of a family of four quantitative self-report gambling harm measures, suitable for population surveys and for more specialised research applications. Importantly, scores on these measures can be converted to decrements to health and

wellbeing, or 'disability weights', for which instructions are provided. These were determined by employing an established inferential framework drawn from public health involving propensity score weighting and control for comorbidities. This methodology puts to rest most or all concerns that were raised about the SGHS / GHS-10. Further validation was derived by interviews, conducted on a stratified sample across the harm continuum. Qualitative analysis of respondents' own descriptions of their relationship with gambling confirmed increasing degrees of harm across the measurement spectrum. Furthermore, elicitation of blinded experts' evaluations of the narratives confirmed this analysis, with increasing scores on all four instruments clearly associated with increasing disability weight estimates. From positive scores on the GHS family of measures, we can confidently infer a statistically significant and psychosocially meaningful decrement to health and wellbeing. When the evidence from this report is taken together, it represents the most well-supported measure of impact from gambling published to-date.

There are a few limitations to this work and opportunities for extension. First, it should be understood that health utility decrements gained by cross-sectional surveys represent an 'instantaneous' index of impact due to morbidity. That is, they capture harm from gambling when the gambling is ongoing. Especially in case of extreme harm, the legacy impacts of gambling can be lifelong and even intergenerational. Evaluating the life-course of individuals under the counterfactual that the harms were never experienced is methodologically challenging. However, tracking harms and health utility over longitudinal designs could inform such efforts. Retrospective studies, in which the health state of individuals and AOs 'in recovery' who previously experienced problems with gambling are also valuable. Additionally, the development of a true epidemiological incidence / relapse / recovery model of gambling problems and harm is a long-term and worthy goal. The second limitation is that, although health utility is an extremely advantageous construct, there are intrinsic differences in estimates, depending on which methodology or protocol is employed. This is a well-known and much broader issue in health state valuation, and is a topic currently under very active research investigation. In the meantime, we advise that researchers take care to compare 'apples to apples' when interpreting health utility scores. That is, if gambling is compared to different health conditions, then the comparison should be made using a similar elicitation protocol. The present work can be extended by replication in different social and cultural contexts, in order to determine whether health utility impacts estimated in the Australian general population are applicable. The qualitative stage revealed some preliminary evidence of differential response framing for AOs, depending on relationship type. A productive extension would be to perform a dedicated study on differential item functioning, depending on relationship type. We expect that this could lead to different implied health utility weights for different relationship categories, and this work would help improve the precision of the GHS-AO instruments. Finally, although the GHS and GHS-AO provide for integrated assessment of gamblers and AOs, these instruments do not capture health utility impacts to children in these families. Because children cannot generally be directly surveyed in population prevalence surveys, a logical next step would be a dedicated study to estimate the likely impact to children conditional on parental GHS score. Then the burden attributable to children can be inferred from prevalence surveys based on questions on basic household composition.

These issues largely do not affect the primary use-case of the GHS instruments, which is for monitoring population impact from gambling, and comparing aggregate levels of impact in different segments of the population. These comparisons may be between times, to track progress towards harm reduction, between gamblers and AOs, or between geographic areas and demographic groups, in order to better target harm amelioration efforts. We commend the use of the GHS-10, the GHS-20, the GHS-10-AO and the GHS-20-AO to jurisdictions and researchers who require an internally consistent, robust and well-validated index of gambling-related harm.

Chapter 1. The evolution of gambling-related harm (GRH) measurement: Lessons from the last decade

This chapter has been published in the *International Journal of Environmental Research and Public Health* under a Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The article underwent minor modifications to conform to the formatting and editing requirements of this report. As a result of comments from peer reviewers for this report, some changes were also made to the intellectual content from the original publication. The full citation for the original work is:

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1.1 Introduction

Although gambling-related harm (GRH) has been a topic of interest in the field for at least 15 years, there has been a recent increase in research specifically addressing this issue. Early work tended to rely on repurposed gambling problems measures, and adopted a categorical classification of harm that is not much distinct from the concept of gambling problems as a mental health issue. Contemporary research has increasingly relied on dedicated measures, a more precise delineation of the distinction between indicators of behavioural addiction vs. harm, and focused on the health-related impacts stemming from the excessive consumption. It is possible to experience harm from gambling without being behaviourally addicted, and more rarely it is at least possible to develop a behavioural addiction before suffering significant gambling losses. These developments have gone hand-in-hand with greater adoption of a public health framework to address questions such as the 'prevention paradox' (i.e., the finding of more population-level harm amongst the large group of gamblers with few individual-level gambling problems), the link between GRH and health and wellbeing (i.e., the association between gambling harm and decrements to quality of life), and the treatment of negative gambling impacts on a continuum from mild to severe (as opposed to categories of "harmed" and "not harmed"). At the same time, there have been significant disagreements and debate regarding both technical and conceptual aspects of this implementation of a public health approach to gambling since it breaks with a long-standing tradition of research into problem gambling as a mental health disorder.

It is timely to review the state of play of developments in this area. Browne et al. (2020a) recently described a technical framework for the evaluation of GRH using propensity score matching as a means for addressing issues of comorbidities and risk factors, with the aim of linking GRH to established public health metrics such as the SF-6D (Brazier et al., 2002). A theoretical and conceptual overview of the distribution of GRH in the population is given by Browne (2019). However, neither of these overview articles attempted to provide a narrative description of the evolution of research into the measurement and evaluation of GRH. Raybould et al. (2021) conducted a systematic review focused on health inequalities in experience of GRH by age, gender, and other

demographic factors. The review included English-language empirical studies employing dedicated measures of harms to the gambler, but excluded studies on harms occurring to affected others, nor did it include harm assessed via legacy measures based on gambling problems. Instead, it focused on demographic differences and the prevention paradox. It did not address the methodological or conceptual issues in the literature such as distinguishing between gambling problems, gambling harm and indicators of behavioural addiction, and how each should be measured.

In contrast, frameworks and review papers on GRH (e.g. Baxter et al., 2019; Hilbrecht et al., 2020; Langham et al., 2016) have provided a strong conceptual framework for understanding what constitutes gambling harm, but have not focused on the methodological issues of measurement. Accordingly, the present review will take stock of recent developments in the measurement of GRH and its applications, discussing controversies associated with this approach, as well as considering applications to key public health questions in gambling research.

1.2 Measuring harm from gambling

The following subsections describe the practice of GRH assessment over the last 15 years. We shall argue that early measurement of GRH was limited in that it repurposed problems-based measures, and therefore conflated the consequences of excessive gambling (i.e. harms) with the behavioural risk factors for excessive gambling: preoccupation, lack of control, and so on. Perhaps most importantly, framing the measurement of GRH with respect to the criteria for a clinical diagnosis leads to the seductive mistake of all-or-none categorisation in contrast to the far more realistic view that harms and benefits occur as a matter of degree. Finally, early approaches tended to ignore the definition of GRH as being an impact to one's health and wellbeing attributable to gambling. As a result, until recently, no validation of GRH was done with respect to indices of this key benchmark. However, as the narrative review below illustrates, there has been a steady trend towards addressing these deficits.

1.2.1 Repurposing problems-based measures

A substantial proportion of GRH research has employed items from the Problem Gambling Severity Index (PGSI), which is a subset of the Canadian Problem Gambling Index (CPGI), to measure harm. The CPGI includes a number of negative consequences that can be understood as harms; e.g. health problems including stress or anxiety, financial problems, borrowing money or selling possessions to gamble, interpersonal problems and feeling guilty about gambling. These items were used effectively by Canadian studies focused on estimating risk curves associated with increasing gambling consumption (Currie et al., 2006, 2009), following the dose-response model that has been applied successfully to the epidemiology of alcohol-related harm. In deriving low-risk gambling limits, Currie et al. (2017) also relied on harm classifications based on the PGSI. Likewise, in estimating the impact of gambling losses, Markham et al. (2016) used the South Oaks Gambling Screen (SOGS), PGSI and the NORC DSM-IV Screen for Gambling Problems (NODS) (Gerstein et al., 1999), treating higher scores as indications of higher levels of harm. In a population based survey, Canale et al. (2016) employed 10 harm items adapted from the DSM-IV Pathological Gambling criteria. These were grouped as dependence harms (e.g. impaired control), possible dependence harms (e.g. chasing losses), and social harms (e.g. relationship or legal problems). Other studies have used a measure such as the PGSI essentially as-is, expediently treating it as an index of harm (Raisamo et al., 2015).

Thus, the studies mentioned above have used measures of problem gambling as proxies for harm. Although some of the items in such scales are clearly harmful consequences of gambling, other items may arguably be indicators of behavioural addiction or even simply incidentally related to gambling harm (e.g., returning another day to win back money lost at gambling). The most pernicious effect of this practice is that the conceptualisation of gambling harm has 'inherited' the clinical categorisation model of gambling problems, obscuring the underlying reality that most people highly involved in gambling experience some benefits as well as some degree of harm from their gambling.

1.2.2 Bespoke / custom approaches

An informal review of the literature reveals a number of idiosyncratic or ad-hoc approaches to assessing GRH. Rather than repurposing existing problems-based measures, Raisamo et al. (2013) took a more systematic approach. A pool of 8 harms covering multiple domains were selected based on a literature review and expert consultations. For each harm respondents also nominated the frequency of harms (e.g. daily/almost daily). In this 2013 study, and a follow-up (Raisamo et al., 2020), a combined variable was created for analysis with three categories: no harms, one harm, and more than one harm. The researchers found experiencing harms was positively associated with gambling frequency (Raisamo et al., 2013), and the most common harm reported was "feeling guilty or ashamed" (Raisamo et al., 2020).

In a different study of gambling impact on Indigenous Australians, Hing et al. (2014) used 11 binary (yes/no) items that covered consequences such as depression, job-loss, criminal activity and bankruptcy. All items were strong discriminators of differing levels of gambling problems as indexed by the PGSI. For example, 'arguments within your household' (over gambling) had a prevalence rate of 0.9 per cent among non-problem gamblers (NP), rising to 44.7 per cent among problem gamblers (PG). In addition, the more severe consequence of separation or divorce, rose from 0.3 per cent (NP) to 21.5 per cent (PG). These examples help to illustrate a seemingly paradoxical property of gambling harms: that 'milder' consequences – because they are more prevalent – are often a more reliable index of severity than severe ones. That is, many mild harmful consequences are almost ubiquitous amongst people with severe gambling problems, whereas the more severe harmful consequences are more idiosyncratic.

Salonen et al. (2017) analysed data from two existing Finnish gambling surveys from 2011 ($N = 4484$) and 2015 ($N = 5415$). A total of 16 harm items were derived from the SOGS and the PGSI, with binary scoring indicating the presence (or not) of that harm. Although men reported more harms than women, the most common harms reported across both genders were: gambling more than intended, chasing losses, and feelings of guilt. However, as discussed in Browne & Rockloff (2019), the first two probes arguably describe behavioural addiction, rather than a direct impact on health and wellbeing.

Using the large ($N = 3,325$) Quinte Longitudinal Survey (QLS) data, Cowlishaw et al. (2019) conducted a sophisticated item response theoretic (IRT) analysis of a similar combined set of items from the PGSI, the NODS, and the Problem and Pathological Gambling Measure (PPGM) (Williams & Volberg, 2014). They confirmed that both problematic gambling behaviours and specific harmful consequences lie on a single continuum of severity. However, they also comment that most of their available probes tended to lie within a relatively narrow band on the severity continuum. Interestingly, harms such as significant health, work or school problems, or family neglect and criminal activity, rather than indicators of addiction, reflected the most severe end of this spectrum. Most recently, Stevens et al. (2019) employed a custom list of 16 negative consequences attributable to gambling, providing good coverage of a range of financial, relationship, and psychological / behavioural issues,

and binary (yes/no) scored. One quarter of at-risk gamblers reported some kind of harm, with the most commonly reported harms being financial and psychological impacts.

Stevens et al. (2019) found that mild-moderate harms, in aggregate, were substantially more numerous in larger non-clinical gambling populations. This underlines the idea that assessing differing degrees of GRH is necessary to obtain a realistic estimate of the total population impact of gambling. On one hand, it is safe to assume that most harmed gamblers are not experiencing harm close to the degree experienced by problem gamblers. On the other hand, discounting the impacts to this far larger group ignores an important part of the spectrum that contributes to total societal impact.

1.2.3 Health-economic assessment

Health-economic approaches support the idea that GRH should be approached by considering all impacts across the population. Unlike the psychometric self-report paradigm favoured by psychologists, these methods include numerous estimates of costs at the population level, including items such as costs of bankruptcies, divorce, or lost productivity, as well as less tangible indicators. Just as when measuring impacts of social issues such as domestic violence or alcohol misuse, there is no assumption that impacts are restricted to 'alcoholics' or people whose actions pass some threshold for violence intensity. Although an economic framework has natural preference for hard indicators easily quantified in economic terms, it is recognised that the most important impacts of gambling are likely in terms of health and wellbeing, which are experienced individually and sometimes subjectively (Browne et al., 2017c; Williams et al., 2011).

A comprehensive review of gambling health-economic studies is beyond the scope of this article, but the framework of Wardle et al. (2018) provides an illustrative and representative example. They organise metrics relating to GRH in a social costing framework relating to limitation of resources (work and employment, money and debt, crime), relationships (familial and community participation), and health (physical, psychological wellbeing / happiness, and mental health). In general, the lists of specific harmful consequences enumerated within various costing frameworks overlap to a large degree (Anielski & Braaten, 2008; Langham et al., 2016; Wardle et al., 2018; Williams et al., 2011), suggesting there is quite strong agreement regarding the possible adverse outcomes from gambling problems. The Australian Productivity Commission (1999) costing study has arguably formed the model for most subsequent efforts. It employed 22 items describing gambling harms across 6 domains, measured in a binary format (yes/no), with wording specifying a causal attribution between gambling and harm. Finally, McDaid and Patel (2019) also outline a measurement framework with social costing in mind, recommending, among other things, the increased use of standardised health and wellbeing measures such as the SF-12 or SF-6D (Brazier & Roberts, 2004) in addition to gambling-specific outcomes.

There is an important and mutually beneficial relationship between health-economic costings and population-representative self-reports of GRH. On one hand, the conceptual framework of health-economic costings supports the premise that self-report measures should be sensitive to degree, and grounded in recognised common metrics such as the SF-6D (Browne et al., 2020a) or disability weights (Rawat et al., 2018). Similarly, it is difficult or impossible for health-economic studies to integrate self-report measures of intangible costs, e.g. to psychological wellness or relationship health, that are not linked to a meaningful health utility metric. In other words, knowing that 2.7 per cent of the population are estimated to be 'moderate-risk gamblers' tells the economic modeller nothing about the degree of suffering those individuals are experiencing, and provides no clear

guidance on how to incorporate this information into estimates of intangible health and wellbeing impact.

1.2.4 Measures targeted at GRH

The Victorian Gambling Screen (VGS) (Ben-Tovim et al., 2001) was perhaps the earliest attempt to include a dedicated measure of the possible harmful consequences of gambling. It included 16 items intended to capture harm-to-self (HS). The HS subscale has been reported to perform well in relation to the SOGS in identifying problem severity, and to have good internal consistency in a clinical population (Tolchard & Battersby, 2010). Unfortunately, the HS subscale includes several items, such as concealing gambling, urges and returning to win back losses, that are almost certainly better considered as indicators of behavioural dependence rather than harms. Furthermore, the item content in some cases is somewhat vague and therefore vulnerable to interpretive biases, such as feeling as if one was "on a slippery slope". This is reflected in low loadings (around .50) on the HS factor (Tolchard & Delfabbro, 2013). Overall, the VGS performed poorly compared to the PGSI and the SOGS (Mcmillen & Wenzel, 2006). Although the VGS was introduced almost 20 years ago, it appears not to have had widespread adoption in gambling research.

The Problem and Pathological Gambling Measure (PPGM) is a 17-item measure that groups items into three categories: 'problems' (harms), 'impaired control' and 'other issues' (Williams & Volberg, 2014). The problems items are a mixture of Likert and binary scored items, capturing concepts such as financial concerns, mental stress, and conflict with family and friends (Williams & Volberg, 2010). Strong psychometric performance has been reported for the PPGM (Back et al., 2015; Williams & Volberg, 2014; Williams et al., 2015). Christensen et al. (2019) conducted a factor analysis of a large, combined dataset of items from the NODS, PGSI and PPGM. They found four components: (1) general gambling problems, (2) financial impacts, (3) relationship and health impacts, and (4) symptoms of behavioural addiction. The statistical separation of behavioural dependence and adverse impacts is consistent with what was found by Browne and Rockloff (2019). It also agrees with domain-level analyses of harms done by Browne et al. (2016), which suggested that financial problems comprised the earliest and most reliable outcome of excessive gambling consumption. Relationship and health problems subsequently follow in some (but not all) cases, depending on the severity of the gambling problem, and the personal situation of the gambler.

The Harm Questionnaire (HQ) (Blaszczynski et al., 2016; Shannon et al., 2017) represents a nuanced approach to assessing GRH. Items were derived via a systematic process, sourcing eight items of harm organised in seven domains from the literature. Each harm is probed via two items, each with a five-point Likert response. The first question involves reporting the degree to which the issue (e.g., drug use) has been a problem in one's life. The second question asks about the degree to which the problem was related to one's gambling. This contrasts with other self-report measures reviewed here in which attribution to gambling is all-or-none, and the adverse consequence is often reported as present or absent. The tool has since been employed to make community and clinical comparisons (Angus et al., 2020) and demonstrated a significant positive correlation with the PGSI ($r = 0.65$) (Shannon et al., 2017). The HQ reflects one approach to an important unresolved problem in GRH assessment, which is "...how to quantify empirical units of gambling-related harm" (Shannon et al., 2017, p. 378), and to move away from the present reliance on problem gambling status as a proxy for harm. Consistent with other literature, they found that psychological and financial harms are the most significant widespread impacts. In addition, consistent with other research (Browne & Rockloff, 2018; Langham et al., 2016) was the finding that the most severe impacts at the community level were general impacts on quality of life, rather than 'crisis' harms such as suicide or bankruptcy.

The 10-item Gambling Harm measure (GHM; O'Neil et al., 2021) similar to the HQ was developed to not only detect the presence of harm, but also the severity. The GHM covers five primary areas of harm including financial, psychological, physical health, social harm, and work/occupation, with a single additional item to capture illegal acts. For each primary area of harm three sub-questions are assessed: over-prioritisation, strains / pressures, and severe harm. The severe harm questions are only asked if the strains / pressures questions are endorsed; representing a graded question format. A total score of 18 can be obtained, and the measure was reported to have good internal consistency ($\alpha = 0.90$) and was positively correlated with the PGSI ($r = 0.75$).

The 11-item Harmful Consequences Questionnaire (Turner et al., 2006, 2008) assesses harmful consequences of gambling across different domains in a gambler's life (e.g. family relationships). The HCQ is measured on a seven-point scale and has reported high reliability ($\alpha > 0.90$).

The CPGI-Population Harm (Quilty et al., 2015) was developed as a supplement to the CPGI (or PGSI) with a view to better understand the effect of gambling at a population level. The procedure for item development was through a review of literature and expert consultations. The 10-item measure is measured on a four-point scale from 0 (not at all / disagree) to 3 (strongly agree) and captures impacts to domains of work, community, and relationships (e.g. has you gambling made things more difficult for your partner). The measure demonstrated good internal consistency and was significantly correlated with the PGSI ($r = 0.77$) and HCQ ($r = 0.76$), but had a weak negative correlation with a quality of life measure ($r = -0.35$).

1.2.5 The Short Gambling Harms Screen

The 10-item Short Gambling Harms Screen (SGHS) (Browne et al., 2017b) was developed from the much longer 72-item 'harms checklist' employed in prior studies to assess the impact of gambling on health and wellbeing (Browne et al., 2017d; Browne et al., 2017e). Although the original checklist covered six broad domains of impact (financial, health, relationships, psychological, social deviance, work/study), the binary (yes/no) items were selected based purely on statistical criteria to maximise sensitivity and specificity, without regard for item content. The SGHS has been criticised for not covering all domains of harm, emphasising milder items (e.g. reduction in savings), and for its binary present/absent scoring approach (Delfabbro & King, 2017, 2019; Delfabbro et al., 2020a). Nevertheless, it has been shown to possess good to excellent psychometric properties and has had the widest uptake among gambling harm measures. Table 1.1 summarises research that has evaluated ([a]) or applied ([b]) the SGHS since it's development.

Table 1.1. Overview of studies employing the SGHS

Reference	Sample size; Locality	Key findings
Browne et al. (2017b)[a]	1524; Australia	SGHS scores correlated with the full 72-item checklist at $r = 0.94$. Increasing SGHS scores predicted subjective wellbeing ($r = -0.29$) better than PGSI or addiction measures. Scale shown to be unidimensional and to have measurement invariance with respect to age and gender.
McLauchlan et al. (2020)[a]	532; US	The psychometric performance of the SGHS remained equivalent when changing the scoring format from binary to Likert scale. No significant differences were found among correlations between the binary and Likert versions of the SGHS and measures of psychological distress, impulsivity, and wellbeing.
Murray-Boyle et al. (2021)[a]	5551; Australia /	The SGHS was strongly correlated with a range of measures including the PGSI ($r = 0.68$), a latent gambling harm variable ($r = 0.87$) and a gambling

	New Zealand	harm scale only including unambiguously harmful consequences ($r = 0.73$). The findings lend support to the unidimensionality and reliability of the SGHS, particularly with respect to the SGHS items capturing legitimate harmful consequences.
Murray-Boyle et al. (In press)[a]	1742; Victoria, Australia	When examining five SGHS items criticised as being non-genuine harms this study found endorsing any of the five items predicted lower wellbeing and higher psychological distress. Each item individually predicted declines in health related quality of life, and endorsement of additional harm item was associated with cumulative declines.
ACIL Allen Consulting et al. (2017)[b]	5000; Tasmania, Australia	Using the SGHS 5531 years of life were lost due to gambling per annum and this figure was similar when using the PGSI (5083 years of life lost). Mean number of harms increased along with PGSI categories: non-problem gamblers had a mean SGHS score of 0.057, 0.59 for low-risk gamblers, 2.164 for moderate risk, and 5.565 for problem gamblers.
Browne et al. (2019a)[b]	1174; Canada	There were similar proportions of respondents who scored 1+ on the PGSI (48.6 per cent) compared to non-zero responses on the SGHS (41.9 per cent). The key proximal and distal risk factors for gambling harm were trait impulsivity, early childhood gambling exposure, gambling fallacies, less use of safe gambling practices, and excessive gambling.
Browne & Rockloff (2019)[b]	1524; Australia	This research demonstrated behavioural dependence as unidimensional and distinct from gambling harm. Nonetheless, harm mediated the relationship between behavioural dependence and wellbeing. Taken together, behavioural dependence and the SGHS predicted wellbeing better (10.2 per cent explained variance), than each measure individually.
Dowling et al. (2021)[b]	5000; Tasmania, Australia	The PGSI and SGHS when considered separately produced similar low-risk gambling guidelines and captured similar proportions of gamblers in the general population.
Hawker et al. (2020)[b]	97; Tasmania, Australia	The proportions of gamblers who had experienced harm (1+ on the SGHS; 25.77 per cent) was similar to those who had scored 1+ on the PGSI (23.71 per cent).
Hing et al. (2019)[b]	1174; Canada	This study used the SGHS as an outcome measure to develop nine safe gambling practices to best prevent gambling-related harm. Six practices were associated with reduced harm (e.g. I keep a household budget) and 3 were associated with increased harm [e.g. I have used cash advances on my credit card to gamble]).
Hing et al. (2018)[b]	92; Victoria, Australia	Gambling harms were negatively associated with saving behaviours related to money management ($r = -0.34$). No significant relationships existed between gambling harm and other aspects of financial literacy / money management (self-confidence, importance, knowledge, helping, and difficulties).
Jenkinson et al. (2019)[b]	5076; Australia	The three most highly endorsed items from the SGHS were reduction of available spending money (24 per cent), reduction of savings (22 per cent), and lastly regrets that made them feel sorry about their gambling (18 per cent).
Newall et al. (2020)[b]	789; UK	Custom sports bettors experienced a higher mean number of gambling harms compared to non-custom sports bettors (2.35 v 1.53). The SGHS was also highly correlated with the PGSI ($r^{pb} = 0.82$).
Paterson et al. (2019)[b]	5788; Australian Capital Territory, Australia	The 12 month prevalence of experiencing gambling harm was 9.6 per cent. When comparing scores on the SGHS of 1+ (9.6 per cent) to scores of 1+ on the PGSI (10.3 per cent) no statistically significant differences were found. However, 8.7 per cent of non-problem gamblers (PGSI) reported 1+ gambling harms on the SGHS.
Rockloff et al. (2020b)[b]	188; US	No significant interactions were found between PGSI status or gambling harm (SGHS) by free-spins influencing bet count.
Rockloff et al. (2020a)[b]	7626; Victoria, Australia	The prevalence of experiencing any gambling related harm was 9.6 per cent with the most frequently endorsed harms being reductions in available spending money (5.1 per cent), reduced savings (3.9 per cent), and regrets about their gambling (3.4 per cent). As PGSI categories increased so too did the proportion of having experienced harm. For non-problem gamblers 4.3 per cent had experiencing harm, 29.2 per cent of low risk gamblers, 59.4 per cent of moderate risk gamblers, and 100 per cent of problem gamblers.

Rodda et al. (2019)[b]	104; Australia	Gamblers who busted (set a limit and broke it) experienced significantly more gambling harms than those who did not bust (4.26 vs 0.86).
Russell et al. (2020)[b]	2004; New South Wales, Australia	Almost half of respondents (44.2 per cent) had scored 1+ on the PGSI compared to 45.2 per cent who nominated experiencing some gambling-related harm using the SGHS. Furthermore, both PGSI and SGHS scores were significantly associated with exposure to loot boxes.
Russell et al. (2018)[b]	784; Victoria, Australia	Gambling harms were strongly related to the PGSI, with a positive relationship between mean SGHS scores and increasing PGSI categories.
Salonen et al. (2019)[b]	2624; Finland	The prevalence of experiencing gambling related harm was 11 per cent with emotional/psychological and financial domains of harm being notably impacted.
Woods et al. (2018)[b]	5982; South Australia, Australia	Using the SGHS, the 12 month prevalence of experiencing any gambling harm was 19 per cent and was higher among those in Greater Adelaide compared to the rest of the state.
Delfabbro et al. (2021)	554; Australia	Using harms drawn from the 72-item harms checklist, prevalence of impact was considered with respect to PGSI categories. The relative contribution of lower severity categories decreased when graded scoring and degree of attribution to gambling was taken into account.

As shown in Table 1.1, the original psychometric validation of the SGHS (Browne et al., 2017b) has been followed by several more papers focusing on specific criticisms of the instrument. McLauchlan et al. (2020) considered both binary and Likert response formats for the SGHS and the PGSI and found approximately equivalent performance for each format. McLauchlan and colleagues also calculated correlations between the SGHS and psychological distress and personal wellbeing (PWI) across the test and re-retest waves. They found high (.6 to .7) correlations between the SGHS and both outcomes, with no significant difference between the two response formats. Murray-Boyle et al. (2021) focused on the milder probes within the SGHS, e.g., 'reduction in savings', and found them to be reliable and valid indicators of 'unimpeachably' severe harms, such as social isolation, feelings of worthlessness, and being absent from work or study. Using different population-representative data from Victoria, Murray-Boyle et al. (in press) considered the relationship of SGHS scores with self-reported wellbeing (using the Australian Unity Wellbeing Index, AUWI) and (Kessler) distress. Gamblers with SGHS scores of zero were identical to non-gamblers. However, SGHS scores of 1+ demonstrated statistically significant decrements, with these becoming incrementally more severe as SGHS scores increased. Table 1.1 also enumerates are the 17 documented applications of the SGHS available at the time of writing.

The work of Delfabbro et al. (2021) deserves special mention. Although they did not evaluate the SGHS specifically, they evaluated the full suite of harms in the 72-item checklist from which items in the SGHS were drawn with respect to their prevalence in each PGSI category. They additionally requested that respondents indicate the degree to which the harm was severe, and the degree to which it was attributable to gambling. They found that when they varied the threshold of inclusion based on these responses, e.g., being at least moderately severe and mostly attributable to gambling, then the relative prevalence in the higher risk PGSI categories increased markedly. This is in some respects highly unsurprising since an individual with more severe gambling problems is almost certainly experiencing any given harm to a greater severity than someone with less severe gambling problems. However, it does highlight that direct comparison of raw scale scores does not necessarily imply that an equivalent relative degree of impact is being felt. That is, a score of 8 versus 4 on the SGHS does not necessarily imply that exactly double the experienced harm. Thus, it highlights the need to scale raw scores on gambling screens with respect to an independent benchmark of impact.

1.2.6 Reflections on the evolution of self-reported GRH

A theoretical limitation of early ad-hoc measurement of harm has been the combination or conflation of indicators of behavioural addiction, with the consequences of excessive time or money expenditure. If harms are conceptualised as involving a direct decrement to an individual's health and wellbeing, then the inclusion of behavioural dependence items presents an issue in terms of content validity. However, because behavioural dependence is so strongly statistically coupled with excessive consumption and harm, this may not be a significant practical problem in many applications. As has been noted by Currie et al. (2009, 2017), the selection of items, and/or classification as 'being harmed', creates uncertainty as to what threshold should constitute genuine harm. This issue is exacerbated when a small set of harms are sourced from legacy measures such as the PGSI, and it is repurposed for classifying gamblers into 'harmed or not' categories. The work of Cowlishaw et al. (2019) goes a long way to clarifying this issue, in utilising a large set of candidate indicators, and recognising that specific adverse consequences lie on a continuum. From this point of view, specific observed symptoms reflect differing degrees of underlying impact, rather than category membership. Cowlishaw et al. (2019) further suggest that items targeting the lower end of the continuum are under-represented in existing measures, and they recommend continued development of a pool of lower-severity cognitive-affective and behavioural items.

The PPGM, the HQ and the SGHS can be thought of as the 'next generation' of measures that aim to specifically assess GRH. The HQ innovates with an interesting two-step approach that attempts to address the degree to which a given harm is attributable to gambling. This is in contrast to the more typical self-attribution approach taken by the PPGM and the SGHS, which instruct respondents to respond to items only with respect to which they occur as a consequence of gambling. Although the HQ is currently lacking psychometric evidence for efficacy, this approach warrants further attention. Both the PPGM and SGHS have had good uptake and published psychometric validation. Conceptually, they differ primarily in terms of whether they are presented as providing a rule for categorical determination (PPGM), versus eschewing categories in favour of a dimensional measure (SGHS).

A deficiency of all available measures is the lack of a confirmed metric to capture the 'units' of GRH. In our view, the only meaningful quantum of measurement is in terms of expected decrements to health utility, as captured by either self-report instruments such as the SF-6D or via direct elicitation as disability weights. Health utility is the public health concept whereby ideal health and wellbeing is defined as unity (1), with the other pole of zero (0) describing an intolerable life that is not worth living. Although work has been done to relate both the PGSI and the SGHS to health utility decrements (ACIL Allen Consulting et al., 2017; Browne et al., 2017e; Rawat et al., 2018), this needs to be repeated more explicitly in the context of psychometric scale development.

1.3 Effects of GRH on health and wellbeing

There is one overriding reason why we should care about GRH, and that is because it leads to measurable decreases in people's health and wellbeing. However, early employment of the construct made no attempt to validate this purported impact using external measures. For example, when attempting to define a gambling consumption threshold for harm Currie et al. (2009), assumed that 'being harmed' was a threshold that needed to be met by experiencing an arbitrary mix of consequences and behaviours. A similar frame is still evident in more recent research, in which multiple thresholds for 'being harmed' are evaluated, without a clear conclusion as to which threshold is preferred (Delfabbro et al., 2020a). Again, this appears to reflect a conceptual cul-de-sac that assumes the need for categorisation that is inherited from clinically inspired problem gambling

instruments. Whereas diagnostic instruments are best ground-truthed via clinical interviews, GRH is better validated via recognised measures of health utility.

Although direct psychometric validation is still scant, there is much indirect evidence that GRH is a coherent construct that affects health and wellbeing. In a study of 1259 indigenous Australian gamblers, Hing et al. (2014) found that depression and household arguments were the most prevalent consequences among problem gamblers. On the other hand, when the SGHS was administered to a large sample of 5076 online wagerers, the most common reported harms were 'reduction of my available spending money' (23.5 per cent), 'reduction of my savings' (21.5 per cent), and 'had regrets that made me feel sorry about my gambling' (18 per cent) (Jenkinson et al., 2019). Salonen et al. (2018) employed the 72-item harm checklist (Langham et al., 2016) (from which the SGHS was derived) in a large-scale Finnish survey that included both population and clinical samples. The most common harms reported in the population sample were financial and emotional/psychological harms. These were also the most prevalent forms of GRH reported in the clinical sample, but this group also reported a relatively high number of harms associated with health and relationships.

In our view, health utility provides an essential grounding for evaluating the diverse and variable impacts from gambling. This echoes exhortations by others (Raybould et al., 2021) to follow a harm minimisation paradigm, to "...consider aggregate harm to individuals, rather than the estimated prevalence of problem gamblers". Rockloff et al. (2019) used the time trade-off (TTO) elicitation approach to assess benefits and negative impacts on both gamblers and concerned significant others (CSOs). They found that gambling likely yields a negative net consumer surplus for Tasmanians. This followed earlier work (Browne et al., 2017e; Rawat et al., 2018) that estimated health utility for each of the PGSI categories. Rockloff et al. (2020a) applied similar utility weights to the SGHS in a Victorian population study (N = 10,638) to calculate aggregate health impacts of GRH. In Victoria, Australia they calculate a decrement of 0.44 for problem gamblers, with smaller decrements for moderate (.29) or low-risk gamblers (0.13). The Tasmanian population prevalence study, noted above, also found that health utility had a negative relationship to the SGHS, when using a sequential discrete-choice TTO protocol (ACIL Allen Consulting et al., 2017). This is consistent with the approximately linear relationship found between the SGHS and subjective wellbeing reported by Browne et al. (2017b). This is similar to effects noted for the PGSI, with subjective wellbeing decreasing linearly with increasing risk status (Blackman et al., 2019). Finally, Murray-Boyle et al. (in press) used Victorian population prevalence data to demonstrate two important findings. First, Murray-Boyle et al. found that unharmed gamblers (SGHS = 0) showed statistically indistinguishable levels of (Kessler) distress and subjective wellbeing to non-gamblers. Second, results revealed that both outcomes deteriorated significantly and progressively with increasing GRH (SGHS 1+).

Ground-truthing measures of GRH with respect to subjective wellbeing, psychological distress, or health utility is an important and ongoing program of research. However, available current evidence already indicates that instruments such as the SGHS are not only diagnostic of key outcomes, but they are also able to differentiate differing degrees of GRH.

1.4 The prevention paradox

Quantifying harm in a population leads naturally to questions such as the prevention paradox (PP). The PP refers to a situation in which the majority of negative outcomes are attributable to a more populous group that do not exhibit a risk factor, as compared to a smaller group who do. To illustrate, the majority of alcohol-related problems (of varying severity) among adolescents were found to be

accounted for by the bottom 90 per cent of drinkers by alcohol intake (Romelsio & Danielsson, 2012). The so-called 'paradox' in terms of population-aggregate impact arises simply because the increased risk at the individual level is more than counterbalanced by the lower prevalence of the risk factor.

While the PP has been a longstanding observation in other areas of public health, it was seldom considered in gambling until raised by Delfabbro and King (2017), who cautioned against its application without considering "... some meaningful threshold for these behaviors and that they are seen to reduce people's quality of life or compromise their psychological, physical, or social wellbeing" (p. 166). This hints at a fundamental issue in traditional PP reasoning, because in order to calculate a relative proportion of incidents in the low and high-risk categories, the PP is only meaningful with respect to a discrete outcome of interest, e.g. the occurrence of alcohol-related violence among problematic and non-problematic drinkers. The concern of Delfabbro and King (2017) and others is that by setting a low-enough threshold for harm, the PP can always be confirmed, and the apparent societal impact of an activity such as gambling thereby exaggerated.

The issue may be partially resolved by considering the PP groupwise with respect to a broad range of outcomes across a spectrum of severity. This was undertaken by Browne and Rockloff (2018) who evaluated the PP with respect to all 72 harms in the harms checklist (Langham et al., 2016). Using the PGSI to assess risk, they found that most harms in the 72-item list were attributable to low- and moderate-risk gamblers, rather than problem gamblers. These included relatively serious harms such as needing temporary accommodation, emergency welfare assistance, experiencing separation or end of a relationship, loss of a job, needing to sell personal items, and experiencing domestic violence from gambling. This analysis was repeated using a Finnish population survey (Browne et al., 2020b) and using the PPGM control dimension to assess risk. This study found that most financial, emotional, and work/study impacts occurred to those with lower levels of control issues. However, most health, relationship, or social deviance harms tended to be attributable to those with more severe control issues. Another population study in New South Wales, Australia included 21 harm items from the moderate-severe end of the spectrum (Browne et al., 2019b). Aggregate calculations from this data indicated that approximately half of these harms were attributable to problem gamblers. Using non-problem gamblers as a baseline, Blackman et al. (2019) found that discrepancies in Personal Wellbeing Index (PWI) scores implied that almost half of gambling harm (46.2 per cent) was attributable to low-risk gamblers, 38.5 per cent to moderate risk gamblers, and 15.3 per cent to problem gamblers. These attributable proportions were strikingly similar to estimates calculated using health utility disability weights using the TTO and VAS elicitation methods in Victorian and New Zealand studies (Browne et al., 2016, 2017a). In Tasmania, Australia, disability weights were empirically linked to the SGHS, and when aggregated, found similar results, with 17.8 per cent of utility decrements attributable to problem gamblers (ACIL Allen Consulting et al., 2017). However, Delfabbro et al. (2020b) analysed data from an online panel of 554 gamblers, considering several alternative scoring strategies for classifying people as harmed or not. They found that determination of the proportion of harm – using thresholds for being harmed or not – that were attributable to the various risk categories, depended greatly on where this threshold was set. The tendency to apply a fixed categorisation of "harmed" vs. "not harmed," however, may not be necessary or desirable. When harm is measured along a continuum and related to outcomes such as disability weights, as noted above, population decrements in these outcomes are invariably highly concentrated in the low-risk population of people with less-severe gambling problems.

Thus, in our view, the discourse around the PP in gambling is really a surrogate for the more important question of whether the impacts to health and wellbeing, i.e. harm, are concentrated in a few people with a severe pathology, or more broadly distributed in the more typical gambling population. Any number of answers to the PP can be generated, if one is selective as to which outcomes count as genuine harms, or if one creates custom thresholds for categorising people as

harmed or not. In sum, arbitrary outcomes and arbitrary thresholds are more likely to mislead than not. PP logic is best suited to situations when there is a clear unitary outcome of interest that occurs or does not (e.g., laying of criminal charges), and clear categorisation of whether people belong in the risk category (e.g., diagnosed with diabetes, or not). While these issues can be partially addressed by being comprehensive in the scope of outcomes measured, and considering multiple thresholds of risk (e.g., as done by Browne and colleagues 2017, 2020b), such analyses do not directly address the issue of quantifying impact and mapping its distribution in the population.

1.5 Conclusions

Both definitions of problem gambling and public health epidemiological frameworks conceptualise impacts from gambling or harm as a scalar decrement to health and wellbeing - not a categorisation as 'harmed or not.' Indeed, there is a consensus in the field that gambling consumption, behavioural dependence, as well as harm, should all be thought of as continuous quantities (Browne, 2019). Given this, it is surprising how little research in the discipline has attempted to assess this impact on a continuum, using recognised quality of life measures. These studies are distinct from evaluations of the PP, because they treat impact as a scalar decrement to wellbeing or health utility, rather than calculating proportions of individuals as 'suffering a harm or not'.

The next key goal in assessing GRH is to fully integrate established measures of gambling problems with the integrated public health Burden of Disease framework. Any self-report measure of GRH yields a numeric score, which must then be grounded to some meaningful assessment of what that score implies. This entails grounding to a common metric of health utility (or DW), as discussed in detail by Browne et al. (2020a). Within a public health Burden of Disease assessment system, clinically relevant categories (e.g. those derived from the PGSI) are related to typical DWs. Ideally, such assessments are integrated with other co-occurring conditions, so that the unique impact of gambling is factored out. Epidemiological population metrics calculated from these then provide the cornerstone for rational public policy and intervention decisions. Although the 'Burden of Harm' studies (Browne et al., 2016; 2017a) represent an important step in this project, the integration component that accounts for comorbidities (such as alcohol abuse) remains to be accomplished.

A second and related goal is to ground-truth scores from candidate GRH instruments to DWs. This is, in our view, the only way to avoid circular arguments or intuitive and entirely subjective judgements regarding 'how bad' a given degree of measured GRH actually is. In terms of psychometric evaluation of alternative instruments, it seems clear – almost by definition – that impact on health and wellbeing is the core benchmark of interest for GRH. Self-report measures of health and wellbeing, such as the SF-6D (Brazier et al., 2002) or the EQ-5D (EQ-5D, 2022) are the obvious first choice, perhaps supplemented by more general measures of wellbeing already in use, such as the PWI. As detailed in Browne et al. (2020a), this benchmarking would ideally be done via a matched sampling and weighting, so as to isolate the effect of GRH from comorbidities and correlates.

Based on the quality of psychometric validation and number of applications, the SGHS is the clear front-runner candidate among current instruments for assessing GRH. Although the available psychometric and validation evidence is strong, it currently lacks formal evaluation that includes both a propensity model (i.e. comparing those reporting harm to an equivalent sample of those without harm) and a causal model (i.e. controlling for comorbid conditions). Furthermore, the SGHS was designed to be a brief unidimensional screen, and to maximise sensitivity. The literature acknowledges six domains of harm, and a more comprehensive measure may provide advantages in

some contexts. Finally, the elicitation of how much each symptom was caused by gambling; as opposed to other causes, as done by the HQ; may present a useful refinement.

In conclusion, we make the following recommendations. First, that further development of GRH measurement leverages psychometric evidence already established for the SGHS. The SGHS has been shown to possess excellent internal psychometric properties, to be a good surrogate for the comprehensive 72-item screen, and to discriminate differing degrees of GRH, using external benchmarks such as the PWI or the Kessler Distress Scale.

Our second recommendation is that formal health utility weights be established, both on a dimensional continuum (e.g. for SGHS or other GRH measures) and for clinical or pseudo-clinical categories (e.g. for PGSI scores). This should be done via a propensity score matching design, using established public health metrics as the key benchmark. The former will allow for accurate assessment of the distribution of differing degrees of GRH among subpopulations, while the latter will facilitate integration of GRH assessment within frameworks such as the Global Burden of Disease. With these two steps taken, GRH assessment can move beyond circular or subjective arguments around what should constitute harm, and provide a firm foundation for future research and policy.

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Chapter 2. A framework for indirect elicitation of the public health impact of gambling problems

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2.1 Background

In Australia and internationally, government agencies and statutory authorities have an expressed goal to minimise gambling-related harm (Costes, 2019; Wardle et al., 2019). Likewise, the gambling research community has largely embraced a public health approach in which risks from gambling are understood primarily in terms of the harmful impacts of the behaviour (Adams et al., 2009; Browne et al., 2017c; Currie et al., 2006; Korn et al., 2003; Shaffer & Kidman, 2004; Wardle et al., 2018). This is distinct from pathological or models that approach harm indirectly in terms of the presumed financial or human cost among those dealing with a gambling disorder (American Psychiatric Association, 2013; Blaszczynski & McConaghy, 1989), or in terms of a financial accounting of the costs attributable to problematic gambling (Browne et al., 2017b).

There are clear advantages to understanding and managing gambling from a harm minimisation approach that have been discussed in detail elsewhere (Costes, 2019; Wardle et al., 2018, 2019; Korn et al., 2003). However, the shift to a harm-centric model has not been without controversy, and raises important conceptual and practical questions regarding what exactly is meant by being 'harmed by gambling', and how this concept is to be measured (Browne & Rockloff, 2017; Delfabbro & King, 2017, 2019). Notably, this is a question that is also being addressed for other issues such as internet gaming disorder (IGD) (King & Delfabbro, 2018). On the one hand, there appears to be a good consensus on the spectrum of outcomes that are indicative of gambling-related harm. For example, a 72-item checklist of harms identified by Browne et al. (2016) has been widely accepted, and covers a range of outcomes identified by other research (Blaszczynski & McConaghy, 1989; Walker et al., 2012). It is also broadly accepted that in the case of gambling, the primary mechanism for producing harm is the excessive financial losses incurred, and to a somewhat lessor extent excessive time spent gambling (Ladouceur, 2004).

In contrast, there is some debate regarding the interpretation of severity and life-impact associated with varying profiles of gambling harm. Although there are several measures of gambling harm

mentioned in the literature, to our knowledge, psychometric validation has only been reported for one measure: the Short Gambling Harms Scale (SGHS; Browne et al., 2018). SGHS scores appear to have a linear negative relationship with self-reported wellbeing. However, the SGHS is not universally accepted. Given that it includes several milder harms, such as 'reduction of my savings', Delfabbro and King (2019) suggest that these might be rational opportunity costs, given the presumed recreational benefits of gambling, and therefore might not be true harms at all. Another criticism of self-report measures for gambling harms is that respondents might over-attribute life problems to gambling, leading to an upward bias – and making the social cost of gambling appear larger than it actually is (Delfabbro & King, 2017, 2019). Alternatively, social desirability bias is another factor which may also affect reporting rates.

Given these critiques, it is worth emphasising that prior estimates of the scope and extent of gambling-related harm do not depend on the assumption that all items in measures such as the SGHS reflect significant amounts of harm. Indeed, the so-called 'burden of gambling harm' studies in Victoria (Browne et al., 2016) and New Zealand (Browne et al., 2017a) were published before the development of the SGHS and followed established public health protocols for the assessment of the relative impact caused by a diverse range of conditions (Salomon et al., 2012). This involves, in broad terms, determining the typical symptomatology associated with the conditions, and then conducting direct comparisons between health conditions by community members and experts, regarding their relative impact on a person's health. These relative comparisons between conditions, as well as more formal elicitation methods such as the Time Trade Off (TTO) task, are standard methods employed by research teams implementing the Global Burden of Disease (GBD) framework (Salomon et al., 2012; Whiteford et al., 2013), an integrated assessment framework introduced by Murray and Lopez (2013) in the early 1990s to measure the global impact of a diverse range of conditions important to public health. As well as physical health-related conditions, the GBD also includes addictive behaviours (e.g., alcohol use disorder and drug use disorder), and mental health conditions (e.g., depression). Importantly vignettes employed for the burden of harm studies were constructed using neutral language, from surveys of gambling harms reported by different at-risk groups, thus reflecting the reported experiences of individual gamblers. Subsequently, people judging these vignettes – including gamblers, non-gamblers and experts – were free to ignore "opportunity costs" or any other harm that they considered to be insignificant when making their determinations about the severity of each person's experience.

An important finding from the burden of gambling harm studies was that the majority of aggregate harm accrues to low and moderate risk gamblers as described by the Problem Gambling Severity Index (PGSI) categories. In attempting to confirm this finding, one alternative is to ask affected gamblers about their overall quality of their life, and empirically estimate the decrement in subjective wellbeing associated with increasing gambling problem severity. This is a standard technique known as 'indirect elicitation' and is commonly used in GBD studies. An analysis using the Australian Unity Wellbeing Index as a dependent measure, and controlling for potential confounding effects of multiple covariates, found nearly identical results as the burden of harm studies (Blackman et al., 2019). Another alternative is to treat harms as outcomes of interest, and count the number arising from different risk groups (Browne & Rockloff, 2018; Canale et al., 2016). However, this 'harm counting' approach is arguably too simplistic for assessing the true degree to which people in different risk categories are harmed by gambling, because of the considerable co-occurrence of many of these harms (e.g., relationship harms are coincident with emotional harms). Co-occurring harms might serve as a good indicator or reflection of an underlying continuum of harmful consequences but unless they are selected extremely carefully, they are unlikely to represent an exact linear composite of that construct (Costa, 2015). In particular, problem gamblers are likely to experience a proliferation of harmful consequences that overlap in terms of their total contribution to a decrement in overall wellbeing.

As the brief discussion above suggests, an accurate picture of the scale and extent of gambling-related harm depends on a careful conceptual and measurement framework that links measures obtained from self-report scales to a recognised index of individual impact. As noted already, the burden of gambling harm studies (Browne et al., 2016, 2017a) implemented direct elicitation methods consistent with the GBD evaluation program. However, limitations acknowledged in these reports were that they did not attempt to consider any positive benefits that may co-occur with gambling harms, especially less severe harms, or control for the possible confounding effect of comorbid conditions. The latter has the most potential to be problematic, given the high degree of co-morbidity of gambling problems with other mental health and substance use disorders (Hodgins et al., 2011). The present article will consider the scope for new alternative *indirect* elicitation approaches, also employed within the GBD assessment efforts, which may provide a useful means to address these and other concerns. While direct assessment methods use vignettes or descriptions of the experience of harmed gamblers, indirect assessment relies on statistical associations between gambling conditions (e.g., low-risk, moderate-risk and problem gambling) and the outcome of decrements to wellbeing.

The present article will provide an overview of the theoretical and methodological issues involved in the indirect assessment of gambling-related harm, including the attribution of causality to gambling, handling covariates and confounding variables, and gambling as a risk factor for other conditions that are harmful. It begins with the definition of gambling-related harm, and what that implies for measurement of this construct.

2.2 A decrease in health and wellbeing caused by gambling

Several definitions of gambling-related harm exist. However, they consistently describe it explicitly as an adverse impact on health and wellbeing. For example, research funded by the UK Gambling Commission defines harm as "*the adverse impacts from gambling on the health and wellbeing of individuals, families, communities and society*" (Wardle et al., 2018). In Australia, the definition adopted by the Victorian Responsible Gambling Foundation includes a similar phrase, "*an engagement with gambling that leads to a decrement to the health or wellbeing of an individual, family unit, community or population*" (Langham et al., 2016). These definitions are consistent with the World Health Organization's (WHO) (1946) definition of health as "*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" (Callahan, 1973). In other words, harmful gambling describes the situation where a person's health and wellbeing decreases as a consequence of their own, or someone else's gambling.

From the above, there is no reason why harmful gambling cannot be placed in the same class as any other behavioural risk-factor that is determinantal to health and wellbeing, such as smoking, problematic alcohol and recreational drug use, or intimate partner violence. And like other behavioural risk-factors, a decrement to health and well-being from harmful gambling can be understood as accruing not just from non-fatal causes of ill-health but from fatal causes as well. Thus, the impact of harmful gambling can be assessed using the GBD framework in which of years of life lost to morbidity and mortality are both accounted for when quantifying the overall burden of disease.

2.3 Screening for gambling harm

Common screens for gambling-related harm focus on items that capture common adverse consequences. Harm is also often confusingly subsumed under the more general construct of gambling problems (Browne & Rockloff, 2019). Several items from the PGSI (Ferris & Wynne, 2001), for instance, arguably probe harmful consequences from gambling whereas others are symptoms of an underlying mental health condition without being necessarily harmful. There have also been efforts to specifically assess gambling harm apart from symptoms of a gambling disorder (Shannon et al., 2017; Williams & Volberg, 2010). However, to our knowledge, the only dedicated measure of gambling harm with published psychometric validation is the Short Gambling Harms Screen (SGHS; Browne et al., 2018). The SGHS was shown to be a highly reliable proxy for the comprehensive 72-item harm checklist, and therefore an appropriate measure of an underlying construct of being harmed by gambling.

There is controversy regarding how screens for harm should be interpreted, particularly with regard to lower levels of severity. For example, although there is consensus that PGSI-classified 'problem gamblers' (PG) are significantly harmed, there is not yet consensus on the degree to which 'low risk' (LR) or 'moderate risk' (MR) gamblers are harmed, or even if they are likely to be harmed at all. LR and MR gambling status has been associated with progressively greater decrements to subjective wellbeing, which supports the contention that they may have suffered harm (Blackman et al., 2019). Although the SGHS is also linearly associated with decreases in self-reported wellbeing, some doubts have been expressed as to whether lower scores on the SGHS are truly indicative of harm (Delfabbro & King, 2017).

To summarise, several screens for gambling harm exist, they include similar content, and harm measures have been shown to have a relatively simple unidimensional structure. However, although screens for gambling harm and problems have been shown to be associated with a loss of wellbeing, they have – at most – been only partially assessed using formal health-epidemiological procedures, which we will discuss in more detail below.

2.4 Capturing harm via disability weights

As mentioned in the introductory section, the GBD framework seeks to measure the global impact of a diverse range of conditions important to public health. At the centre of this framework are *disability weights* (DW), which aim to capture the average health loss associated with living with a particular manifestation of a condition. When combined with a measure of disease frequency in the population, this provides an estimate of the non-fatal burden of the condition in Years Lived with Disability (YLD). The fatal burden is measured in Years of Life Lost (YLL) and the total burden in Disability Adjusted Life Years (DALYs).

Disability weights for a range of substance use and mental disorders are included in this framework (Whiteford et al., 2013). Disability weights are bounded between zero and one, with values close to zero having a negligible impact on health, and values close to one reflecting a profound impact making life intolerable. The reverse of this scale is often referred to as a Health State Valuation (HSV) as used in Quality Adjusted Life Years (QALYs), which are considered a cornerstone of health-economic analysis (Kind et al., 2009). Although gambling disorder is included in the DSM-V and ICD-10, and the field itself considers gambling-related problems to be a public health issue (Korn et al., 2003), it is not currently evaluated in the GBD (Salomon et al., 2015). In contrast, the latest version of

the GBD includes four different severity categories for alcohol use disorder, ranging from very mild (DW = 0.12) to severe (DW=0.57) (Salomon et al., 2015).

2.4.1 Direct elicitation

Disability weights estimated within the GBD and other disease burden studies are commonly done via elicitation methods. The GBD 2013 program relied heavily on a Discrete Choice Evaluation (DCE) protocol of *direct elicitation*, in which participants in a general survey were asked to compare pairs of lay-person condition descriptions, and indicate which condition was worse. Another common direct elicitation method is the time trade-off (TTO), which measures the extent to which respondents would be willing to give up an amount of life time to avoid a hypothetical condition and be in full health (Schwarzinger et al., 2003).

To our knowledge, the only applications to-date of direct elicitation to assess the impact of harmful gambling were undertaken in Australia (Browne et al., 2016) and New Zealand (Browne et al., 2017a). In these studies, both relative comparisons with other conditions, as well as TTO elicitation techniques, were used to assess condition descriptions reported by individuals at different levels of the PGSI (Browne et al., 2017d). The Australian study yielded DW of 0.14 for so-called low-risk gamblers, 0.29 for moderate-risk, and 0.46 for problem gamblers, which happens to correspond quite closely to DW estimated for the three lower levels of severity for alcohol use disorder within the GBD framework (Salomon et al., 2015).

Direct elicitation methods that involve general population samples do not necessarily assume that the consensus evaluation is perfectly unbiased. Rather, they assume that because it is the public that is affected by health-related policies, then the public's view regarding the impact of conditions is the most valid and meaningful. To illustrate, if the consensus community view is that the severity of gambling problems is similar in magnitude to that of alcohol abuse, and it is the community that bears the costs and benefits of both behaviours, then there are few technical or theoretical grounds with which to challenge that evaluation. Nevertheless, the aforementioned Australian and New Zealand burden of harm studies that used the direct elicitation method to find DWs for gambling also included a panel of experts from the fields of gambling research and treatment. Interestingly, there was broad concordance between the results of these experts and public views.

These observations notwithstanding, gambling may present special difficulties when it comes to *attribution* of symptoms or harm to the condition of harmful or disordered gambling – a topic that will be discussed in detail below. Furthermore, it should be noted that the vast majority of the disease burden estimates mentioned above incorporate disability weights that assume conditions occur in isolation, and are therefore vulnerable to the problems that arise due to comorbidity (Hilderink et al., 2016). This is indeed also true for the 'burden of harm' estimates accomplished for gambling (Browne et al., 2017c). Although some novel approaches have been developed to overcome this problem, they necessarily involve some simplifying assumptions, as will be discussed below.

2.4.2 Comorbidity

Comorbidity, for the purposes of this discussion, describes the situation where two or more health problems occur in a person simultaneously, either by chance or because the conditions are related to each other in some way. *Independent* comorbidity is where the probability of having multiple

conditions at the same time equals the product of the probabilities for each condition. *Dependent* comorbidity, on the other hand, is where the probability of having multiple conditions is greater than the product of the probabilities for each condition, and occurs because of common causal pathways (for example common risk factors causing both diabetes and heart disease) or because one health problem may increase the risk of another.

Both types of comorbidity can be problematic for the conceptual framework proposed by Murray and Lopez (2013), particularly when the set of available disability weights is comprised of evaluations for each health state as it occurs independently from others. As noted above, this includes the vast majority of burden of disease studies to date.

The severity of a health state associated with two or more conditions in combination may not necessarily be the sum of the disability weights for each condition. In most cases, it is likely to be less than the sum. In others, there may be exacerbating effects on overall health of having the combination of conditions. For example, the experience of symptomatic grade 2 osteoarthritis of the hip and severe vision loss together is probably not as disabling as the addition of the two weights for these health states (0.14 and 0.43, respectively). However, the experience of the latter with profound deafness may be equal to or even more disabling than the simple summation approach indicates.

In an early response to this problem, Mathers et al. (2001) proposed an adjustment that assumed health state valuations (that is, 1 minus the disability weight) are multiplicative, so that a combined weight for two conditions is more severe than the weight for either condition on its own but less than if the weights were simply added together. In this approach, the combined severity weight for causes $k = 1$ and $k = 2$ is given by,

$$DW_{[1,2]} = 1 - (1 - DW_1) \times (1 - DW_2) \tag{1}$$

This can be generalised to *n* conditions thus,

$$DW_{[1,n]} = 1 - \prod_{j=1}^{n}(1 - DW_j) \tag{2}$$

where () denotes the product operator.

To illustrate, if an individual was experiencing both severe alcohol use disorder and is also classified as a problem gambler, the combined DW is not 0.57+0.46 = 1.03, but rather 1 - (1 - 0.46)*(1-0.57) = 0.77.

Equation (2) has been extensively used to derive combined weights for comorbid conditions in subsequent applications of the framework. Work by Flanagan et al. (2006) indicates that, in the absence of anything else, the multiplicative approach to deriving composite weights is reasonably robust.

Mathers' initial implementation derived individual weights consistent with these composite weights by leaving the weight for the most severe condition unchanged but adjusting the weight for the milder condition such that it equalled the composite weight minus the weight for the more severe condition. Implicit in this approach is an assumption that the prevalence of a set of comorbid conditions is equal to the product of the individual prevalences of these conditions; in other words, that health problems occur independently of each other (see James et al., 2018). Subsequent work demonstrates that correcting for dependence between groups of conditions has a non-trivial impact on comorbidity-adjusted disability weights and ultimately integrated measures such as DALYs (Mathers et al., 2006).

The difficulty associated with controlling for comorbidity arises due to the perceived impracticality of obtaining empirical data regarding comorbidity rates and effects on DWs for every possible combination of conditions included in a typical GBD analysis (Ferrari et al., 2016). However, as demonstrated by Gadermann et al. (2012) for 19 comorbid mental and chronic physical disorders at least, it is possible to gather self-report data on multimorbidity, as well health status, and then to model the simultaneous main and interactive effects of each condition on health. Importantly, rather than relying on DWs elicited directly from evaluations of health states (described above), this kind of approach infers the DW attributable to a given condition based on the self-reported health states of affected individuals. This is sometimes referred to as *indirect elicitation* of DW. In this calculation, rather than assessing "how bad" suffering is from each condition, instead a person's overall health and wellbeing is assessed, and a statistical association is made, usually by means of regression, between a person's poor health and the presence of a wide range of disease conditions. From this association, DWs can be indirectly inferred in a sample from the strength of each association between a given disease and people's measured general health and wellbeing.

2.4.3 The challenge of attribution

Given the ubiquity of comorbidity in a population, and the multiple simultaneous effects on health and wellbeing that this gives rise to, a key requirement of DW estimation is to be able to confidently attribute an impact on health to a given condition. As mentioned above, directly elicited DWs can be scaled given the presence of multiple conditions using mathematical heuristics, or alternatively, modified empirically from observed interaction effects. However, even in the absence of comorbidity, the attribution of causality is still a problem for integrated health assessment techniques such as the Murray and Lopez (2013) framework, given that the necessary empirical data are rarely available.

To summarise, a direct elicitation approach relies on the ability of either experts or community members to:

(a) Describe the symptomatology that occurs as a result of having a condition; i.e. forming condition descriptions

(b) Assess the total impact of that symptomatology, relative to a healthy individual.

Thus, this approach entails that the task of attribution is delegated to participants, community members, or experts via elicitation protocols. On the one hand, this is preferable to researchers making arbitrary judgements regarding symptomology or severity. On the other hand, there is the possibility that both the participants and the elicitation methods themselves may introduce various forms of bias. Investigation and resolution of these issues are areas of ongoing methodological research (Doctor et al., 2010; Rehm & Frick, 2014; Wiedermann & Frick, 2014; Yepes-Nunez et al., 2017).

To conclude, direct elicitation of DW is the current standard within the GBD framework to assess burden of disease. The elicitation techniques employed for gambling to date have followed the same principles and methods used for other conditions, including harmful alcohol use. These 'raw' DWs can then be scaled to account for comorbidity when calculating YLD within an integrated assessment framework. However, adjusting for comorbidity is often done via an analytic formula, rather than based on empirical data. Furthermore, integrated frameworks often do not take into account dependent comorbidity, and therefore may apply insufficient adjustments for highly comorbid conditions like gambling problems (Boyd et al., 2007). For instance, Petry and colleagues (2005) have

estimated that 73.2 per cent of people in the United States with a gambling problem also have an alcohol use disorder, which should strongly affect proper DW adjustment for both conditions. Finally, direct elicitation generally requires evaluations of a vignette or condition description made by third parties. Thus, it is not 'direct' in sense of eliciting health state information directly from the affected individuals, which might compromise its validity.

2.4.4 Indirect elicitation

Indirect elicitation is 'indirect' in the sense that condition descriptions are not evaluated directly for their impact. Rather, individuals suffering from the condition are compared to those who do not have the condition in terms of their self-reported HSV or health and wellbeing. Self-reported HSVs can be elicited using a Visual Analog Scale (VAS; Gadermann et al., 2012) or a survey instrument such as the SF-12 (Brazier & Roberts, 2004). It is important to recognise that the goal is to estimate the presumed causal effect of a condition on HSVs from cross-sectional data. This is similar to estimating the HSV under a counterfactual scenario in which the condition was eliminated (Morgan & Winship, 2015). In this scenario, the challenge of attribution is not relegated to the judgements of participants, but rather made the subject of statistical analysis. To make plausible inference of causality, such studies must take great care to accomplish two goals:

1. To estimate a *propensity model* (see Rosenbaum & Rubin, 1985) - the function of risk factors that lead some individuals to have the condition when others do not.

2. To estimate a *causal model* (see Lunceford & Davidian, 2004) – the unique effect of the condition on HSV after controlling for comorbid health-related issues.

The same covariates may appear in both the propensity model and the causal model. The propensity model is used to match the control group and the condition group as closely as possible, which may involve both purposeful sampling and case weighting (Li et al., 2018; Lunceford & Davidian, 2004; Morgan & Winship, 2015; Rosenbaum & Rubin, 1985). That is, the purpose of the propensity model is to find a matched sample of others not suffering from gambling problems or harm who otherwise resemble the gambling-harmed participants on key risk factors. In the case of gambling, the causal model should incorporate known comorbidities (e.g. alcohol misuse) that are also known to affect wellbeing, to avoid attributing non-gambling impacts (e.g. those due to alcohol) to gambling.

Despite the challenges involved, indirect elicitation studies complement direct elicitation studies in several important ways. First, they are based on HSVs elicited from the individuals suffering from the condition, arguably increasing their validity. The respondents are *not* asked to attribute the degree to which their health was affected by a given condition, which eliminates a potential source of bias by virtue of people over (or under) attributing the contribution of the condition to their wellbeing. Also, they provide the opportunity to gather detailed comorbidity information, thus providing empirical estimates of both dependent and independent comorbidity rates and consequently the information needed to adjust DWs for these comorbidities. Finally, because self-reported HSV can be influenced by positive or negative effects of a behaviour, there is no implicit assumption that gambling can only have a negative impact on wellbeing. Any positive contributions to wellbeing, such as those measured by Rockloff et al. (2019), will be balanced against negative contributions, which eliminates another important source of bias.

2.5 Indirect elicitation for evaluating harm from gambling

The factors that are associated with gambling problems are well understood. It is also known that gambling problems are also highly comorbid with other addictive and mental health disorders. Thus, the indirect elicitation method via self-reported HSVs, combined with a propensity score weighting framework, presents particular benefits in evaluating the effects of gambling-related harm. It provides a means to appropriately adjust DWs, while also implicitly recognising any potentially positive contributions of gambling to health and wellbeing that may partially offset the negatives. Direct elicitation, while having its own strengths, has neither of these benefits.

Figure 2.1 illustrates the basic framework for this kind of evaluation applied to gambling-related harm. Two statistical models are involved. First, the propensity model describes the effect of risk factors on the likelihood of experiencing gambling-related harm. In practical terms, that comparisons between harmed and unharmed individuals are matched and weighted as much as possible with respect to risk factors. For example, if the majority of problem gamblers are young men, then it is most appropriate to compare them with a control group that has a similar preponderance of young men. Conceptually, this stage requires a discrete approach to categorising individuals into case and control groups. An accepted population screen such as the PGSI may be used for this purpose[1]. Second, the causal model links indices of gambling harm with HSVs. This requires accounting for comorbid and non-independent conditions in the regression model, to avoid attributing common variance exclusively to gambling. Discounting effects due to comorbidity can be handled via (negative) interaction terms between conditions. Such estimates can ultimately feed into a fully integrated computational analysis for YLDs or DALYs such as the GBD. However, one caveat to this is that integration into the GBD framework demands data supporting a lifetime epidemiological model of gambling involving incidence, duration, relapse, and recovery.
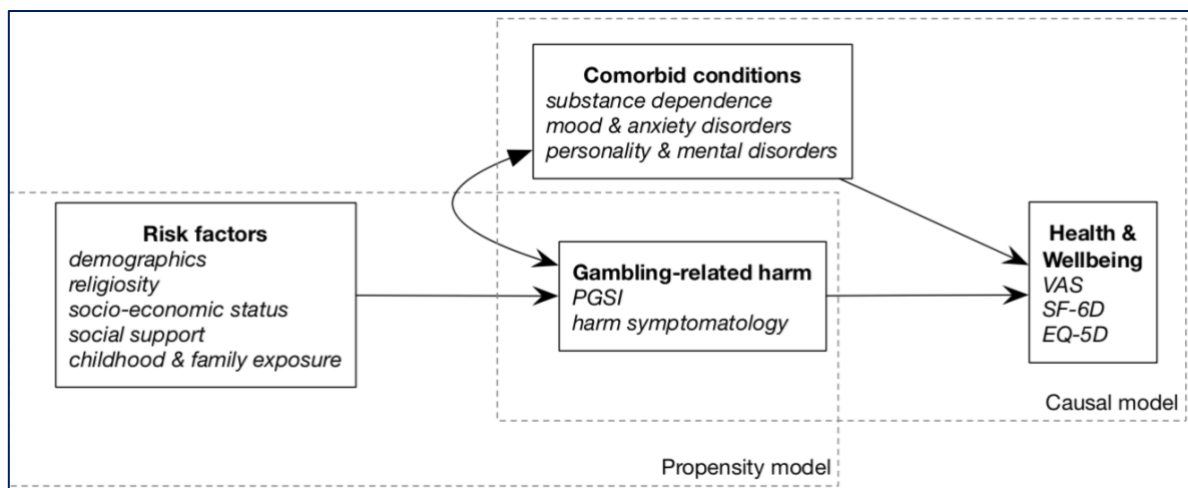
Figure 2.1. Framework for propensity score matching and causal inference for health-related impacts of gambling

As this framework makes clear, indirect elicitation of the health impacts of gambling depend not only on good indices of gambling harm and HSVs, but also on good knowledge of both risk factors and co-

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[1] It should be noted that the PGSI measures both problem-gambling symptoms and harmful outcomes, but for the purposes of this analysis the harmful outcomes are the measurement property of interest

morbid health-related conditions with harmful gambling. Thus, we will now review and summarise the current knowledge regarding these two sets of covariates.

2.5.1 Risk factors for gambling problems / harms

This section enumerates risk factors for gambling problems (i.e. disordered and/or harmful gambling) which have been identified in previous research and should be considered for inclusion in an indirect evaluation framework. Gambling problems are conceptually distinct from gambling-related harm. However, they are quite strongly correlated, and risk factors for problems can be safely assumed to also be risk factors for harms. Given that the bulk of literature on risk factors deals with gambling problems, we employed it as a proxy for harm. Sources considered included meta-analyses, systematic reviews, theoretical models, and recent original research that has not been included in the aforementioned sources (Table 2.1). To our knowledge, this list includes all significant relevant systematic reviews on this topic.

Table 2.1. Key sources examined to identify risk factors for gambling problems

Reference	Study design
Abbott et al. (2015)	Systematic review
Browne et al. (2019)	Original research
Cunha et al. (2017)	Original research
Dowling et al. (2017)	Systematic review & Meta-analysis
Hing et al. (2016)	Original research
Johansson et al. (2009)	Systematic review
Miller (2015)	Systematic review
Sharpe (2002)	Theoretical model
Sharpe & Tarrier (1993)	Theoretical model
Vasiliadis et al. (2013)	Systematic review
Williams et al. (2012)	Systematic review

The risk factors identified from these sources were grouped into five broad categories: childhood/family, cultural, demographic, geographic, and personal. The goal was to identify the most important risk factors that represent unique factors that predict whether an individual is likely to experience gambling problems.

Previous research has highlighted issues surrounding a person's childhood and family upbringing, often under different and yet conceptually similar terms. Childhood gambling exposure via parental gambling problems or children participating in parental gambling activities have been identified (Browne et al., 2019). That is, the extent to which parents gamble may drive exposure to gambling during childhood, which has been associated with an increased risk of becoming a problem gambler in adulthood (Abbott et al., 2015; Browne et al., 2019; Williams et al., 2012). Family structure more broadly is also a childhood risk factor, with single parent households (Miller, 2015), and lower levels of parental supervision (Hing et al., 2016) being found to be risk factors for adult gambling problems. Child-specific factors have also been highlighted, for example the child's antisocial behaviours (Dowling et al., 2017), and childhood ADHD (Attention deficit hyperactivity disorder) (Sharpe, 2002; Sharpe & Tarrier, 1993). However, rather than including recalled childhood ADHD in the model, it may be better to include adult impulsivity, which is also highlighted below. Adult impulsivity may be more reliably measured and strongly correlated with childhood ADHD. Children are also highly affected by

their peer group, and peer antisocial behaviours have therefore been highlighted as a risk factor (Dowling et al., 2017), as has peer gambling (Williams et al., 2012). Thus, a propensity model for gambling problems ought to include variables assessing childhood family structure, as well as childhood gambling or childhood exposure to gambling from family and peers. These are all fairly objective factors, that should be recalled with less noise, and be highly correlated with, other factors such as childhood antisocial behaviors.

Cultural factors also appear relevant to adult gambling problems. Ethnic minority groups have been shown to be at a greater risk of adult gambling problems (Johansson et al., 2009), as well as people who speak a language other than English at home (Hing et al., 2016), and those born overseas (Abbott et al., 2015; Johansson et al., 2009). Religiosity has also been highlighted as a risk factor (Abbott et al., 2015; Browne et al., 2019), although this did not appear as a statistically significant factor in a recent meta-analysis (Dowling et al., 2017).

A large number of demographic factors have been shown to be predictors of adult gambling problems. Poor academic performance (Dowling et al., 2017) and lower educational attainment (Browne et al., 2019; Cunha et al., 2017; Williams et al., 2012) are commonly identified risk factors. Male gender is as another key risk factor, with young men being several times more likely to experience problems than many other age-gender categories (Abbott et al., 2015; Cunha et al., 2017; Dowling et al., 2017; Johansson et al., 2009). Young women, as well as men, are generally more likely to experience problems (Browne et al., 2019; Hing et al., 2016; Johansson et al., 2009). Unemployment also presents a risk (Hing et al., 2016; Johansson et al., 2009), and occupational status more broadly appears related to whether or not one experiences problems (Abbott et al., 2015; Browne et al., 2019; Miller, 2015). Relatedly, high income broadly appears to be a relevant protective factor (Abbott et al., 2015; Browne et al., 2019; Williams et al., 2012), as is high socio-economic status (Abbott et al., 2015; Dowling et al., 2017; Miller, 2015). Marital status is also relevant, with both people who are currently single (Abbott et al., 2015; Browne et al., 2019), and those who are divorced (Miller, 2015) at higher risk compared to others. These findings accord with results regarding household living status, with those living alone (Miller, 2015) or in a group household (Hing et al., 2016) considered to be at higher risk. In general, it is clear that being in a more vulnerable social and socioeconomic situation is a key dimension which predicts whether or not one will experience problems with gambling. A variety of brief indices could be used to capture this information for propensity matching and risk modelling, including age, gender, employment status, income, education, and marital status.

Geographic and environmental factors also appear relevant to the development of gambling problems. Living in a large city has been identified as a risk factor (Abbott et al., 2015; Johansson et al., 2009), as well as the distance between one's residence and the gambling venue (Browne et al., 2019). More generally, the availability of gambling products represents an inherent risk (Sharpe, 2002; Williams et al., 2012), which in the contemporary context, represents a combination of both land-based and remote (online and mobile) gambling opportunities. However, the availability of gambling products is a complex and dynamic risk factor, which the field is still in the process of addressing (Vasiliadis et al., 2013). Nevertheless, at a minimum, measures of venue distance and metropolitan / regional / rural residential location should be included in a propensity model.

Finally, stable personal or psychological factors also appear relevant to the risk of developing gambling problems. A number of psychological factors, such as personality disorders or substance dependencies are more appropriately considered under the label of comorbidities. Impulsivity, however, is reliably observed as an important risk factor (Dowling et al., 2017; Johansson et al., 2009; Sharpe, 2002; Sharpe & Tarrier, 1993; Williams et al., 2012), and emerged as the single strongest correlate of adult gambling harm in one study (Browne et al., 2019). In terms of propensity matching,

adult impulsivity may be a more reliable construct to match the two groups on than the related traits of childhood ADHD (Sharpe, 2002; Sharpe & Tarrier, 1993) or childhood antisocial behaviours (Dowling et al., 2017). The similar construct of sensation seeking has also been consistently highlighted as a risk factor for gambling problems (Abbott et al., 2015; Dowling et al., 2017; Johansson et al., 2009). The experience of early big gambling wins is thought to be an important risk factor (Sharpe, 2002), but did not emerge as a statistically significant predictor in a recent meta-analysis (Dowling et al., 2017). Trait impulsivity and/or sensation seeking are therefore the most relevant psychological traits to consider for propensity modelling.

In practical terms, for the purpose of generating a suitable propensity model for gambling problems, it is not necessary to include an exhaustive list of all correlates. As demonstrated by Browne et al. (2019), many risk factors are correlated with each other, and therefore do not necessarily provide unique information in a simultaneous regression model. Furthermore, it is not necessary for the propensity model to be 'perfect'. Rather, the goal is to ensure that a good case can be made for gambling, rather than some other variable(s), have an instrumental role in explaining differences between the case and control groups (Morgan & Winship, 2015).

2.5.2 Health conditions comorbid with gambling

Gambling disorders are known to have significant co-morbidities with other psychiatric disorders (Hodgins et al., 2011). High rates of problem gamblers have also been observed in mental health settings, with a recent study reporting rates of problem gambling among patients eight times that observed in the general community (Lubman et al., 2017). While the extent of comorbidities with gambling problems has been well documented narratively (Turner & Ferentzy, 2012), arguably the following three research articles provide the strongest evidence for understanding these co-morbidities in both clinical and community samples:

1. Dowling et al. (2015a): A systematic review and meta-analysis for the prevalence of co-morbid psychiatric disorders among treatment-seeking problem (including pathological) gamblers

2. Lorains et al. (2011): A systematic review and meta-analysis for the prevalence of co-morbid disorders in population representative surveys of problem (including pathological) gamblers

3. Dowling et al. (2015b): A systematic review and meta-analysis for the prevalence of co-morbid personality disorders among treatment seeking problem (including pathological) gamblers

Table 2.2 explains the constituent parts of Table 2.3. Results drawn from the three aforementioned reviews form part of Table 2.3 (specifically columns 2 & 3). Table 2.3 also contains information drawn from a range of other sources and was generated to enable a better understanding of comorbidities and relative risk, which was not made explicit in the cited articles.

Table 2.2. Column guide

Column	Description
1. Disorder	The specific comorbid disorder
2. Number of estimates & 3. Mean comorbid prevalence (per cent)	These two figures/columns should be interpreted in conjunction. Column 2 is a count of *individual estimates* that were used to estimate the mean prevalence of co-morbidity. For example, the *mean co-morbid prevalence* of 'alcohol abuse' was derived using nine studies. Column 3 is the actual *mean comorbid prevalence*. For example, the co-morbidity of 'alcohol abuse' among problem gamblers was estimated to be 18.2 per cent. The figures in this column were derived from Dowling et al. (2015a, 2015b) who examined treatment seeking problem gamblers, and Lorrains et al. (2011) who examined community samples of problem gamblers.
4. Community prevalence (per cent)	This figure is the rate of the disorder observed in the *general population irrespective of problem gambling status* (e.g. 8.5 per cent community prevalence for any alcohol use disorder). Community prevalence rates were drawn from multiple sources (see notes in Table 2.3).
5. RR (*SE*)	Relative risk (RR) is the likelihood of having a specific co-morbid disorder for a problem gambler, compared to the general population. E.g. The rate of alcohol abuse is almost 4*x* higher among problem gamblers than in the general population. This calculation was based on estimates from previous research, and associated standard error (*SE*) rates are approximated by propagating uncertainty for both the numerator and denominator, using a first-order Taylor expansion $\sigma_f \approx \lvert f \rvert \sqrt{\left(\frac{\sigma_A}{A}\right)^2 + \left(\frac{\sigma_B}{B}\right)^2 - 2\frac{\sigma_{AB}}{AB}}$ where $f = \frac{A}{B}$ and A and B represent the probability of a gambler and the general population to have the condition, respectively. We assume the covariance term to be zero.
6. DW	Disability weights (DW) quantify the health loss associated with an outcome and are measured on a scale from 0 (indicating full health) to 1 (a state equivalent to death) (Salomon et al., 2015)
Other notes	• Where possible, 95 per cent confidence intervals for estimates are presented in square brackets • A dash in any cell '-' indicates that piece of information was not able to be obtained • The information was obtained from a wide range of sources. Due to methodological variations between studies (e.g. diagnostic tools used) the figures should be interpreted with caution when comparing. A discussion of these issues will follow later in this paper.

Table 2.3. Prevalence of comorbid disorders among problem/pathological gamblers

Disorder	Number of estimates	Mean comorbid prevalence (%)	Community prevalence (%)	RR (*SE*)	DW
Any DSM-IV Axis 1 disorder	5[a]	74.8 [36.5-93.9]	20.0 [18.9-21.0][d]	3.7 (0.74)	-
Any alcohol or substance use disorder	10[a]	22.2 [16.1-29.8]	5.1 [4.5-5.8][d]	7.8 (0.85)	-
	3[b]	57.5			
Any alcohol use disorder	12[a]	21.2 [5.6–28.1]	8.5 ($SE = 0.24$)[e]	2.9 (0.68)	Very mild (0.123)[p] Mild (0.235)[p] Moderate (0.373)[p] Severe (0.570)[p]
	8[b]	28.1			
Alcohol abuse	9[a]	18.2 [13.4–24.2]	4.7 ($SE = 0.18$)[e]	3.9 (0.60)	-
Alcohol dependence	7[a]	15.2 [10.2–22.0]	3.8 ($SE = 0.14$)[e]	4.0 (0.81)	-
Any substance (non-alcohol) use disorder	7[a]	7.0 [1.7–24.9]	2.0 ($SE = 1.00$)[e]	6.1 (4.23)	-
	3[b]	17.2			
Substance (non-alcohol) abuse	8[a]	6.6 [3.3–12.7]	1.4 ($SE = 0.08$)[e]	4.7 (1.73)	-
Substance (non-alcohol) dependence	6[a]	4.2 [1.5–11.4]	0.6 ($SE = 0.05$)[e]	7.0 (4.25)	-
Nicotine dependence	3[a]	56.4 [35.7–75.2]	12.8 ($SE =0.39$)[e]	4.6 (0.80)	-
	4[b]	60.1			
Cannabis use disorder	3[a]	11.5 [4.8–25.0]	1.5 ($SE = 0.08$)[f]	7.7 (3.46)	Mild dependence (0.329) Moderate to severe (0.479)[p]
Any mood disorder	10[a]	23.1 [14.9–34.0]	9.2 ($SE = 0.22$)[e]	3.3 (0.54)	-
	3[b]	37.9			
Major depressive disorder	17[a]	29.9 [20.5–41.3]	7.1 ($SE = 0.20$)[e]	3.7 (0.75)	Mild (0.145)[p] Moderate (0.396)[p] Severe (0.658)[p]
	6[b]	23.1			
Dysthymic disorder	3[a]	6.7 [4.8–9.2]	1.8 ($SE = 0.09$)[e]	3.7 (0.65)	0.33-0.38[q]
Bipolar disorder	10[a]	8.8 [4.4–17.1]	Mania 1.7 ($SE = 0.08$)[e]	5.5 (1.92)	Manic episode (0.492) Residual state (0.032)[p]
	6[b]	9.8			
Any anxiety disorder	10[a]	17.6 [10.8–27.3]	11.1 ($SE = 0.33$)[e]	2.5 (0.39)	Mild (0.030)[p] Moderate (0.133)[p] Severe (0.523)[p]
	3[b]	37.4			

Obsessive compulsive disorder (OCD)	7[a]	8.2 [3.4–18.6]	1.2 ($SE = 0.30$)[g]	6.8 (3.66)	0.12-0.60[q]
Panic disorder	6[a]	13.7 [6.7–26.0]	Without agoraphobia 1.5 ($SE = 0.07$)[e]	9.1 (3.31)	0.11-0.69[q]
Generalised anxiety disorder (GAD)	4[a]	14.4 [3.9–40.8]	2.1 ($SE = 0.10$)[e]	6.1 (4.49)	0.17-0.60[q]
	3[b]	11.1			
Post-traumatic stress disorder (PTSD)	4[a]	12.3 [3.4–35.7]	4.7 ($SE = 0.17$)[h]	2.6 (1.76)	0.11-0.51[q]
Social phobia	3[a]	14.9 [2.0–59.8]	2.8 ($SE = 0.13$)[e]	5.3 (5.27)	0.17-0.59[q]
Other disorders					
Intermittent explosive disorder	3[a]	4.6 [2.5–8.4]	3.9 ($SE = 0.30$)[i]	1.2 (0.40)	-
Kleptomania	3[a]	2.7 [1.2–5.9]	0.4 [0.1-1.0][j]	6.8 (4.90)	-
Psychotic disorder	5[a]	4.7 [3.4–6.5]	Psychosis 0.4 ($SE = 0.1$)[k]	11.8 (3.54)	Schizophrenia[p] Acute state (0.778) Residual state (0.588)
Somatoform disorder	5[a]	3.6 [1.6–8.0]	0.8 [0.3-1.4][l]	4.5 (2.58)	0.144[r]
Adjustment disorder	5[a]	9.2 [4.8–17.2]	0.3 [0.1-0.5][m]	30.7 (14.83)	-
ADHD	4[a]	9.3 [4.1–19.6]	4.4 ($SE = 0.6$)[n]	2.1 (0.94)	0.045[p]
Any personality disorder (PD)	9[c]	47.9 [29.8-66.7]	7.8 [6.1-9.5][o]	6.1 (1.39)	-
Any cluster A disorder	4[c]	6.1 [1.5-22.1]	3.8 [3.2-4.4][o]	1.6 (1.39)	-
Paranoid personality disorder	8[c]	10.1 [4.2-22.1]	2.3 [1.6-3.1][o]	4.4 (2.12)	-
Schizoid personality disorder	8[c]	6.0 [2.5-13.7]	1.1 [0.7-1.5][o]	5.5 (2.79)	-
Schizotypal personality disorder	7[c]	4.1 [0.8-19.4]	0.8 [0.5-1.1][o]	5.1 (6.01)	-
Any cluster B disorder	4[c]	17.6 [6.0-41.8]	2.8 [1.8-3.7][o]	6.3 (3.44)	-
Antisocial personality disorder	14[c]	14.0 [10.5-18.4]	1.4 [0.8-2.3][o]	15.3 (4.42)	-
	2[b]	28.8			
Borderline personality disorder	8[c]	13.1 [4.3-33.5]	1.8 [1.2-2.5][o]	7.3 (4.35)	0.193[r]
Histrionic personality disorder	7[c]	6.3 [1.0-30.4]	0.6 [0.4-0.9][o]	10.5 (12.7)	-
Narcissistic personality disorder	8[c]	16.6 [8.0-31.2]	1.9 [0.1-5.6][o]	8.7 (7.16)	-
Any cluster C disorder	4[c]	12.6 [4.8-29.1]	5.0 [4.2-5.9][o]	2.5 (1.26)	-
Avoidant personality disorder	6[c]	13.4 [5.9-27.5]	2.7 [1.9-3.7][o]	5.0 (2.21)	-
Dependent personality disorder	8[c]	6.0 [1.4-22.5]	0.8 [0.5-1.3][o]	7.5 (7.00)	-
Obsessive-compulsive personality disorder	6[c]	13.4 [5.9-27.5]	3.2 [2.4-4.1][o]	4.2 (1.81)	-

Table 2.3 highlights elevated rates for <u>all</u> disorders among problem (including pathological) gamblers compared to the general population. These disorders vary greatly in terms of their base-rate in the general population, and in terms of the increased risk of gamblers to have the disorder. Problem gamblers are almost four times more likely to have a comorbid mental disorder (Axis-I).

Problem gamblers are almost eight times more likely to also be experiencing alcohol or drug use disorders compared to the general population. The rate for alcohol use disorders is almost three times higher among problem gamblers, and six times higher for a drug use disorder. More specifically nicotine dependence (4.6*x*) and cannabis use disorder (7.7*x*) were significantly elevated among problem gamblers.

Mood disorders are over three times more common among problem gamblers. Problem gamblers are almost four times more likely to have co-occurring major depressive disorder or dysthymic disorder, and five times more likely for bipolar disorder.

Anxiety disorders are two and a half times more common among problem gamblers than in the general population. More specifically, panic disorder, obsessive compulsive disorder, and generalised anxiety disorder, are *each* over six times common among problem gamblers.

Problem gamblers are six times more likely to be diagnosed with a co-occurring personality disorder. While problem gamblers were at higher risk for all types of personality disorder, Cluster B disorders were particularly elevated (6.3*x*); with anti-social personality disorder (15.3*x*) and histrionic personality disorder (10.5*x*) being particularly prevalent among problem gamblers.

2.5.2.1 Limitations

The information presented in Table 2.3 was obtained from a range of sources and in this task we were limited to the research available. The following points should be taken into account when interpreting the findings.

The studies examining rates of comorbidities among gambling populations across three meta-analyses (Dowling et al., 2015a, 2015b; Lorains et al., 2011) were largely from Western countries (particularly the US) and lacked broader cultural/geographical representation. To offset this limitation, where possible, we sourced community prevalence rates for comparison from similar countries.

Meta-analyses by virtue of combining estimates from a range of studies include a range of biases. Thus, the reported prevalence rates may be heterogeneous as a result of methodological differences such as sampling and use of diagnostic tools (see Dowling et al. 2015a, 2015b, and Lorains et al. 2011 for more details).

Estimates of comorbid condition prevalence vary in terms of whether they were derived from treatment-seeking problem gamblers (Dowling et al., 2015a, 2015b) or general population screens for problem gambling (Lorains et al., 2011). Given that treatment-seekers are likely to be on the most

severe end of the spectrum, estimates of prevalence and relative risk are likely to be relatively larger for the former group. Likewise, the degree of relative risk can be assumed to be proportionately lower among low-risk and moderate-risk gamblers.

Our calculation of relative risk required sourcing the community prevalence for disorders. Given community prevalence rates presumably include problem gamblers, the RR may be slightly underestimated, due to problem gamblers forming part of the broader population. Furthermore, the rates of some disorders in the general community were not able to be sourced. For example, to our knowledge there are no reliable population estimates for kleptomania. Thus, we used estimates for kleptomania derived from a single sample of 791 college students.

Notwithstanding the above limitations, this collation of evidence provides a useful overview of which disorders are most strongly comorbid with gambling, along with population base rates and disability weight estimates where possible. Although the rate of mental health and substance use conditions is generally higher among problem gamblers, alcohol/substance use disorders, mood disorders, anxiety disorders, and personality disorders have the strongest degree of association. In a multivariate evaluation of the instrumental role of gambling in driving changes in health and wellbeing, it is not practical nor necessary to include every possible co-morbid health condition. Rather, it is desirable to include the more severe and more prevalent conditions, that demonstrate strong non-independent comorbidity with gambling problems.

2.6 Conclusions

We have argued that gambling harm is best understood as a decrement to health and wellbeing. It follows that epidemiological tools designed to assess the impact of conditions on health have direct application to gambling, just as they do for similar addictive and behavioural problems. Two major studies in Australia and New Zealand have adopted a direct approach to assess the impact of gambling. This approach can be complemented by an indirect approach, that relies on self-reported HSVs, avoids potential biases in self-attribution of the impact of gambling, and takes into account comorbid health conditions. Both approaches have been employed successfully in the epidemiological literature on evaluating other addictive behaviours and mental health conditions, leading to their inclusion in frameworks for estimating their global burden on health. Unlike alcohol, substance, or intimate partner abuse, gambling problems are not yet included in frameworks such as the GBD. Arguably, this omission perpetuates a policy environment in which the benefits of gambling as a source of revenue to government are readily apparent, whilst the true public health impact of this behaviour remains largely invisible (Wardle et al., 2019; van Schalkwyk et al., 2019).

Given that the field of gambling studies has embraced a public health approach for some decades now, the lack of progress in aligning the evaluation of the impacts of gambling with other risky health related behaviours is both striking and disappointing. The present review has provided a primer on epidemiological evaluation frameworks in terms of their potential application to gambling and outlined the case for supplementing prior efforts at direct elicitation with an indirect elicitation framework. We have summarised the state of knowledge regarding risk factors that determine propensity for the development of gambling harm, as well as comorbid conditions. This information is necessary for implementation of indirect elicitation of the health impacts of gambling-related harm. It is intended as a resource for research teams planning to evaluate gambling using counterfactual logic, using matched sampling propensity weighting, while also accounting for comorbid disorders. Our view is that present information on both sets of covariates is more than sufficient for indirect elicitation of the

relationship between problematic gambling behaviour and health. Future research should focus on implementing this framework, thereby facilitating the integration of gambling within the GBD and similar public health assessment frameworks.

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Chapter 3. Benchmarking gambling screens to health-state utility: The PGSI and the SGHS estimate similar levels of population gambling-harm

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3.1 Introduction

How bad is it to have gambling problems or to experience gambling-related harm? Much gambling research rests on the use of population screens to measure these phenomena (Browne et al., 2021). These screens yield categories, such as low-risk, moderate-risk or problem gambler (LR, MR, PG) on the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001), or scores: 0-10, in the case of the Short Gambling Harms Screen (SGHS; Browne et al., 2017). However, there is controversy as to what these measures indicate in terms of negative impact actually experienced by the self-reporting gambler (Delfabbro & King, 2017, 2019). Are LR or MR gamblers genuinely impacted, or are they merely *at-risk* of meaningful impact? Likewise, are low (e.g., 1-2) scores on the SGHS truly indicative of meaningful harm, or might they merely reflect rational opportunity costs (Delfabbro & King, 2017)? These basic questions have large ramifications, not only for how these screens should be interpreted at an individual level, but also regarding their use in capturing the distribution and extent of impacts from gambling in populations, and the targeting of policy interventions for harm reduction (Canale et al., 2016; Costes, 2019; Livingstone & Woolley, 2007; Wardle et al., 2019).

In their summary of the evolution of population assessment of gambling impacts, Browne et al. (2021) argue that scales for harm must be assessed with regard to external benchmarks. There has been detailed enumeration of the population prevalence of specific gambling-related harms, such as having sold personal items due to gambling (Browne & Rockloff, 2018; Browne et al., 2020b; Rockloff et al., 2020). However, these do not, except in a qualitative or implied sense, address the question of how subjectively *bad it is* to experience these consequences. Some limited work has been done to further this goal. Blackman et al. (2019) found monotonic decrements in subjective wellbeing across the three PGSI risk categories, relative to non-problem gamblers (NPGs). Similarly, Hilbrecht and Mock (2019) found lower levels in several facets of quality of life for LR and MR gamblers relative to NPG on the PGSI. Similarly, the SGHS was validated against the Personal Wellbeing Index (PWI), showing

a monotonic and approximately linear correlation, with lower PWI scores associated with higher SGHS scores (Browne et al., 2017a). Most recently, relatively low scores of 1-2 on the SGHS were shown to be associated with significant higher psychological distress (Kessler) and lower wellbeing (PWI), compared to those who scored 0 (Murray-Boyle et al., in press).

Prior work demonstrates that gambling screens are associated with external measures that imply impacts to global health and wellbeing (Blackman et al., 2019; Hilbrecht et al., 2019). However, in some sense, these results simply kick the can further down the road, begging the question of which external metrics are most relevant, and how decrements on these benchmarks should themselves be interpreted. Recently, a case has been made for the central role of *health utility* as the key yardstick for scoring gambling screens (Browne et al., 2020a). In that paper, an approach was outlined for employing global health utility instruments to assess gambling. We will briefly reprise this rationale, which will be applied in this study.

3.1.1 Health utility as a benchmark for gambling impact

There is general agreement that impact from gambling is best understood as "*a decrement to the health or wellbeing of an individual…*" (Langham et al., 2016). The public health / health economic framework of health utility (Payakachat et al., 2009) operationalises this concept – since gambling harm is understood as a decrease to a person's health-related quality of life. A drop in health and wellbeing is an anti-hedonic outcome that is, by definition, something that an individual would prefer to avoid. Crucially, and unlike other candidate benchmarks, health utility is measured on a metric scale, where a score of 1 corresponds to optimal health, and a score of 0 corresponds to a health state judged to be not worth living, or equivalent to death (Weinstein & Stason, 1977). Making the democratic assumption that every individual's utility is equally important, then optimal population health can be effected by maximising the integral over the lifespan and over people.

These attractive theoretical properties justify the central role of health utility across many disciplines concerned with public health. However, estimating or eliciting the typical decrement associated with a condition (e.g, alcohol abuse or problem gambling) is less straight-forward. Protocols such as the Time Trade Off, the Standard Gamble or the Visual Analogue Scale are used to elicit *preference-based utilities*, based on providing raters with some stimuli that describe the experience of the condition. Also known (somewhat confusingly) as direct elicitation paradigms, they rely on the ability of respondents to accurately imagine the experience of the condition, and to judge a relative preference for hypothetical scenarios with- and without the condition. As delineated elsewhere (Dolan & Kahneman, 2008; Neumann et al., 2000; Solberg et al., 2020), there are inherent biases and limitations to these procedures. Nevertheless, when combined with rank-ordering methods between conditions, and accounting for co-morbidities, these methods have been used to great effect to assess the relative contribution of conditions in the Global Burden of Disease framework, and specifically for mental and addictive disorders (Rehm & Shield, 2019). Direct elicitation methods have also been applied to assess utility weights for PGSI categories (Browne, 2019; Browne et al., 2017b, 2017c, Rawat et al., 2018), finding preference weights for gambling that are similar to those for mild, moderate and severe alcohol misuse. However, there are challenges to preference-based utilities, such that (1) assessors may struggle to imagine the net effect of living with a given degree of gambling problems, (2) there may be framing effects associated with popular conceptions of problem gambling, and (3) the decrement may be anchored to a counterfactual that assumes an ideal state of health and wellbeing (i.e., 1) that is unlikely to be realistic for most respondents (i.e., few people are in a perfect state of mental and physical health).

Dolan and Kahneman (2008) provide arguments in favour of *experienced utility* as opposed to decision or preference-based utility to assess the impact of a condition. In this framework, persons with and without the condition (i.e., some degree of gambling problems or harms) are asked about their own experienced quality of life. After weighting and/or case matching with controls, and controlling for major co-morbidities, the relative difference in self-reported health is attributed to the condition. However, given an observed decrement, this procedure presents its own challenges in attributing causality to the condition. First, the study should approximate an experimental random assignment, such that individuals in both groups have the same *propensity* to experience gambling problems or harms. This is important to reduce confounding, because the risk factors that lead some individuals to have a propensity for gambling problems may also contribute to a lower health status due to other sources of harm. Second, when estimating the direct effect of a gambling-related condition on health utility, known co-morbid conditions that might also affect the outcome should be controlled for (Garrido et al., 2014; Mendex et al., 2011). This control is a second way to avoid attributing the impact of co-occurring conditions to the gambling, rather than to co-occurring conditions. Thus, unlike other attempts to estimate health utility impacts from gambling screens (Moayeri, 2020), this framework includes both propensity and causal modelling components, and requires identification of relevant risk-factors and co-morbid conditions. We again refer the reader to Browne et al. (2020a) for a more detailed overview and rationale for this framework as applied to gambling-related harm, as well as a review of relevant risk-factors and comorbidities for gambling problems.

3.1.2 Aims

The present study attempts to implement an indirect elicitation approach to estimate the health utility impacts for any gambling screen. Our objective was to estimate metric (0,1) health utility weights for two common population screens for gambling impact: the SGHS and the PGSI using an experienced utility / propensity score weighting approach. The SGHS measures gambling harm whereas the PGSI measures problem gambling, although these constructs are highly correlated, and both are expected to be related to reductions in wellbeing.

3.2 Method

Our analysis was based on a comparison of health utility scores between unharmed / non-problem gamblers, for the SGHS and PGSI, respectively, who had participated in gambling at least once in the last year (hereafter, the *control* group) and those experiencing some degree of harm or problems (hereafter, the *affected* group). It is important to note that the control group for the SGHS and PGSI analyses were slightly different, as some respondents may have scored 0 on the SGHS and therefore been in the control group for SGHS-based analyses, but scored more than 0 on the PGSI and therefore been in the affected group for PGSI-based analyses. Sampling was stratified with respect to group, age and gender. Cases were propensity weighted based on key risk factors, and regression-estimated coefficients were estimated with control variables for gambling comorbidities. Similar analyses were run using the PGSI and the SGHS to define the reference (score 0) and affected (score 1+) groups. Categorical, linear and non-linear utility functions of 1+ scores were compared.

3.2.1 Participants

Australian participants aged 18+ were recruited from a commercial panel provider during late 2020 and early 2021 as part of a broader project to study gamblers, non-gamblers, and 'concerned significant others'. The commercial panel has their network of respondents who have signed up to take part in research opportunities. The panel invited respondents through email and all data was collected online. As compensation, participants received points which could be exchanged for rewards as per the panel's internal points-accumulation system.

All eligible participants were required to be Australian residents, aged 18 years or above, provide consent to participate in the study, and to have gambled[1] in the past 12 months. Residents of the state of Victoria were excluded due to Covid-19 lockdown at the time of sampling. Using soft-quotas, we attempted to sample approximately equal groups with respect to age (18-29, 30-44, 45+) and gender with respect to control / affected group status. A total of 22,699 started the survey, however 16,061 were screened out for the following reasons: 5848 did not meet the residency or age criteria, 5922 provided incomplete responses, 441 provided poor quality data (such as straight lining through the survey), and 3850 were excluded due to quotas being full. A total of 6638 responses were retained, of which 2603 were gamblers and formed part of the present analysis, with 1193 (45.8%) scoring zero on *both* population screens. Table 3.1 provides the demographic characteristics for gamblers and figures are presented separately for gamblers who scored zero and 1+ on *each* screen. For the SGHS 1546 gamblers (59 per cent) scored 0 and 1057 (41 per cent) scored 1+, and for the PGSI 1331 (51 per cent) scored 0 and 1272 (49 per cent) scored 1+. The most common forms gambled on included lotteries (82.1 per cent of sample), electronic gaming machines (65.3 per cent), scratch tickets (64.0 per cent), race betting (63.8 per cent), raffle tickets / competitions (62.9 per cent), sports betting (43.6 per cent), and Keno (41.3 per cent). Less than one-third of participants gambled on all other forms (casino table games, informal private betting, prize draws, bingo, eSports, fantasy sports, and 'other').

Table 3.1. Descriptive statistics for the sample of gamblers, by SGHS and PGSI reference and affected groups

Variable	Reference		Affected	
	SGHS 0 n (%)	PGSI 0 n (%)	SGHS 1+ n (%)	PGSI 1+ n (%)
Total	**1546 (100)**	**1331 (100)**	**1057 (100)**	**1272 (100)**
Gender				
Male	880 (56.9)	758 (56.9)	613 (58.0)	735 (57.8)
Female	665 (43.0)	572 (43.0)	443 (41.9)	536 (42.1)
Other	1 (0.1)	1 (0.1)	1 (0.1)	1 (0.1)
Mean age (SD [years])	51.16 (17.48)	52.14 (17.13)	42.15 (16.03)	42.65 (16.48)
Country of birth				
Australia	1232 (79.7)	1068 (80.2)	845 (79.9)	1009 (79.3)
Other	314 (20.3)	263 (19.8)	212 (20.1)	263 (20.7)
Main language spoken at home				
English	1497 (96.8)	1296 (97.4)	991 (93.8)	1192 (93.7)
Other	49 (3.2)	35 (2.6)	66 (6.2)	80 (6.3)
Aboriginal or Torres Strait Islander origin				
No	1463 (94.6)	1266 (95.1)	958 (90.6)	1155 (90.8)
Yes	83 (5.4)	65 (4.9)	99 (9.4)	117 (9.2)

[1] Gambling included participating in at least one of the follow activities within the past 12 months: race betting, electronic gaming machines (pokies), casino table games, sports betting, informal private betting for money, Keno, bingo, esports betting, and fantasy sports betting.

State/Territory of residence				
New South Wales	652 (42.2)	564 (42.4)	526 (49.8)	614 (48.3)
Queensland	452 (29.2)	395 (29.7)	258 (24.4)	315 (24.8)
South Australia	196 (12.7)	164 (12.3)	119 (11.3)	151 (11.9)
Tasmania	56 (3.6)	47 (3.5)	29 (2.7)	38 (3.0)
Northern Territory	8 (0.5)	7 (0.5)	5 (0.5)	6 (0.5)
Australian Capital Territory	31 (2.0)	31 (2.3)	22 (2.1)	22 (1.7)
Western Australia	151 (9.8)	123 (9.2)	98 (9.3)	126 (9.9)
Highest educational qualification				
No schooling	-	-	-	-
Did not complete primary school	6 (0.4)	4 (0.3)	-	2 (0.2)
Completed primary school	24 (1.6)	19 (1.4)	10 (0.9)	15 (1.2)
Year 10 or equivalent	163 (10.5)	146 (11.0)	87 (8.2)	104 (8.2)
Year 11 or equivalent	41 (2.7)	33 (2.5)	19 (1.8)	27 (2.1)
Year 12 or equivalent	235 (15.2)	186 (14.0)	159 (15.0)	208 (16.4)
A trade, technical certificate or diploma	489 (31.6)	430 (32.3)	251 (23.7)	310 (24.4)
A university or college degree	421 (27.2)	375 (28.2)	372 (35.2)	418 (32.9)
Postgraduate qualifications	167 (10.8)	138 (10.4)	159 (15.0)	188 (14.8)
Work status				
Work full-time	585 (37.8)	496 (37.3)	566 (53.5)	655 (51.5)
Work part-time or casual	256 (16.6)	217 (16.3)	182 (17.2)	221 (17.4)
Full-time student	27 (1.7)	22 (1.7)	34 (3.2)	39 (3.1)
Unemployed and looking for work	69 (4.5)	64 (4.8)	61 (5.8)	66 (5.2)
Full-time home duties	102 (6.6)	89 (6.7)	44 (4.2)	57 (4.5)
Retired	447 (28.9)	392 (29.5)	132 (12.5)	187 (14.7)
Sick or on a disability pension	41 (2.7)	32 (2.4)	26 (2.5)	35 (2.8)
Other	19 (1.2)	19 (1.4)	12 (1.1)	12 (0.9)
Occupation				
Manager	287 (18.6)	240 (18.0)	252 (23.8)	299 (23.5)
Professional	375 (24.3)	327 (24.6)	259 (24.5)	307 (24.1)
Technician or trade worker	114 (7.4)	99 (7.4)	79 (7.5)	94 (7.4)
Community or personal service worker	90 (5.8)	79 (5.9)	69 (6.5)	80 (6.3)
Clerical or administrative worker	268 (17.3)	240 (18.0)	138 (13.1)	166 (13.1)
Sales worker	123 (8.0)	113 (8.5)	104 (9.8)	114 (9.0)
Machinery operator and driver	58 (3.8)	50 (3.8)	20 (1.9)	28 (2.2)
Labourer	139 (9.0)	106 (8.0)	101 (9.6)	134 (10.5)
Small business operator	92 (6.0)	77 (5.8)	35 (3.3)	50 (3.9)
Marital status				
Single or never married	327 (21.2)	269 (20.2)	298 (28.2)	356 (28.0)
Separated or divorced	135 (8.7)	128 (9.6)	74 (7.0)	81 (6.4)
Widowed	54 (3.5)	49 (3.7)	17 (1.6)	22 (1.7)
Married or living with partner (de facto)	1030 (66.6)	885 (66.5)	668 (63.2)	813 (63.9)
Household composition				
Single person	351 (22.7)	308 (23.1)	249 (23.6)	292 (23.0)
One parent family with children	77 (5)	71 (5.3)	74 (7.0)	80 (6.3)
Couple with children	520 (33.6)	426 (32.0)	408 (38.6)	502 (39.5)
Couple with no children	525 (34.0)	469 (35.2)	266 (25.2)	322 (25.3)
Group household (i.e. living with two or more people to whom you are NOT related)	73 (4.7)	57 (4.3)	60 (5.7)	76 (6.0)
Annual personal income				
$0 to $19,999	244 (15.8)	217 (16.3)	137 (13.0)	164 (12.9)
$20,000 to $39,999	402 (26.0)	348 (26.1)	200 (18.9)	254 (20.0)
$40,000 to $59,999	233 (15.1)	202 (15.2)	188 (17.8)	219 (17.2)
$60,000 to $79,999	238 (15.4)	192 (14.4)	161 (15.2)	207 (16.3)
$80,000 to $99,999	160 (10.3)	132 (9.9)	113 (10.7)	141 (11.1)
$100,000 to $119,999	102 (6.6)	97 (7.3)	99 (9.4)	104 (8.2)
$120,000 to $139,999	60 (3.9)	52 (3.9)	58 (5.5)	66 (5.2)
$140,000 to $159,999	39 (2.5)	38 (2.9)	46 (4.4)	47 (3.7)
$160,000 to $179,000	24 (1.6)	15 (1.1)	18 (1.7)	27 (2.1)
$180,000 or more	44 (2.8)	38 (2.9)	37 (3.5)	43 (3.4)
Annual household income				
$0 to $19,999	70 (4.5)	56 (4.2)	48 (4.5)	62 (4.9)
$20,000 to $39,999	287 (18.6)	255 (19.2)	145 (13.7)	177 (13.9)
$40,000 to $59,999	226 (14.6)	209 (15.7)	156 (14.8)	173 (13.6)
$60,000 to $79,999	214 (13.8)	166 (12.5)	137 (13.0)	185 (14.5)
$80,000 to $99,999	166 (10.7)	152 (11.4)	136 (12.9)	150 (11.8)

$100,000 to $119,999	149 (9.6)	125 (9.4)	133 (12.6)	157 (12.3)
$120,000 to $139,999	103 (6.7)	91 (6.8)	89 (8.4)	101 (7.9)
$140,000 to $159,999	127 (8.2)	102 (7.7)	84 (7.9)	109 (8.6)
$160,000 to $179,000	47 (3.0)	45 (3.4)	38 (3.6)	40 (3.1)
$180,000 or more	157 (10.2)	130 (9.8)	91 (8.6)	118 (9.3)
Residence				
Capital city and surrounds	1003 (64.9)	864 (64.9)	766 (72.5)	905 (71.1)
Regional town with more than 10,000 persons	396 (25.6)	341 (25.6)	223 (21.1)	278 (21.9)
A rural or remote location	147 (9.5)	126 (9.5)	68 (6.4)	89 (7.0)

Note: PGSI and SGHS are highly correlated indicators, treated in parallel in subsequent analyses.

3.2.2 Measures

All participants completed the following measures. Problem gambling status was assessed using the PGSI. The PGSI uses nine items (e.g. have you bet more than you could really afford to lose?) with each item measured on a four-point scale (from 0 = never to 3 = almost always). Total scores are summed and risk categories are yielded (non-problem 0, LR 1-2, MR 3-7, PG 8+) (Ferris & Wynne, 2001). Reliability for the PGSI was high in the current sample ($\alpha = 0.95$)

Gambling harm was assessed using the SGHS. The SGHS comprises 10-items (e.g. had regrets that made me feel sorry about my gambling) each measured in a binary no/yes format. The SGHS captures financial, emotional/psychological, and relationship harms due to gambling and yields scores 0-10 (Browne et al., 2017a) however the screen does not specify categories. Nonetheless, recent research assessing the SGHS using the Personal Wellbeing Index suggests that cut-offs of 1-2, 3-5, 6+ provide a reasonable categorisation of differing degrees of harm (Murray-Boyle et al., in press). Reliability for the SGHS was high in the current sample ($\alpha = 0.90$)

We measured health utility using the SF-6D (see Brazier et al. 2004 for a detailed description). The SF-6D is a preference-based measure derived from the SF-12 item self-report measure (Burdine et al., 2000). It captures physical functioning, role limitations, social functioning, pain, mental health, and vitality, and yields health utility coefficients between 0.345 to 1.000 (Hunger et al., 2011).

Demographic characteristics identified as risk factors for gambling problems and harms (Browne et al., 2020a) were considered for inclusion in the propensity model: gender, country of birth, personal and parent's highest level of education achieved, selected work status flags (FT student, unemployed, being unable to work due to infirmity, labourer), marital status, household composition (e.g. single, couple with children), personal and household income, and metropolitan/regional/rural residential location. Psychological risk factors such as cognitive style or rash impulsivity were measured but excluded due to potential endogeneity, particularly with respect to gambling problems when considered as a mental health condition.

The following key co-morbidities that affect health were also measured: excessive alcohol consumption (AUDIT-C) (Reinert & Allen, 2002), any recreational drug use, cigarette smoking frequency (single-item measures), and ever having been diagnosed with a mood disorder, anxiety disorder, personality disorder, or any other mental health disorder (separate binary indicators). The AUDIT-C is a three-item measure of hazardous drinking (e.g. how often do you have six or more standard drinks on one occasion) with each item measured on a five-point scale. Reliability for the AUDIT-C in the current sample was ($\alpha = 0.67$)

3.2.3 Statistical analysis

The R statistical programming environment was used for all analyses. The analyses took a multi-step approach, and all analyses were conducted for SGHS as well as PGSI. Because SGHS and PGSI are correlated, there is significant overlap between the affected and control groups for the two measures. The first step was to determine the required weights for the propensity score matching, which was based on initial logistic regressions predicting SGHS or PGSI (0 vs 1+; "Propensity" models in Table 3.2). Based on these regression results, propensity score weights were used in subsequent analyses predicting SF-6D scores using SGHS (and PGSI separately) as independent variables. Known risk factors were included as covariates ("Causal" models in Table 3.2). A final set of OLS regression models was run predicting SF-6D using SGHS (and PGSI separately) as independent variables, but without the risk factors as covariates, to determine the effect of the covariates on the estimated decrements.

The working for the weights in the causal models is based on the binomial logistic regression predicting harm (SGHS = 1+) compared to not experiencing harm (SGHS = 0), or the equivalent for PGSI (0 vs 1+). The predictors in the models were known risk factors for experiencing gambling harm or problems and were chosen for each model based on backwards stepwise elimination using the Akaike Information Criteria, to avoid redundancy and multicollinearity. The models for SGHS and PGSI therefore had slightly different predictors to each other. While stepwise variable elimination has limitations for interpreting covariates, they do not apply in this case because our objective was not to interpret these covariate effects, but to achieve statistical control.

From the logistic regressions, predicted probability of harm (or problems) was derived for each individual and then cases in each group (affected vs control) were inversely weighted with respect to these group propensities based on the standard propensity weighting method:

$$\text{if(affected)}: \frac{1}{\hat{P}(\text{affected})}$$
$$\text{if(control)}: \frac{1}{1 - \hat{P}(\text{affected})}$$

This weighting acts to remove some potential selection bias from confounders in estimating the direct effect of gambling harm on health. This is because people with different demographic and other characteristics differ in their propensity to experiencing harm or problems from gambling, and these same risk factors can also contribute directly to lower wellbeing. For example, from Table 3.2, younger people in the present study were more likely to experience some degree of harm. The propensity weighting balances the groups of who were *actually* affected / unaffected, with respect to their *propensity* for being affected by gambling harms or problems. For example, looking at Table 3.1, affected gamblers were more likely to be younger compared to controls. The process "weights down" younger respondents in the affected group, and "weights up" younger respondents in the control group, balancing the groups with respect to this particular risk factor. One issue with propensity weighting is that excessively large or small weights can lead to outside case influence. However, skew and outliers of weights were moderate (median ~1.8, mean ~2, max ~ 6), so no thresholding of excessively large weights was required.

In a supplementary analysis, shown in Table 3.3, the empirically derived estimates were applied to population estimates of SGHS and PGSI score prevalence using a recent Victorian prevalence dataset (Rockloff et al., 2020), in order to estimate population aggregate impact. Finally, a standard Pearson correlation matrix was calculated for descriptive purposes (available at https://static-

content.springer.com/esm/art%3A10.1186%2Fs12889-022-13243-4/MediaObjects/12889_2022_13243_MOESM1_ESM.docx).

3.2.4 Ethics

Ethical approval for this study was received from the CQU Human Research Ethics Committee (#22341) and all methods were performed in accordance with the relevant guidelines and regulations. Participants provided informed consent before participating.

3.3 Results

The mean SF-6D health utility score for the entire sample was .769, which was similar to the mean of .763 from the 2009/2019 wave of the Household, Income and Labour Dynamics in Australia (HILDA) survey (n=17,630) (Norman et al., 2013).

Table 3.2 provides model summaries for the propensity (columns 1-2) and causal (columns 3-4) components of SF-6D for the SGHS and the PGSI.

Table 3.2. Model summaries and beta coefficients for propensity and causal models of health utility scores

Model		Beta coefficients (SE)					
		Propensity		Causal		Causal (no covariates)	
DV		SGHS (0 vs 1+)	PGSI (0 vs 1+)	SF-6D	SF-6D	SF-6D	SF-6D
Regression type		Logistic	Logistic	OLS	OLS	OLS	OLS
DV		SGHS	PGSI	SGHS	PGSI	SGHS	PGSI
Constant		2.042***	2.435***	0.836***	0.832***	0.803***	0.804***
		(0.257)	(0.235)	(0.009)	(0.009)	(0.004)	(0.004)
Gambling harms (SGHS)	(0) None (n = 1546)			-		-	
	(1-2) Low (n = 370)			-0.020**		-0.022**	
				(0.006)		(0.007)	
	(3-5) Moderate (n=368)			-0.062***		-0.075***	
				(0.007)		(0.007)	
	(6-10) High (n = 319)			-0.109***		-0.153***	
				(0.007)		(0.008)	
Gambling problems (PGSI)	(0) Non-problem NP (n=1331)				-		-
	(1,2) Low risk LR (n=399)				-0.005		-0.007
					(0.006)		(0.007)
	(3-7) Moderate risk MR (n=438)				-0.051***		-0.066***
					(0.006)		(0.007)
	(8+) Problems PG (n=435)				-0.099***		-0.137***
					(0.007)		(0.007)
Alcohol consumption (AUDIT-C)	Non-drinker			-	-		
	(0-3) Non-risky			0.008*	0.011*		
				(0.007)	(0.008)		
	(4+) Risky			0.007	0.011		
				(0.007)	(0.007)		
Age (polynomial)	Linear (1)	-0.034***	-0.037***	0.278*	0.111		
		(0.003)	(0.003)	(0.124)	(0.123)		
	Quadratic (2)			-0.251	-0.365**		
				(0.118)	(0.116)		
	Cubic (3)			-0.235	-0.246*		
				(0.116)	(0.113)		
Gender	Male	-	-	-	-		
	Female	-0.160	-0.251	-0.016***	-0.019***		
		(0.107)	(0.090)	(0.005)	(0.005)		
Country of birth	Overseas	-	-	-	-		
	Australia	-0.164	-0.264*	-0.015*	-0.008		
		(0.107)	(0.105)	(0.006)	(0.006)		
Education	Secondary or less	-	-				
	Trade/Cert	-0.091	-0.227*				

		(1)	(2)	(3)	(4)	(5)	(6)
		(0.114)	(0.111)				
	Tertiary	0.212	-0.110				
		(0.120)	(0.119)				
	Postgrad	0.344*	0.200				
		(0.153)	(0.154)				
Unemployed (ref = no)			-0.284				
			(0.195)				
Personal income		0.111***	0.079**				
		(0.029)	(0.029)				
Household income		-0.128***	-0.095***				
		(0.025)	(0.024)				
Mother's highest education achieved		-0.063***					
		(0.019)					
Sick or on a disability pension (ref = no)				-0.126***	-0.133***		
				(0.015)	(0.015)		
Recreational drug use (ref = no)				-0.020*	-0.015		
				(0.008)	(0.008)		
Cigarettes consumed per day	Non-smoker (0)			-	-		
	< 10			-0.014*	-0.019**		
				(0.007)	(0.007)		
	10+			-0.010	-0.018*		
				(0.007)	(0.007)		
Past year diagnosis of … (ref = no)	Mood disorder			-0.049***	-0.053***		
				(0.009)	(0.009)		
	Anxiety disorder			-0.066***	-0.071***		
				(0.007)	(0.007)		
	Personality disorder			-0.017	-0.023		
				(0.013)	(0.013)		
	Any other psych. disorder			-0.037**	-0.027*		
				(0.012)	(0.012)		
	Observations	2,603	2,603	2,603	2,603	2,603	2,603
	Adjusted R2			0.292	0.288	0.148	0.132
	Residual Std. Error			0.165	0.163	0.181	0.181
	Model df			18, 2584	18, 2584	3, 2599	3,2599
	F			60.693***	59.427***	151.3***	132.9***

Notes: Propensity models are unweighted. Case weights for the causal models (both with and without covariates) calculated from estimated probabilities from the propensity models; *$p<0.05$; **$p<0.01$, ***$p<0.001$

With reference to the propensity model summarised in the first two columns of Table 3.2, for both screens, affected gamblers were significantly more likely to be younger, have a higher personal income, but lower household income. Those people scoring 1+ on the PGSI were less likely to have a trade/certificate level education than controls, while those scoring 1+ on the SGHS were more likely to have a postgraduate qualification than controls. Figure 3.1 illustrates how differential weighting of the affected group and comparison group compensates for selection effects determined by the propensity model. Figure 3.1 (panels A, C) shows a histogram of the predicted probability of being in the affected group (versus controls) for the PGSI and SGHS respectively, and the corresponding weights (panels B, D). The most important control covariates were comorbidities: having an anxiety or mood disorder (approximate -.05 to -.07 decrement to health utility) and being sick or on a disability pension (approximately -.13 decrement).
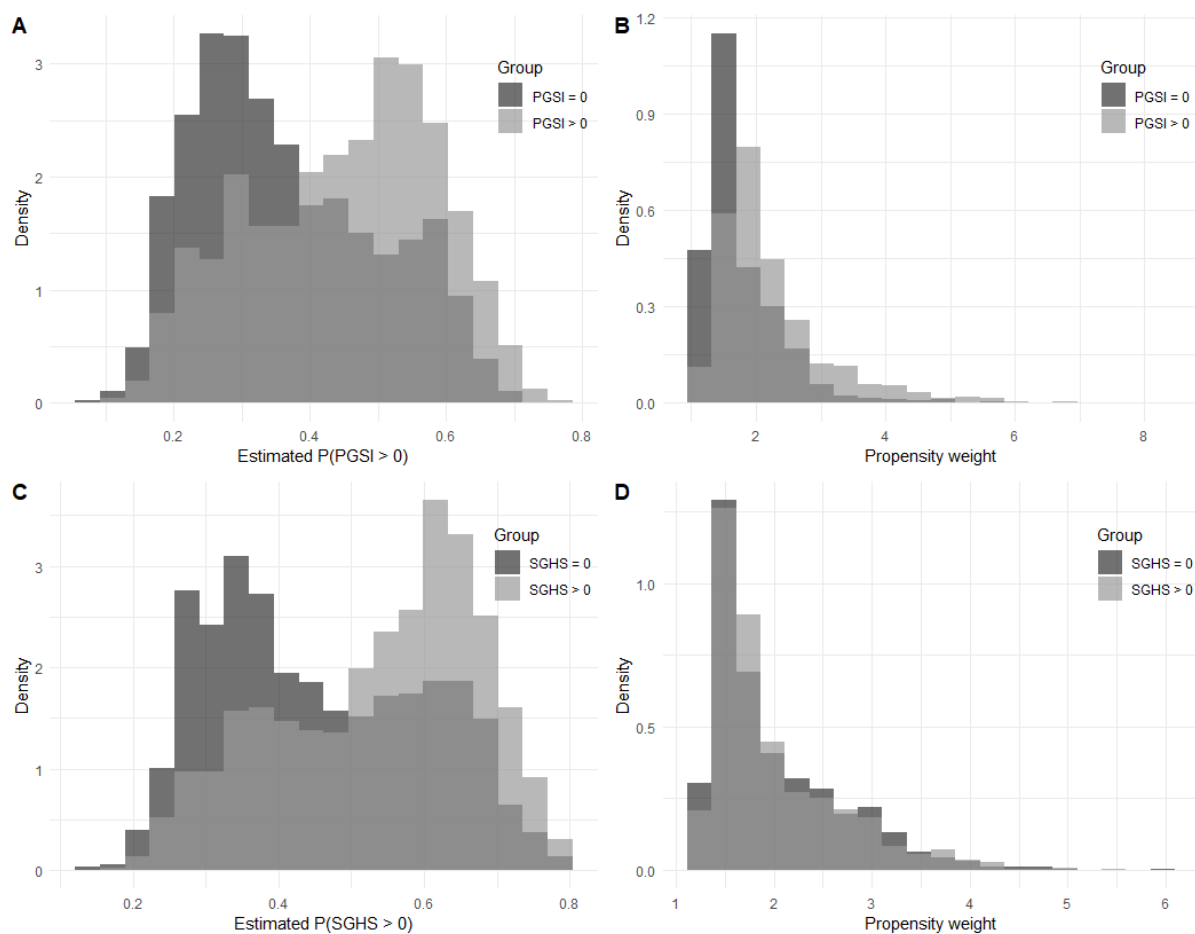
Figure 3.1. Distribution of the estimated probability of being in the affected group, for PGSI (A) and SGHS (C), and associated derived propensity weights used in the causal model (B,D)

Note: The medium grey is simply overlap between the two distributions

SGHS and PGSI causal models both accounted for about 29 per cent of variability in health utility. Causal effects for Low (1-2), moderate (3-5) and high (6-10) degrees of gambling harm (SGHS) were all significant, and estimated as -.020, -.062 and -.109, respectively. Causal effects for LR, MR and PGs (PGSI) were -.005, -.051 and -.099, respectively. Only the effects for MR and PG were significant

decrements. To check for the influence of covariates, we re-ran the analyses without any covariates. We found the same pattern of significant / non-significant effects for SGHS and PGSI categories and only slightly larger magnitude decrement weights, with 13.2 per cent of variance in SF-6D scores explained by the PGSI alone, and 14.8 per cent explained by the SGHS.

Table 3.3 combines these per-person utility decrements with prevalence estimates from a recent population survey in Victoria, Australia to yield a basic calculation of population aggregate impact. It is important to note that because the prevalence of LR and low-harmed individuals is much higher than more severe categories, uncertainty associated with aggregate impact is more pronounced for this group.

Table 3.3. Burden of harm estimates by PGSI and SGHS categories

	Category	Prevalence in Victorian gamblers	SF-6D utility weight (Current study, comorbidity controlled)	SF-6D utility weight (Moayeri, 2020)	Aggregate impact (DALYs)	Implied proportion of total population impact
PGSI	LR (1-2)	9.7%	-.005 *ns*	-.030	2874	14.6%
	MR (3-7)	3.5%	-.051*	-.057*	10372	52.6%
	PG (8+)	1.1%	-.099*	-.181*	6454	32.8%
TOTAL		**14.3%**			**19700**	**100%**
SGHS	Low (1-2)	7.1%	-.020*	-	8416	42.2%
	Moderate (3-5)	1.6%	-.061*	-	5784	29.0%
	High (6-10)	0.9%	-.108*	-	5761	28.8%
TOTAL		**9.6%**			**19961**	**100%**

Note: * $p < 0.01$ (or lower threshold) Weights from Moayeri (2020) provided for comparison only, and not used for subsequent calculations. SF-6D decrement (or disability) weights were sourced from Table 3.2 above, and control for other variables. Prevalence figures for the PGSI & SGHS in the Victorian community were sourced from Rockloff et al. (2020), based on respondents who gambled in the last 12 months. Aggregate based on population of Victorian adults from census data: 5,926,624 x prevalence x SF-6D decrement, to form an estimate of per-year, disability adjusted life years (DALYs).

3.4 Discussion

This propensity score weighting study is the first to evaluate population gambling screens using health utility as the criterion outcome, propensity score matching and control for co-morbidities. For the PGSI, this yielded a similar pattern of decrements to that calculated by Moayeri (2020) from the Household Income and Labour Dynamics in Australia dataset (Table 3.3). The smaller effect sizes found in the present study, especially for PG, appear to primarily be due to the additional measures of controlling for comorbid conditions. The use of an experienced utility framework complements prior elicitation of preference-based utility for the PGSI only (Browne, 2017; Browne et al., 2017c; Rawat et al., 2018), and contributes to literature validating the SGHS as an index of gambling-related harm. A key limitation is that these estimates are not directly comparable to preference-based utilities in terms of raw magnitudes, due to a variety of methodological differences. Nevertheless, the results are consistent in relative terms, in that per-person impacts to MR problematic gamblers, measured with the PGSI, and moderately-harmed gamblers, measured with the SGHS, are about half that of those in the most severe categories. However, while the decrement to those in the least severe SGHS group was statistically significant, no significant decrement to health-utility was found for LR gamblers identified by the PGSI. This may, of course, simply be a matter of relative power for the two scales.

Both the SGHS and the PGSI yielded consistent results in total population impact, and in finding that less than one-third (~6,000 DALYS) of the population impact was attributable to the small proportion of gamblers identified as being in the most severe category of either instrument. Thus, the discrepancy between the two instruments is largely reflected in the attribution of utility decrements to the moderate and low categories. Further insight is gained by taking into account the differing sensitivity of the instruments, as indicated by the prevalence column in Table 3.3. Contrary to suggestions that the SGHS might 'lower the bar' for harm (Delfabbro & King, 2017), the PGSI identifies *more* affected gamblers across all categories (14.3 per cent 1+) than the SGHS (9.6 per cent 1+), particularly in the LR and MR groups. Given the aggregate population impact is commensurate at about 19,800 DALYs, this indicates that the SGHS is a more specific instrument for identifying harmed individuals. On the other hand, the non-significant difference for LR gamblers supports a degree of scepticism regarding whether or not LR gamblers experience a meaningful degree of harm. The ability of the SGHS to identify statistically significant health decrements at low levels of harm is consistent with the theory underlying its development (Browne et al., 2017a; Browne, 2019), which was to specifically target harmful outcomes from excessive gambling, rather than the broader concepts of risky, uncontrolled, or problem gambling.

3.4.1 Limitations and future directions

The study used experienced utility as the key outcome, propensity score matching of affected and unaffected individuals, and controlled for known comorbidities so as not to over-attribute associated SF-6D decrements to gambling. To the author's knowledge, this is the best approach for estimating health utility impacts attributable to gambling problems or harms from cross-sectional self-report data. It provides a useful complement to the directly elicited preference-based utilities elicited for the PGSI in prior work (Browne et al., 2017c). It is also arguably more conservative than the results of Moayeri (2020), avoiding both over-attribution and the stigma and framing effects involved in direct assessment of the impact of gambling. Nevertheless, the statistical techniques employed here are by no means a 'silver bullet' for achieving unbiased causal or counterfactual estimates from cross-sectional data (Morgan & Winship, 2015).

The SF-6D, which is calculated from responses to the SF-12, has the advantage of yielding health utility scores on a genuine metric suitable for summation over individuals to create an index of population impact. However, it is arguably not perfectly suited to assessing the full scope of impacts to wellbeing and life-satisfaction caused by gambling. It includes items pertaining to physical pain and physical functioning, which we would not necessarily expect to be affected even by quite severe gambling problems. Thus, this can make it relatively insensitive compared to other benchmarks, such as measures of psychological distress or personal wellbeing. Future counterfactual studies might consider using a broader suite of outcomes that capture wellbeing, happiness and life-satisfaction. This would maintain the advantage of being an independent 'yardstick' for gambling-specific screens, at the expense of not necessarily yielding results on a metric scale.

Participants were drawn from a commercial panel provider, and opted into the study. Although demographic characteristics were reasonably typical of the Australian population, they did not comprise a random representative sample. Strictly representative samples are generally required for mean or prevalence estimates, but this is not the case when assessing relationships between variables, as in the present study. As discussed elsewhere (Russell et al., 2022), virtually all sampling in the social sciences, including random digit dial computer-assisted telephone interviews, are not truly population representative. Nevertheless, the likely characteristics of those who are drawn to

enrol in a commercial panel, such as having free time or requiring supplemental income, should be borne in mind when generalising to the population.

Finally, it is important to emphasise that gambling problems are known to lead to long-term financial, social and emotional impacts to the gambler and those around them. The present study was only designed to assess the 'instantaneous' health-related impact of the gambler who is currently reporting some degree of harm or problems. It does not measure economic impacts, legacy impacts, or harms to others.

In sum, understanding the impacts of gambling on health and wellbeing requires synthesising evidence from a variety of sources and methodologies. The current study provides a new reference point in this ongoing effort, but should not be taken as overriding or replacing knowledge gained from prior quantitative or qualitative approaches.

3.4.2 Conclusion

Hitherto, the PGSI and the SGHS have provided only qualitative categorisation of affected gamblers, leading to dispute as to how non-zero scores on these instruments should be interpreted in terms of *how much* impact we should infer, given these scores. Consequently, prevalence surveys of gambling problems and harm have been limited to describing the prevalence of gamblers across nominal categories without strong guidance for a meaningful interpretation of these categories. Prior work employing direct elicitation of health impact has been criticised for being vulnerable to various forms of biases. This paper presents indirect estimates of experienced health utility decrements attributable to gambling, a method that overcomes these limitations. All non-zero increasing scores on the SGHS are associated with progressively larger decrements to health. Those reporting a high degree of harm on the SGHS (6+) experience around 5 times the impact as those in the low range (1-2). However, this impact varies inversely with the prevalence of individuals in these categories, yielding a similar 'burden' of population impact across the spectrum of harm. Broadly similar results were found for the PGSI, with the important exception that no significant decrement was detected for LR gamblers, and relatively greater burden attributable to MR gamblers. Since the decrement associated with PGs is almost exactly double that of MR gamblers, a reasonable heuristic when using the PGSI is to weight these two categories accordingly in statistical calculations. The SGHS yields a similar population-aggregate estimate of the 'burden of gambling harm' compared to the PGSI (~20,000 DALYs per annum in Victoria Australia), but confines this impact to 9.6 per cent, rather than 14.3 per cent of gamblers. For these individuals, there is a spectrum of harm, with progressively fewer individuals experiencing a greater degree of impact. The methodological choices of this paper, including the use of the SF-6D benchmark, reliance on experienced-utility, and the propensity weighting methodology were all geared towards a conservative estimate of impact from gambling. Further work applying this framework could consider a broader range of outcomes, consider life-course and legacy impacts, and – perhaps most critically – also consider harm to others. Importantly, this study shows that the SGHS and the PGSI have broadly similar performance in identifying decrements to health-utility from engagement with gambling, and demonstrates that the SGHS does not overestimate harm in the community relative to the PGSI.

Especially given the purported commitment of gambling research to a public health model, it is somewhat remarkable that this is one of the first studies to attempt to link standard gambling screens of problems and harms to established measure of impact to health and wellbeing. Most government policies are geared towards reducing negative impacts of gambling, i.e., maximising health utility in the affected communities. Therefore in our view, the success (or failure) of policy is properly

evaluated by monitoring aggregate changes in health utility. Population-weighted scoring of the PGSI or the SGHS for this purpose may be done by applying the health utility decrements estimated here. Gambling research has also suffered from the terminology of 'low / moderate risk' (of gambling problems) applied to intermediate PGSI categories, which implies that they are not currently experiencing negative impact (see Browne & Rockloff, 2017 for a detailed discussion of this issue). At least in the case of the moderate risk category, these individuals suffer a detectable degree of harm; and in aggregate, contribute more to population impact than the more severe but less prevalent 'problem gambler' cohort. The present study did not preferentially sample those in the low risk category, and the relatively small per-person impact was not statistically detectable. However, given their relatively high prevalence in the population this does not imply the aggregate impact to this group is zero or negligible. Further work to specifically study this group is warranted.

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Chapter 4. The 20-item Gambling Harms Scale (GHS-20): Benchmarked to health utility using propensity weighting and control for comorbidities

4.1 Introduction

In jurisdictions around the world with legal gambling, authorities have a mandated responsibility to reduce harm from gambling. This is in line with a public health approach to managing gambling, which treats the issue in an epidemiological framework like that applied to tobacco or alcohol. The benchmark of health and wellbeing is central to this framework, and this is reflected in definitions of gambling harm that emphasise decrements to the same (Wardle et al., 2018, Langham et al., 2015). Population screens such as the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001) are not well suited to monitoring population gambling harm, since they (a) conflate the harms from problem gambling (i.e. the outcome) with the risk factor of behavioural addiction, (b) yield only prevalence estimates (e.g. of "problem gamblers") rather than a total metric of impact, (c) are ambiguous about the status of "at risk" gamblers (i.e. whether they are harmed or not) and (d) provide no guidance as to how persons of varying risk or impact might be combined into a single population metric. In short, screens for problem gambling have only an indirect theoretical link to health and wellbeing (Browne, 2019), and were not designed with this benchmark in mind.

The Short Gambling Harms Screen (SGHS) (Browne et al., 2017) is a 10-item measure intended to address a gap in the measurement of gambling harm, which has a direct theoretical link to health impact. As articulated in a recent review (see Chapter 1), although several other approaches to gambling harm measurement exist, the SGHS is – by some margin – the most widely adopted instrument, has been translated into several languages for use in multiple jurisdictions, and is seemingly the only dedicated harms scale with psychometric support. Nevertheless, concerns about the SGHS have been expressed in the literature (Delfabbro & King, 2017), and also (more commonly) at presentations given at gambling governance conference venues. Some concerns, such as the binary response format, or speculation that some items might reflect rational opportunity costs of gambling, have already been addressed empirically (Murray-Boyle et al., 2021, McLauchlan et al., 2020). However, there is still some uncertainty and debate as to whether the SGHS truly indexes meaningful impacts to health and wellbeing. Furthermore, due to its brevity, the SGHS does not provide complete coverage of all domains of gambling related harm: physical health, relationships, finances, psychological and emotional, work/study and social deviance (Langham et al., 2015). Furthermore, the item selection process (from an initial pool of 72 items) for the SGHS was based on sensitivity (i.e. minimising false negative zero scores), rather than with respect to an external validation metric.

Both the public health framework and standard definitions of gambling harm advise for the use of *health utility* as the key outcome of interest and the ultimate yardstick with which to evaluate scores on a screen intended to encompass negative impact from gambling. In Chapter 2 we described how a public health measurement framework would be applied in order to estimate health decrements associated with gambling. We outlined a process for indirect elicitation of decrements to *experienced health utility* associated with gambling, which avoids potential response bias introduced by preference-based elicitation using direct evaluation of vignettes or

descriptions. This involves collecting a sample of harmed and unharmed individuals, which is then weighted based on known socio-demographic risk factors, so as to balance the groups based on their propensity for experiencing harms or problems. Multivariate regression is then used to estimate the unique relationship between the screen and health utility, whilst controlling for known comorbidities identified from the literature (e.g. diagnosis with another mental disorder, alcohol use) that also impact health. Given that it is unfeasible and unethical to conduct a controlled experiment (that would involve 'giving' the treatment group gambling problems), this framework has clear advantages in demonstrating the causal link between gambling harm symptomatology and health utility.

The framework described above was applied in Chapter 3 to the SGHS and the PGSI, using the SF-6D based on the SF-12 health survey (Burdine et al., 2000, Busija et al., 2011). This benchmark is a self-report assessment of health functioning, from which raw scores can be converted to a set of reference health utilities. Health utility is a 0-1 metric with one extrema representing a life not worth living, and the other reflecting optimal health and wellbeing. The preference-based elicitation of these utilities' mean scores are ratio comparable, and decrements attributable to health conditions can in-principle be summed over individuals to yield an assessment of population-level impact. In Chapter 3 we calculated implied utility decrements for both gambling screens, finding all non-zero SGHS scores associated with significant decrements to health utility. Significant decrements were also detected for PGSI moderate risk and problem gamblers, but not for low risk gamblers.

4.1.1 Aims

The present study aimed to develop and validate an extended 'sister' scale to the SGHS, with the properties of:

a) better representation of all harm domains, as described in Langham et al. (2015)

b) more emphasis on moderate-to-severe harms, as suggested by Delfabbro and King (2017)

c) additional items selected based on unique associations with decrements to health utility

d) calculated implied health utility decrements for the total sum score

At the outset, we determined that the total length of the new scale should be 20 items, complementing the original 10-item harm scale. For the causal regression stage of our measurement framework, we employ a generalised additive model (GAM) approach for estimating the relationship between both scales and health utility. This appears to be the most elegant approach to handle potential non-linearity in the relationship. Henceforth we will refer to the new scale as the Gambling Harms Scale 20 (GHS-20) and the original SGHS as the Gambling Harms Scale 10 (GHS-10). This naming scheme is adopted to ensure consistency with corresponding versions for affected others that are in-development. Since there is a law of diminishing returns regarding psychometric performance for longer scales, we leave as an open question as to whether the GHS-20 performs measurably better in psychometric terms than the GHS-10.

4.2 Method

4.2.1 Measures

Table 4.1 provides an index to the gambling harm items evaluated in this study, and their associated domains. The 10 GHS-10 items are marked with *, whereas items marked + are referred to in the results section and include those additional items that ultimately form the GHS-20. The selection process for these items is detailed below.

Table 4.1. Abbreviations, full item content, and domain categories of candidate gambling harm items

Abbreviation	Item	Domain
Red. Spending *+	Reduction of my available spending money	Financial
Red. Rec. Exp. *+	Less spending on recreational expenses such as eating out, going to movies or other entertainment	Financial
Red. Savings *+	Reduction of my savings	Financial
Sold Items *+	Sold personal items	Financial
Inc. CC Debt *	Increased credit card debt	Financial
Late Bills	Late payments on bills (e.g. utilities, rates)	Financial
Red. Ess. Exp.+	Less spending on essential expenses such as medications, healthcare and food	Financial
Time+	Used my work or study time to gamble	Work/Study
Red. Perf.+	Reduced performance at work or study (i.e. due to tiredness or distraction)	Work/Study
Absent+	Was absent from work or study	Work/Study
Red. Sleep Gamb.	Loss of sleep due to spending time gambling	Health
Malnutr.	Didn't eat as much or often as I should	Health
Dep.+	Increased experience of depression	Health
Regret *	Had regrets that made me feel sorry about my gambling	Emo/Psych
Fail. *+	Felt like a failure	Emo/Psych
Shame *	Felt ashamed of my gambling	Emo/Psych
Distress *+	Felt distressed about my gambling	Emo/Psych
Vulner.+	Felt insecure or vulnerable	Emo/Psych
Worthl.+	Felt worthless	Emo/Psych
Red. Time *	Spent less time with people I care about	Relationships
Red. Events	Spent less time attending social events (non-gambling-related)	Relationships
Inc. Tension	Experienced greater tension in my relationships (suspicion, lying, resentment, etc.)	Relationships
Isolation+	Social isolation (felt excluded or shut-off from others)	Relationships
Inc. Conflict+	Experienced greater conflict in my relationships (arguing, fighting, ultimatums)	Relationships
Threat End.	Threat of separation or ending a relationship/s	Relationships
Red. Contrib. Cult.	Reduced my contribution to religious or cultural practices	Soc. Deviance
Pay Mon.+	Promised to pay back money without genuinely intending to do so	Soc. Deviance
Viol.	Had experiences with violence (including family/domestic violence)	Soc. Deviance
Chil. Negle.	Didn't fully attend to the needs of children	Soc. Deviance
Took Mon.	Took money or items from friends or family without asking first	Soc. Deviance
Theft Gov.	Petty theft or dishonesty in respect to government, business, or other people (not family/friends)	Soc. Deviance

Note: * item included in the original GHS-10, + item identified in the present analysis.

Participants reported on their demographic characteristics such as age, gender, and country of birth (see Table 4.2 for key characteristics).

Problem gambling status was assessed using the Problem Gambling Severity Index (Ferris & Wynne, 2001). The PGSI uses nine items (e.g., "Have you bet more than you could really afford to lose?") measured on a four-point scale from 0 (never) to 3 (almost always). All nine items are summed with resulting classifications of 0 (non-problem gambler), 1 to 2 (low-risk gambler), 3 to 7 (moderate-risk gambler), or 8+ (problem gambler). Coefficient alpha for the PGSI in the present dataset was .95, and coefficient omega was .92.

Gambling harms were assessed using a checklist of 31 items covering six domains of harm (financial [7-items], relationship [6], emotional/psychological [6], health [3], work/study [3], and social deviance [6]). These items were selected based on formative research (Browne & Rockloff, 2018; Browne, Volberg, et al., 2020) that identified which harms from the original 72-item checklist were at least moderately prevalent among those experiencing some degree of gambling problems. The referenced studies comprised both internet panel and population-representative screens. Thus, in the interest of managing survey length, it was possible to exclude from consideration harms with very low prevalence (e.g. attempted suicide or loss of significant assets), which would entail they provide little information in a new harms screen. Certain items, such as 'increased use of tobacco' present issues in a health context, terms of assessing a comorbidity and were excluded based on content non-central to the experience of gambling harm. Items comprising the SGHS (now GHS-10) (Browne et al., 2017) comprised a subset of these items. Item abbreviations and full item content are presented in Table 4.1.

Quality of life was assessed using the 26-item WHOQOL-BREF (World Health Organization, 1996). Each item is measured on a five-point scale. Apart from the SF-6D (described below), the WHOQOL-BREF is probably the most well known and most-used instrument to assess global health and wellbeing. The measure comprises two general items about overall quality of life, as well as four overall domains including physical health (7 items), psychological (6 items), social relationships (3 items), and environment (8 items). Three items require reverse scoring. Scores for the four domains are transformed so that each domain's score ranges from 4 to 20, with higher total scores indicating higher perceived quality of life in that respective domain. A composite quality of life score was also calculated using equally weighted average scores from the four domains to provide a single benchmark. However, consistent with recommendations by the instrument authors, the main analyses, including item selection, were conducted using the WHOQOL-BREF subscales.

Health utility was measured using the SF-6D (Brazier et al., 2004), which is a measure derived from the SF-12 self-report measure (Burdine et al., 2000). It involves conversion of the raw SF-12 responses to health utility scores using data from preference-based protocols, in which respondents are asked to consider how much life one is willing to sacrifice or risk, to avoid the limitation in functioning described. It captures physical functioning, role limitations, social functioning, pain, mental health, and vitality; and yields health utility coefficients between 0.345 to 1.000 (Hunger et al., 2011). These scores are intended to function as a true metric, in the sense that they are bounded by zero (impairment so severe that life is not worth living) to one (full health), and ratios of scores are consistent. That is, a decrement of 0.2 is twice as bad as a decrement of 0.1 since it implies that a typical person would give up (or risk) twice as much time to avoid a fixed amount of time living with the former condition. The SF-6D has been used in fields related to gambling, such as to estimate health utility for alcohol use disorder (Barbosa et al., 2021), but except for the study reported in Chapter 3, has not hitherto been used to evaluate the impact of gambling-related harm.

4.2.2 Participants

The dataset was the same as that analysed in Chapter 3. Participants were recruited from a commercial panel provider during late 2020 and early 2021 (see Appendix 1 for full questionnaire). As compensation, participants received points which could be exchanged for prizes and/or cash via their panel. To be eligible, participants were required to be Australian residents, aged 18 years or above, and to have gambled in the past 12 months. Gambling included participating in at least one of the following activities: race betting, electronic gaming machines (pokies), casino table games, sports betting, informal private betting for money, Keno, bingo, esports betting, and fantasy sports betting. Residents of the state of Victoria were excluded due to multiple Covid-19 lockdowns which meant no access to venue-based gambling, including at time of sampling. Using soft quotas, we aimed to sample approximately equal groups with respect to age (18-29, 30-44, 45+) and gender, and with respect to *reference* (i.e., no harms nominated) versus *affected* group status (> 1 harms on the SGHS-10). Of the 22,699 respondents who began the survey, 16,061 were screened out. Of those who screened out, 5848 did not meet the residency or age criteria, 5922 withdrew (i.e., did not complete the survey), 441 provided poor quality data such as straight lining through the survey, and 3850 were excluded due to quotas being full. A total of 6638 responses were retained, of which 2603 were people who gamble, who formed part of the present analysis. The remaining responses included a sample of those affected / unaffected by another's gambling, which did not form part of the present study. A total of 1546 (59.4 per cent) scored zero on the GHS-10 and 1057 (40.6 per cent) scored 1+. Table 4.2 provides the demographic characteristics for these gamblers who scored zero (the reference group) versus 1+ (the affected group) on the GHS-10.

Table 4.2. Descriptive characteristics for the sample of gamblers by GHS-10 status

Variable	Reference No harms nominated n (%)	Affected 1+ harms nominated n (%)
Total	**1546 (100)**	**1057 (100)**
Gender		
Male	880 (56.9)	613 (58.0)
Female	665 (43.0)	443 (41.9)
Other	1 (0.1)	1 (0.1)
Mean age (SD [years])	51.16 (17.48)	42.15 (16.03)
Country of birth		
Australia	1232 (79.7)	845 (79.9)
Other	314 (20.3)	212 (20.1)
Main language spoken at home		
English	1497 (96.8)	991 (93.8)
Other	49 (3.2)	66 (6.2)
Aboriginal or Torres Strait Islander origin		
No	1463 (94.6)	958 (90.6)
Yes	83 (5.4)	99 (9.4)
State/Territory of residence		
New South Wales	652 (42.2)	526 (49.8)
Queensland	452 (29.2)	258 (24.4)
South Australia	196 (12.7)	119 (11.3)
Tasmania	56 (3.6)	29 (2.7)
Northern Territory	8 (0.5)	5 (0.5)
Australian Capital Territory	31 (2.0)	22 (2.1)
Western Australia	151 (9.8)	98 (9.3)
Highest educational qualification		
No schooling	-	-
Did not complete primary school	6 (0.4)	-
Completed primary school	24 (1.6)	10 (0.9)
Year 10 or equivalent	163 (10.5)	87 (8.2)
Year 11 or equivalent	41 (2.7)	19 (1.8)
Year 12 or equivalent	235 (15.2)	159 (15.0)

A trade, technical certificate or diploma	489 (31.6)	251 (23.7)
A university or college degree	421 (27.2)	372 (35.2)
Postgraduate qualifications	167 (10.8)	159 (15.0)
Work status		
Work full-time	585 (37.8)	566 (53.5)
Work part-time or casual	256 (16.6)	182 (17.2)
Full-time student	27 (1.7)	34 (3.2)
Unemployed and looking for work	69 (4.5)	61 (5.8)
Full-time home duties	102 (6.6)	44 (4.2)
Retired	447 (28.9)	132 (12.5)
Sick or on a disability pension	41 (2.7)	26 (2.5)
Other	19 (1.2)	12 (1.1)
Occupation		
Manager	287 (18.6)	252 (23.8)
Professional	375 (24.3)	259 (24.5)
Technician or trade worker	114 (7.4)	79 (7.5)
Community or personal service worker	90 (5.8)	69 (6.5)
Clerical or administrative worker	268 (17.3)	138 (13.1)
Sales worker	123 (8.0)	104 (9.8)
Machinery operator and driver	58 (3.8)	20 (1.9)
Labourer	139 (9.0)	101 (9.6)
Small business operator	92 (6.0)	35 (3.3)
Marital status		
Single or never married	327 (21.2)	298 (28.2)
Separated or divorced	135 (8.7)	74 (7.0)
Widowed	54 (3.5)	17 (1.6)
Married or living with partner (de facto)	1030 (66.6)	668 (63.2)
Household composition		
Single person	351 (22.7)	249 (23.6)
One parent family with children	77 (5)	74 (7.0)
Couple with children	520 (33.6)	408 (38.6)
Couple with no children	525 (34.0)	266 (25.2)
Group household (i.e. living with two or more people to whom you are NOT related)	73 (4.7)	60 (5.7)
Annual personal income		
$0 to $19,999	244 (15.8)	137 (13.0)
$20,000 to $39,999	402 (26.0)	200 (18.9)
$40,000 to $59,999	233 (15.1)	188 (17.8)
$60,000 to $79,999	238 (15.4)	161 (15.2)
$80,000 to $99,999	160 (10.3)	113 (10.7)
$100,000 to $119,999	102 (6.6)	99 (9.4)
$120,000 to $139,999	60 (3.9)	58 (5.5)
$140,000 to $159,999	39 (2.5)	46 (4.4)
$160,000 to $179,000	24 (1.6)	18 (1.7)
$180,000 or more	44 (2.8)	37 (3.5)
Annual household income		
$0 to $19,999	70 (4.5)	48 (4.5)
$20,000 to $39,999	287 (18.6)	145 (13.7)
$40,000 to $59,999	226 (14.6)	156 (14.8)
$60,000 to $79,999	214 (13.8)	137 (13.0)
$80,000 to $99,999	166 (10.7)	136 (12.9)
$100,000 to $119,999	149 (9.6)	133 (12.6)
$120,000 to $139,999	103 (6.7)	89 (8.4)
$140,000 to $159,999	127 (8.2)	84 (7.9)
$160,000 to $179,000	47 (3.0)	38 (3.6)
$180,000 or more	157 (10.2)	91 (8.6)
Residence		
Capital city and surrounds	1003 (64.9)	766 (72.5)
Regional town with more than 10,000 persons	396 (25.6)	223 (21.1)
A rural or remote location	147 (9.5)	68 (6.4)

4.2.3 Analysis

The R statistical programming environment (R Core Team, 2020) was used for all analyses. Tetrachoric correlations were calculated between binary variables using the *psych* package (Revelle & Revelle, 2015). We used two indices of internal consistency to evaluate the candidate items, including coefficient *alpha* based on the average inter-item covariance and coefficient *omega*, which measures the ratio of variance captured by a general factor g to that attributable to subfactors (F) via hierarchical confirmatory factor analysis (CFA) (Flora, 2020). Because the items were binary scored, tetrachoric correlations served as the input for all indices of reliability, and logistic links were employed for the CFA. Together, these coefficients speak not only to the reliability of the scale sum, but also to the degree of unidimensionality evinced by the item set.

Further insight into item performance can be gained by applying a unidimensional, two-parameter latent trait model (2P LTM) to the candidate items, also using a logistic link function. This was implemented using the *ltm* package (Rizopoulos, 2006). Like a CFA, this model estimates latent trait scores (Ө), which in the present analysis correspond to the underlying degree of harm experienced. LTM is best thought of as a variant of CFA in a format that emphasises the properties of binary or ordinal response items. Item characteristics are captured via two item parameters: the intercept (α) and slope (β) of the logistic link functions from the latent variable to each binary measure, usually described as the *severity* and *discrimination* parameters in the LTM literature. These parameters can be thought of, respectively, as the degree to which a positive response on an item reflects severe underlying harm (Ө), and how reliably it differentiates differing degrees of underlying harm (Ө). We calculated point-biserial correlations of each item with the latent harm scores, as well as validation outcomes such as the SF-6D.

The *lasso* (least absolute shrinkage and selection operator) is a form of multivariate regression that implements both variable selection and regularisation (Tibshurani, 1996) that addresses some of the limitations of both standard regression and stepwise variable selection in handling collinearity and redundancy in predictors. Rather than simply minimising the mean squared error, it introduces a term that penalises higher magnitude coefficients, thus encouraging a more parsimonious and robust solution. Similar to stepwise regression, the solution will generally include some coefficients thresholded to zero (or excluded from the equation), when they do not contribute sufficient unique information when other variables are included. However, the lasso does not suffer from high dependence on sample variability that is well known to affect stepwise methods. Because of this attractive property, the lasso has been recently applied to psychometric problems in variable/item selection (Gonzalez, 2020; Jacobucci et al., 2019; Sun & Ye, 2019). In this paper the lasso was employed for multivariate evaluation and selection of harm items, predicting the SF-6D and the WHOQOL-BREF subscales as outcomes. The underlying logic is that if a given harm symptom indexes a meaningful and unique quantum of gambling-related harm, it should be associated with an observable reduction in quality of life as indicated by one or more of these outcomes. Additionally, beta coefficients were constrained to be negative, as a positive coefficient would imply a partial positive effect of a harm on health utility, which is both theoretically undesirable and detrimental to scale performance. This procedure leads to the selection of a subset of harms that demonstrate a robust and unique negative association with each outcome.

4.3 Results

4.3.1 Associations between candidate items

Figure 4.1 displays the matrix of tetrachoric correlations between the 31 candidate harm items. For ease of interpretation, items are algorithmically sorted such that clusters of items with higher mutual correlations are placed together. The magnitude and direction of the correlations were very homogenous, with a mean inter-item correlation of .73, a SD = .08 and IQR [.70, .78]. Accordingly, a three-level colour scaling has been applied to enhance contrast between inter-item correlations. *Reduction of my available spending money, Reduction of my savings,* and *Less spending on recreational expenses such as eating out, going to movies or other entertainment* showed lower correlations with more severe social deviance items such as *Had experiences with violence (including family/domestic violence).* This was also somewhat the case for the moderately severe financial harms of *Increased credit card debt* and *Sold personal items.* Similarly, the cluster of *Used my work or study time to gamble, Didn't fully attend to the needs of children,* and *Reduced my contribution to religious or cultural practices*, all indicative of relatively severe social dysfunction, tended to have slightly lower cross-associations overall, but particularly so with milder financial harms. As apparent in the lower left triangle, there were particularly strong mutual associations between emotional impacts. However, it should be emphasised that these patterns were quite subtle differences of degree. The lowest inter-item correlation was .53, which represents a moderately strong positive association. In line with this, alpha reliability for all 31 items was .99 and beta (the minimum split-half reliability) was .97. Similarly, coefficient omega was calculated to be .87, with all items loading strongly (.73-.93) on the general factor, relatively low on subfactors (.21 - .45), and eigenvalues of [*g*: 20.78, F1: 2.3, F2: .80, F3: .96, F4: .46]. As shown in Figure 4.2, the subfactor loadings mirrored the structure identified above, with some sub-factor structure apparent with respect to emotional affect and depression, financial stressors, and the remaining sub-factor reflecting work, social and cultural dysfunction.

To summarise, (1) the full candidate set of items comprised a very reliable indicator of an underlying general construct of harm, (2) loadings and inter-item associations were very homogenous, (3) some sub-factor structure was apparent, but these facets were subtle and contributed little to the total explained covariance, and (4) no individual items stood out as being incontrovertibly superior or inferior based on simple cross-correlations or factor loadings.
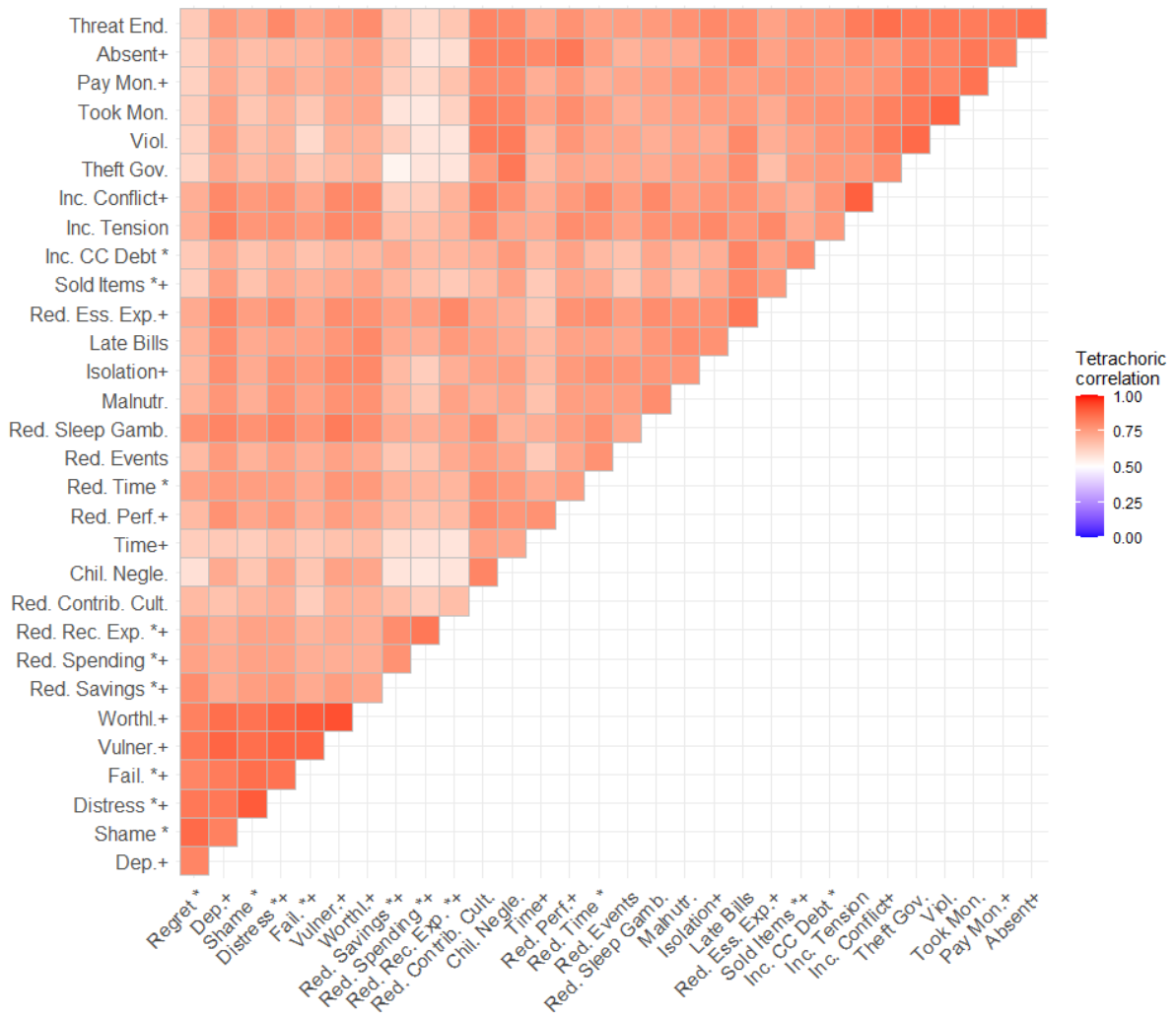
Figure 4.1. Visualisation of tetrachoric correlations among candidate gambling harm items
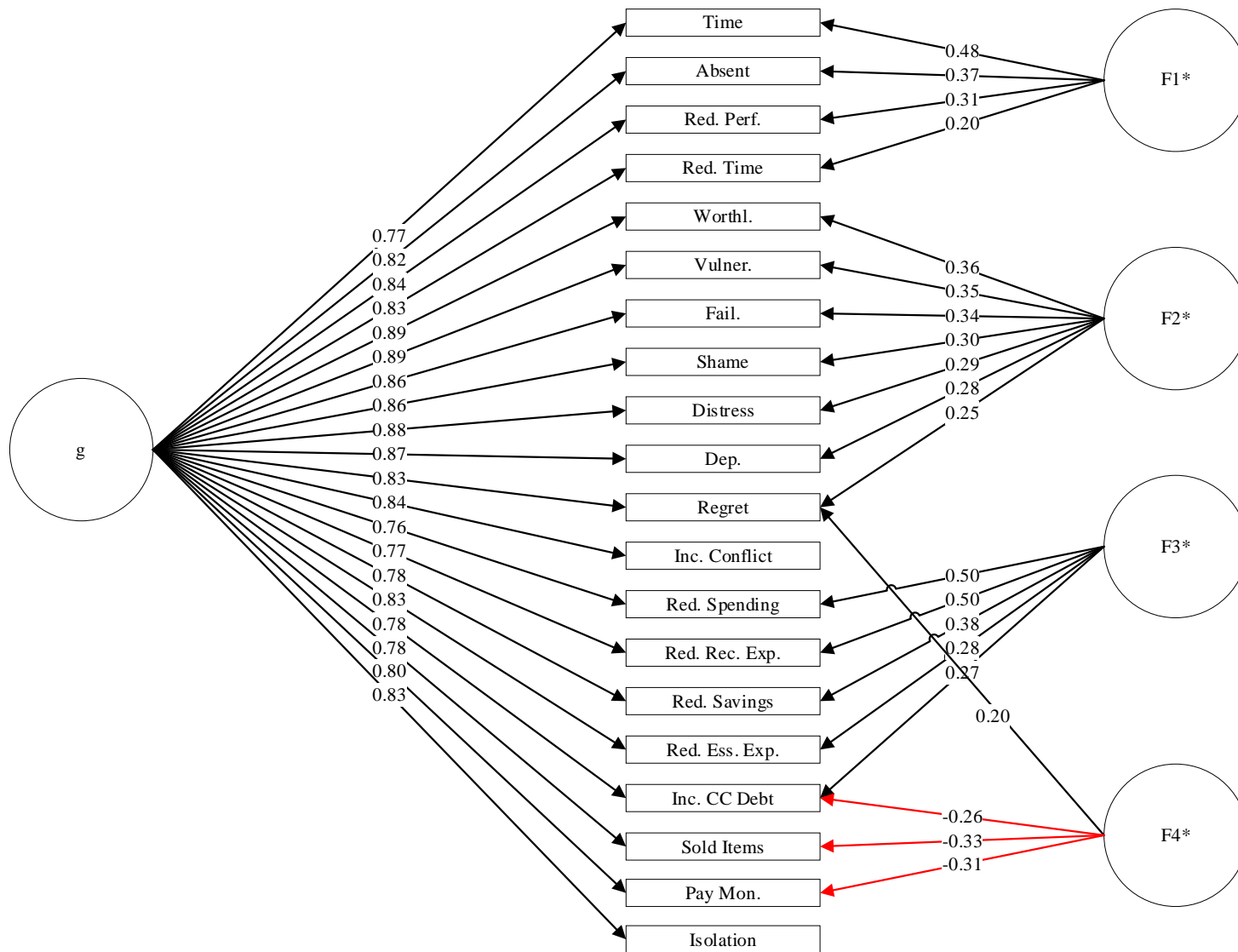
Figure 4.2. Hierarchical CFA general and subfactor loadings for GHS-20 items

4.3.2 LTM analysis

Table 4.3 summarises the LTM parameters for each item, along with the point-biserial correlation of each item with the latent factor $r(\Theta)$, the key validation outcome r(SF-6D), as well as the prevalence of positive responses of each item in the present dataset. Item-wise correlations between these parameters are given below. Of note is that $r(\Theta)$ and 2P(β) are very highly correlated ($r = .91$), confirming that both index the degree to which each item indicates the underlying dimension of harm. More interestingly, these indices of internal consistency had a moderately strong correlation with the external measure of health utility (r(SF-6D)) of -.65 and -.51 respectively. In other words, items that had a stronger association with the underlying general factor of harm, also tended to have a stronger association with the external measure of health utility. In contrast, items that had a higher severity (and correspondingly lower prevalence) showed a slightly negative correlation with the external measure: the correlation between r(SF-6D) and 2P(α) was -.16. Emotional affect items such as *Vulner.* and *Worthl.* tended to perform best, both in terms of $r(\Theta)$ and r(SF-6D). However, items overall were relatively homogenous according to both criteria. Two further considerations should be kept in mind. First, these two aspects of item performance do not take into account information redundancy between items[1]. For example, if *Vulner.* and *Worthl.* had a correlation approaching 1, then inclusion of both items in a scale would not be advisable, since they would not provide unique information about either the latent factor or external outcomes. Second, a correlation with either benchmark does not incorporate the prevalence of the item, which affects the information content of the item. For example, given two items showing equivalent bivariate correlational performance in Table 4.3, if one item had a prevalence of 1 per cent and the second item had a prevalence of 50 per cent, then the more prevalent item would provide far greater information, or (equivalently) explain more variance, in those benchmarks.

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[1] Excessive correlations between items can certainly be taken into account within an omnibus CFA / LTM framework for item selection (Browne et al., 2018). However, in the interest of accessibility, we opted for the use of more well-established methods.

Table 4.3. Summary of LTM parameters for candidate gambling harm items

	$r(\Theta)$	r(SF-6D)	2P(α)	2P(β)	N
Red. Spending *+	.37	-.27	1.90	2.23	608
Red. Rec. Exp. *+	.40	-.27	2.27	2.47	554
Red. Savings *+	.41	-.27	1.92	2.36	622
Sold Items *+	.48	-.29	4.40	2.82	229
Inc. CC Debt *	.48	-.24	4.01	2.76	273
Late Bills	.57	-.31	4.82	3.43	266
Red. Ess. Exp.+	.55	-.29	4.62	3.34	278
Time+	.41	-.29	3.39	2.21	281
Red. Perf.+	.53	-.32	5.00	3.38	237
Absent+	.53	-.30	5.64	3.45	178
Red. Sleep Gamb.	.55	-.30	4.15	3.24	329
Malnutr.	.52	-.28	4.17	3.07	298
Dep.+	.59	-.36	4.55	3.67	337
Regret *	.44	-.29	2.35	2.55	546
Fail. *+	.51	-.32	3.61	3.06	385
Shame *	.50	-.29	3.26	3.05	442
Distress *+	.58	-.31	4.11	3.59	386
Vulner.+	.62	-.35	4.89	3.83	317
Worthl.+	.61	-.35	4.65	3.72	331
Red. Time *	.50	-.31	3.60	2.91	361
Red. Events	.48	-.26	3.60	2.66	321
Inc. Tension	.59	-.31	4.90	3.65	289
Isolation+	.54	-.33	4.16	3.21	322
Inc. Conflict+	.59	-.31	5.17	3.74	269
Threat End.	.59	-.30	5.82	3.96	225
Red. Contrib. Cult.	.51	-.27	4.62	3.04	233
Pay Mon.+	.53	-.31	5.03	3.35	230
Viol.	.52	-.28	5.86	3.56	170
Chil. Negle.	.50	-.27	5.05	3.12	195
Took Mon.	.52	-.26	6.05	3.62	160
Theft Gov.	.49	-.27	6.37	3.68	141

	Correlations				
	$r(\Theta)$	r(SF-6D)	2P(α)	2P(β)	N
$r(\Theta)$	-	-.65	.67	.91	-.51
r(SF-6D)		-	-.16	-.51	.00
2P(α)			-	.84	-.93
2P(β)				-	-.61

Note: $r(\Theta)$ correlation with the latent harm factor, r(SF-6D) correlation with the SF-6D, 2P(α) the intercept or severity parameter, 2P(β) the slope or discrimination parameter, N the number of positive responses recorded in the present dataset, * item included in the original GHS-10, + item identified in the present analysis for inclusion in the GHS-20.

4.3.3 Multivariate item selection via the lasso

Regularised multivariate regressions were conducted on the SF-6D and sub-scales of the WHOQOL-BREF using lasso, and constraining coefficients to be zero or less. Beta coefficient estimates are summarised in Table 4.4, ranked by aggregate unique effect magnitude. The reader is reminded that these reflect partial effects of a set of items with a strong unidimensional structure and accordingly, significant collinearity. Thus, a zero reported coefficient does not imply no relationship of the harm item with the SF-6D, only that it does not meet the lasso threshold for contribution of *additional* explanatory information, given the potential inclusion of all other harm items. Items for the GHS-20 were selected based on the criteria of providing unique explanatory information on the SF-6D or WHOQOL-BREF subscales. Sixteen of the thirty-one coefficients were non-zero, reflecting robust contribution of independent information in the outcome, in the context of all other items. Six of the ten items comprising the GHS-10 were re-identified by this method. Emo/Psych items and depression (Health) showed the strongest effects. Financial items, including milder items, were also strongly represented in the list of non-zero coefficient estimates. However, items were identified from each of the six harm domains.

Table 4.4. Penalised lasso coefficients for simultaneous regressions predicting health and quality of life outcomes on candidate harms

Harms		Outcome				
Category	**Item**	**SF-6D**	**WHOQOL-BREF**			
			Phys.	**Psych.**	**Relations.**	**Environ.**
Health	Dep.+	-0.26	-0.18	-0.13	-0.12	-0.08
Emo/Psych	Worthl.+	-0.04	-0.08	-0.14	-0.10	-0.18
Emo/Psych	Fail.*+	-0.02	-0.12	-0.12	-0.12	-0.07
Emo/Psych	Distress*+	0.00	0.00	-0.11	-0.13	-0.16
Relationships	Isolation+	-0.14	-0.12	0.00	0.00	0.00
Emo/Psych	Vulner.+	-0.14	-0.04	0.00	0.00	0.00
Work/Study	Time+	-0.15	0.00	0.00	0.00	0.00
Financial	Red. Ess. Exp.+	0.00	0.00	0.00	0.00	-0.14
Financial	Red. Rec. Exp.*+	0.00	-0.04	-0.03	0.00	-0.05
Work/Study	Red. Perf.+	-0.10	0.00	0.00	0.00	0.00
Financial	Red. Spending*+	-0.03	0.00	-0.04	0.00	0.00
Financial	Red. Savings*+	0.00	-0.06	0.00	0.00	0.00
Work/Study	Absent+	-0.05	0.00	0.00	0.00	0.00
Relationships	Inc. Conflict+	-0.03	0.00	0.00	0.00	0.00
Financial	Sold Items*+	-0.02	0.00	0.00	0.00	0.00
Soc. Deviance	Pay Mon.+	-0.01	0.00	0.00	0.00	0.00
Relationships	Red. Time*	0.00	0.00	0.00	0.00	0.00
Financial	Inc. CC Debt*	0.00	0.00	0.00	0.00	0.00
Financial	Late Bills	0.00	0.00	0.00	0.00	0.00
Health	Red. Sleep Gamb.	0.00	0.00	0.00	0.00	0.00
Health	Malnutr.	0.00	0.00	0.00	0.00	0.00
Emo/Psych	Regret*	0.00	0.00	0.00	0.00	0.00
Emo/Psych	Shame*	0.00	0.00	0.00	0.00	0.00
Relationships	Red. Events	0.00	0.00	0.00	0.00	0.00
Relationships	Inc. Tension	0.00	0.00	0.00	0.00	0.00
Relationships	Threat End.	0.00	0.00	0.00	0.00	0.00
Soc. Deviance	Red. Contrib. Cult.	0.00	0.00	0.00	0.00	0.00
Soc. Deviance	Viol.	0.00	0.00	0.00	0.00	0.00
Soc. Deviance	Chil. Negle.	0.00	0.00	0.00	0.00	0.00
Soc. Deviance	Took Mon.	0.00	0.00	0.00	0.00	0.00
Soc. Deviance	Theft Gov.	0.00	0.00	0.00	0.00	0.00

Note: Non-zero penalised coefficients shaded, * item included in the original GHS-10, + item identified in the present analysis.

4.3.4 Validity and internal consistency of the GHS-20

The union of 10 GHS-10 items and lasso-identified items comprised 20 harms that comprise the GHS-20. The sum of the additional 10 items, excluding common items with the GHS-10 is labelled GHS-20^{-10} and was also analysed to provide a form of split-half reliability. Table 4.5 summarises bivariate associations of the harm scales and the PGSI with the two major health and quality of life validation measures. As shown in Table 4.5, the two 10-item halves of the GHS-20 were moderately strongly correlated at $r = .78$. The GHS-20^{-10} subset showed a slightly stronger correlation (-.41) with the SF-6D than GHS-20, the GHS-10 or the PGSI (-.37). However, the GHS-10 and GHS-20 had stronger associations with the PGSI (.77, .78 respectively) than the subset of new items (.70). Associations of all measures with the SF-6D tended to be higher than with the WHOQOL-BREF. Alpha and omega coefficients for the GHS-20 were .98 and .90, respectively. Figure 4.2 illustrates a 4-subfacet hierarchical CFA on the GHS-20 items that corresponds to the calculated omega. Loadings on the general factor are strong and homogenous and sub-facet variance is small with eigenvalues of {G: 13.66, F1: 1.62, F2: .77, F3: .89, F4: .50}. Nevertheless, coherent clustering can be seen with respect to item content: time and preoccupation (F1), affect (F2) and finances (F3). F4 explains marginal variance but appears to capture a small negative residual association between propensity to feel regret, and some indices of 'irresponsible' financial behaviour.

To summarise, coefficient omega, CFA eigenvalues and factor loadings confirm that the GHS-20 demonstrated strong internal consistency and unidimensionality. Bivariate negative correlations with health and life quality validation measures were not markedly higher than the GHS-10, and both the GHS-10 and the GHS-20 showed almost identical correlations with the PGSI.

Table 4.5. Bivariate correlations of harm scales with the PGSI, and health and quality of life measures

	GHS-20	GHS-20^{-10}	GHS-10	PGSI	SF-6D
GHS-20^{-10}	.84				
GHS-10	.98	.78			
PGSI	.78	.70	.77		
SF-6D	-.38	-.41	-.36	-.37	
WHOQOL-BREF	-.31	-.31	-.30	-.30	.63

Note: $N = 2602$, All correlations significant $p < .01$. GHS-20^{-10} refers to the sum of the 10 additional items included in the GHS-20. Thus, associations between the GHS-20^{-10} and the GHS-10 can be thought of as a form of split-half reliability.

4.3.5 Benchmarking the GHS-20 to health utility

The final stage in the analysis was to calculate the magnitude of the decline in health utility, conditional on GHS-20 scores. We applied the propensity weighting and control framework as outlined in Chapter 2 and the same methodology described in Chapter 3. A total of 1102 gamblers who scored zero on the GHS-20 formed the reference group. The first column of Table 4.6 describes a logistic model of the propensity of participants to be a harmed case, i.e. score 1+ on the GHS-20 (N = 1501) as a function of demographic characteristics. The predicted probabilities are used to calculate case weights in order to balance the influence of these factors for subsequent causal models (columns 2 and 3 of Table 4.6). These models also control for known comorbidities (e.g., smoking, disability) of gambling-related harm that may be confounded with health utility. The first causal model shows mean decrements associated with arbitrary cut-offs of

the GHS-20: 0 versus: [1-2], [3-5], [6-10], [11-20], and the second causal model incorporates only a single linear term for the raw GHS-20 score. We also calculated a Generalised Additive Model (GAM) for causal effects, which makes no assumptions regarding group cut-offs or linearity, and allows for fitting of any smooth relationship between the GHS-20 and the SF-6D. Interestingly, plotting the conditional effects of this model showed a nearly linear relationship. Separating the linear and smooth terms showed a significant effect for curvilinearity, $F(edf = 1.631) = 1.137$, $p = .002$, but this improved the explained variance only marginally: 31.1 per cent to 31.4 per cent. Figure 4.3 shows the GAM estimated decrements by GHS-20 score, with a reference line to indicate linearity. Some concavity is evident in the marginal SF-6D scores, indicating some degree of saturation. This is to be expected, as progressively more symptoms are reported, there is a logical bound to the degree further symptoms indicate further impact to health. Appendices 2 & 3 include full details of how to administer the GHS-10 and GHS-20, including a scoring table to convert raw scores to implied health utility decrements. The utility decrements for the GHS-10 (formerly SGHS) was done using an identical method and dataset as for the GHS-20, as described in this chapter, but using scores on the 10-item version, rather than the 20-item version, as the instrumental variable.

Table 4.6. Model summaries and beta coefficients for propensity and causal models

		Beta coefficients (SE)		
Model		**Propensity**	**Causal (categorised)**	**Causal (score)**
Regression type		**Logistic**	**OLS**	**OLS**
DV		**P(GHS20>0)**	**SF-6D**	**SF-6D**
Intercept		2.008** (0.252)	0.840** (0.009)	0.835** (0.008)
GHS-20 categories	0		-	
	1-2		-0.018** (0.006)	
	3-5		-0.043** (0.008)	
	6-10		-0.083** (0.008)	
	11-20		-0.129** (0.008)	
GHS-20 sum				-0.012** (0.001)
Alcohol consumption	Non-drinker		-	-
(AUDIT-C)	Non-risky		0.006 (0.008)	0.006 (0.008)
	Risky		0.005 (0.007)	0.006 (0.007)
Age	Linear	-0.035** (0.003)	0.169 (0.123)	0.142 (0.122)
	Quadratic		-0.314** (0.117)	-0.318** (0.116)
	Cubic		-0.202 (0.116)	-0.188 (0.115)
Gender	Male	-	-	-
	Female	-0.188* (0.088)	-0.017** (0.005)	-0.017** (0.005)
Country of birth	Overseas	-	-	-
	Australia	-0.184 (0.106)	-0.015** (0.006)	-0.015** (0.006)
Education	Secondary or less	-		
	Trade/Cert	-0.041 (0.113)		
	Tertiary	0.192 (0.118)		
	Postgrad	0.401** (0.153)		
Personal income		0.101** (0.029)		
Household income		-0.116** (0.024)		
Mother's highest education		-0.066** (0.019)		
Sick /disability pension	No		-	-
	Yes		-0.128** (0.015)	-0.129** (0.015)
Recreational drug use	No		-	-
	Yes		-0.017* (0.008)	-0.016* (0.008)
Cigarettes per day	0		-	-
	< 10		-0.015* (0.007)	-0.015* (0.007)
	10+		-0.012 (0.007)	-0.012 (0.007)
Past year diagnosis of psychological disorder…	Mood		-0.052** (0.009)	-0.051** (0.009)
	Anxiety		-0.064** (0.007)	-0.062** (0.007)
	Personality		-0.011 (0.013)	-0.006 (0.013)
	Any other		-0.031** (0.012)	-0.026* (0.012)
	N	2,603	2,603	2,603
	R^2		0.312	0.314
	Adjusted R^2		0.307	0.310
	Log Likelihood	-1,655.800		
	Akaike Inf. Crit.	3,331.601		
	Residual Std. Error		0.163 (df = 2583)	0.163 (df = 2586)
	F Statistic		61.724** (df = 19; 2583)	74.046** (df = 16; 2586)

Note:*$p<0.05$; **$p<0.01$
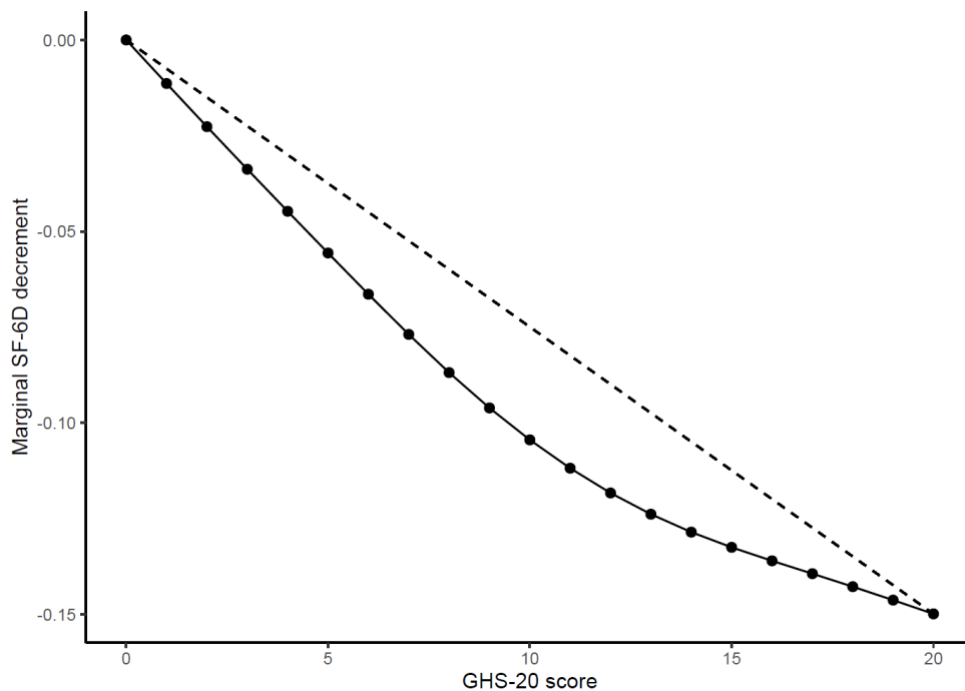
Figure 4.3. SF-6D decrements conditional on GHS-20 score

Note: Dashed reference line indicates departure from linearity.

4.4 Discussion

In Hamlet, Claudius laments that "When sorrows come, they come not single spies, but in battalions". This truism applies to the primary finding of the present analysis, which is that negative incidents and symptoms arising from gambling do not happen in isolation, but rather reflect an underlying malaise with significant implications for health and wellbeing. In short, the reliability and validity of the construct of gambling related harm is well supported. That is, each instance of harm correlates well with the whole, and the totality of harm is predictive of decrements to health utility. The strong structural connections between specific harm symptomology make the task of the psychometrician easier, in that a sufficiently large set of symptoms, when aggregated, can be almost guaranteed to do relatively well at capturing the underlying degree of impact to the gambler. This is illustrated by the homogenous positive intercorrelations between individual harms and loadings on a common factor, and most simply by the +.78 correlation between the 10 additional items for the GHS-20 and the original GHS-10. However, a corollary of this property is that there is a law of decreasing returns when extending the original scale. Although the GHS-20 was designed with an eye to maximising the predictive power with respect to health and wellbeing, it provides either marginal or no improvement to the GHS-10 in terms of predicting outcomes. Nevertheless, as predicted by theory, like the GHS-10, the GHS-20 is associated ($r = -.38$) with the key criterion measure, the SF-6D. Researchers are advised to employ the GHS-20 when time/space permits, when more precision in marginal health utility impact is required, or better coverage of the domains of harm is desired. In statistical terms, the GHS-10 is a perfectly feasible substitute when this is not the case, being correlated with the GHS-20 at .98, and having similar relationships with key outcomes.

A strength of the present development effort is the use of propensity-weighted multivariate causal modelling: i.e. balancing harmed and unharmed individuals with respect to demographics and controlling for major comorbidities. Linear and non-linear fits show that increasing GHS-20 scores are associated with unique and progressive decrements to health utility. Scores as low as 1-2 show a statistically significant decrement to health. The scoring tables provided in Appendices 2 & 3 are commended for use in population surveys to calculate an aggregate 'burden of harm' for gamblers. We intend to publish similar instruments and scoring instructions for matching instruments for those affected by another's gambling.

The item content and sub-factor structure of the GHS-20 deserve special mention. The additional selected items yield a scale that includes items from all domains of harm as conceptualised by Langham et al. (2015). As illustrated in Figure 4.2, and captured by diagnostics such as coefficient omega, although the scale is highly unidimensional, there is some detectable sub-factor structure. Thematic clustering can be seen with respect to reallocation of time from other life commitments, financial impacts, and psychological distress. The first two clusters map onto the two theoretical mechanisms by which harm from gambling is thought to occur, which is the excessive attrition of time and money from the gambler. Other items such as social isolation and increased conflict in relationships, along with psychological distress, represent more direct impacts on health and wellbeing. Nevertheless, theoretical structure does not necessarily match with statistical structure: a person experiencing gambling-related harm is likely to experience symptomatology across all domains. Whilst we would not discourage research on specific harm domains, all psychometric evidence on the GHS-10 (formerly SGHS) and GHS-20 points to a unitary structure.

A note of caution should be sounded regarding the interpretation of raw correlations reported for descriptive purposes in this study. Harms from gambling vary markedly in their prevalence, with lower prevalence tending to be indicative of more severe gambling problems and greater impact to health utility. To illustrate, given two binary items with identical and equal correlations with an outcome of interest, if item (A) has a prevalence of 1 in 1000 and (B) has a prevalence of 1 in 10, then (B) would explain approximately 100 times more variance in a population-representative sample, and is far more desirable from a psychometric perspective. In short, all else being equal, more prevalent items provide more information about an outcome. The lasso regression item-selection approach taken in this paper, which also considers inter-item redundancy (i.e. common covariation with the outcome), is therefore the preferred benchmark for item evaluation.

The principal contribution of this work is to provide a new scale for gambling-related harm, the GHS-20, that covers all dimensions of harm identified by Langham et al. (2015), while also providing a metric for how scores on the scale imply a decrement to a gambler's health and wellbeing. Having a wide representation of the different types of harm will give end-users confidence in employing a comprehensive measure that is well-related to meaningful health outcomes and the PGSI. Having a measure of harm, like the GHS-20, that is related to gambling problems but is conceptually independent of gambling as a mental health condition provides unique advantages. Measuring harm independently of mental illness allows for a quantification of the harm experienced by people with different levels of comorbidities, but also provides for a recognition that it is at least possible to experience gambling-harm without having a mental health condition. This brings gambling studies into line with other health-related fields, which recognise that people can experience harm from (e.g.) alcohol and drug use without necessarily having a substance dependency. Such an endeavour is not 'lowering the bar' for gambling problems, but rather recognising that health-related impacts can impact, to varying degrees, a broader class of gamblers.

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Chapter 5. The 10-item and 20-item Gambling Harms Scale for Affected Others (GHS-10-AO, GHS-20-AO): Benchmarked to health utility using propensity weighting and control for comorbidities

5.1 Introduction

Gambling-related harms can significantly impact not only the lives of gamblers, but also those who have close or mutually supportive relationships with them. These individuals are often termed 'affected others' (AOs) or 'concerned significant others' (CSOs). Whilst there is evidence that the number of AOs almost certainly greatly exceeds that of affected gamblers (Goodwin et al., 2017), little progress has been made to quantify this impact in terms of health and wellbeing (Browne et al., 2021). Thus, there is a clear need for a population screen for harm to AOs that can be scored with respect to a common metric of health utility, and therefore be directly comparable to the measured impacts experienced by gamblers.

There has been increasing interest in understanding the types, nature and extent of harms experienced by AOs (Castrén et al., 2021; Ferland et al., 2021; Hing et al., 2022; Lind et al., 2022). Being an AO is associated with a range of health and wellbeing issues including psychological distress, depression and anxiety (Castrén et al., 2021; Chan et al., 2016; Dannon et al., 2006; Salonen et al., 2016; Svensson et al., 2013; Wenzel et al., 2008), poor physical health due to stress such as headache and digestive problems (Chan et al., 2016; Lorenz & Yaffee, 1988; McComb et al., 2009) and lower subjective wellbeing (Tulloch et al., 2021).

AOs, like gamblers, can experience a range of harms across multiple domains. These include financial harms, relationship harms (e.g. disruption, conflict, separations), emotional or psychological harms (e.g. worry, psychological distress), harms to physical health, cultural harms, harms that impact work or study, and criminal activity (Langham et al., 2016). However, while AOs appear to experience harms across similar domains to that of gamblers, their specific experiences often differ in type and severity. Li et al. (2017) compared a large number of harms between gamblers and AOs and found some marked differences in these two groups' experiences. For example, even though both gamblers and AOs experienced negative psychological impacts, "feelings of regret and shame were reliable early indicators of harms for gamblers themselves, whilst feelings of anger and hopelessness were among the negative emotions that tended to be first felt by those affected" (Li et al., 2017, p. 241). This implies that a measure of harm to gamblers based on specific symptomatology, such as regret and shame, cannot be simply transposed to assess AOs.

While some scales have been developed to explicitly measure harms to AOs, they have not been adequately validated or widely adopted. For example, Dowling and colleagues (2014) developed the Problem Gambling Significant Other Impact Scale and a version of the Problem Gambling Family Impact Measure for family members of people experiencing a gambling problem (Dowling et al., 2016). However, these were designed for specific purposes and do not appear to have been widely utilised for other research purposes. Two other measures with relatively little uptake include the 16-item Family Member Impact Scale (FMI; Orford et al., 2005, 2017) and the 43-item Inventory of

Consequences Scale (Hodgins et al., 2007). The FMI which was originally designed to assess the impact due to a family member's drinking or drug use, and has since been adapted for use by family members of someone with a gambling problem (Chan et al., 2016). The ICS not only assesses emotional and behavioural consequences to affected others, but also consequences to the gambler (e.g. Over the past month, how often … Has he/she felt bad after gambling). Although the inventory captures a wide range of consequences, the length taken to administer all 43 items may be inefficient to use as a screening tool or brief form of assessment.

Salonen et al. (2016) developed a gambling harms list using options identified from the literature and professional consultation. The 11 items included two financial harms, two relational harms, three emotional harms, three social harms, and one health and work harm, and an open-ended 'any other harm' option. These items were intended to be used individually to describe harms, however, and were not formally developed as a scale. The list has been more recently used by Lind et al. (2022) and Castren et al. (2021), who added an additional work/study harm item. Both studies found that the most reported harms were in the financial, emotional, and relationships domains. Most critically, none of the scales developed to assess harm to AOs can be scored with respect to a quantifiable metric of impact to health and wellbeing. This leads to ambiguity and debate in the field regarding whether reported symptomatology entails a meaningful impact, as well as suggestions that prevalence-based interpretations may be 'lowering the bar' for classifying someone as an AO (Delfabbro & King, 2019).

Recently, the Short Gambling Harms Screen for Concerned Significant Others (SGHS-CSO; ACIL Allen Consulting et al., 2017) was developed for use in a Tasmanian prevalence survey. The 10 items were identified via statistical criteria to maximise the sensitivity of the screen. The final screen included two financial harms, three relational harms, three emotional harms, and one each for work/study and deviance. The authors employed a somewhat novel elicitation protocol, using a sequential Time Trade Off task, administered by Computer Assisted Telephone Interviewing (CATI) directly to affected individuals. Although the results were highly suggestive of the SGHS-CSO indicating meaningful health utility impacts, the authors note methodological limitations that entail that the results must be regarded as preliminary. Nonetheless, Hing et al. (2022) recently utilised the SGHS-CSO in a large, nationally representative gambling study in Australia. The findings indicated around 6 per cent of respondents had been harmed by another person's gambling. The most common harms were emotional, relational and financial, consistent with those found using Salonen et al.'s (2016) harm items.

In addition to academic research, Australian state and territory prevalence surveys have employed a variety of items measuring harms to AOs. For example, (Acil Allen Consulting et al., 2017; Rockloff et al., 2020; Woods et al., 2018). The development of a standardised measure has the potential to enhance consistency across future prevalence surveys.

Arguably the most important recent development in assessment of harms to gamblers themselves has been the validation of the 20-item Gambling Harms Screen (GHS-20) and the SGHS (now re-labelled GHS-10) (see Chapters 3 & 4). These were benchmarked with respect to the WHOQOL-BREF and the SF-6D: two leading and well-accepted self-report measures of health and wellbeing (World Health Organization, 1996; Brazier et al., 2004). The SF-6D yields health utility scores on a 0-1 metric scale, and can be aggregated across individuals to yield an index of aggregate population impact. Inference for direct causal impact of harm symptomatology to health utility decrements is established via propensity weighting and controlling for comorbidities (see Chapter 2).

The present paper aims to develop corresponding scales to the GHS-10 and GHS-20 for affected others (as opposed to gamblers), using an identical measurement framework, such that they can be

scored with respect to a common metric of health utility. This effort clears the way, for the first time, to measure total gambling harm in populations accruing both to gamblers and the people around them.

5.2 Method

At the outset we determined that the new scales: GHS-10-AO and GHS-20-AO would comprise 10 and 20 items, to match the existing scales for gamblers. These new scales are also designed to be short so that they can be used in studies where space is at a premium, such as for use in a telephone or online survey. In the sections below we describe the feeder items used, and the psychometric process for selecting items, validating the sum score with respect to internal reliability and external validity checks, and benchmarking scores to health utility.

5.2.1 Participants

Ethical approval was obtained from the CQU Human Research Ethics Committee (#22341) and an online survey was launched in late 2020. Participants were recruited via a commercial panel in exchange for points which they could then use to redeem rewards. Recruitment occurred as part of a larger project targeting gamblers, affected/unaffected others, and a control sample of individuals who were neither gamblers or affected/unaffected others. Full details of the methodology are reported elsewhere (see Chapter 4). In summary, for the sample of interest in the current study (affected/unaffected others) participants were required to reside in Australia, be aged 18+ years, and have had a close relationship with someone who gambled (excluding gambling only on raffles, lottery tickets, or instant scratch tickets) in the past 12 months. As describe in the analysis section below, a reference group with no harms was critical to the analysis plan. To enable the recruitment of unaffected others it was necessary the screening criteria only include reference to a close relationship with a gambler (as opposed to a 'problem gambler' for example). A close relationship was defined as: *often a family member, a relationship in which you know each other well, in which you care about each other, and in which you depend on each other*. People residing in the state of Victoria were excluded due to the numerous Covid-19 lockdowns during the study period, which limited opportunities for venue-based gambling. Soft-quotas for age (18-29, 30-44, 45+ years) and gender were implemented, and a total of 2018 participants met all eligibility criteria and were included in subsequent analysis. Of these 2018, 572 participants (28.3 per cent) reported 0 harms, and 1446 (71.7 per cent) reported 1+ harms from the possible set of 24 gambling-harm items. About half (N = 1032, 51.1 per cent) reported 5 or more harms. This relatively high incidence of at least some negative consequences from another's gambling is consistent with the high rate of gambling problems generally found in online panels (Russell et al., 2022). Nevertheless, in a population representative survey, Lind et al. (2022) found that 65 per cent of participants (those who had a significant other with problems with gambling) reported at least one harm in their list.

5.2.2 Measures

Participants reported on their demographic characteristics including gender, age, country of birth, Aboriginal or Torres Strait Islander origin, residence, education, employment, marital status, household, and income. Table 5.1 reports this information separated out by participants who reported no harms vs those who reported 1+ harms.

Table 5.1. Descriptive statistics for participants by harm status

Variable	Reference No harms nominated n (%)	Affected 1+ harms nominated n (%)
Total	**572 (100)**	**1446 (100)**
Gender		
Male	215 (37.6)	651 (45.0)
Female	356 (62.2)	791 (54.7)
Other	1 (0.2)	4 (0.3)
Mean age (SD [years])	44.27 (17.50)	38.21 (14.92)
Country of birth		
Australia	455 (79.5)	1208 (83.5)
Other	117 (20.5)	238 (16.5)
Main language spoken at home		
English	552 (96.5)	1350 (93.4)
Other	20 (3.5)	96 (6.6)
Aboriginal or Torres Strait Islander origin		
No	552 (96.5)	1292 (89.3)
Yes	20 (3.5)	154 (10.7)
State/Territory of residence		
New South Wales	222 (38.8)	669 (46.3)
Queensland	172 (30.1)	378 (26.1)
South Australia	76 (13.3)	145 (10.0)
Tasmania	19 (3.3)	37 (2.6)
Northern Territory	1 (0.2)	8 (0.6)
Australian Capital Territory	10 (1.7)	35 (2.4)
Western Australia	72 (12.6)	174 (12.0)
Highest educational qualification		
No schooling	-	1 (0.1)
Did not complete primary school	1 (0.2)	1 (0.1)
Completed primary school	7 (1.2)	13 (.9)
Year 10 or equivalent	51 (8.9)	95 (6.6)
Year 11 or equivalent	13 (2.3)	40 (2.8)
Year 12 or equivalent	103 (18.0)	233 (16.1)
A trade, technical certificate or diploma	180 (31.5)	357 (24.7)
A university or college degree	157 (27.4)	431 (29.8)
Postgraduate qualifications	60 (10.5)	275 (19.0)
Work status		
Work full-time	207 (36.2)	732 (50.6)
Work part-time or casual	121 (21.2)	310 (21.4)
Full-time student	29 (5.1)	69 (4.8)
Unemployed and looking for work	25 (4.4)	76 (5.3)
Full-time home duties	39 (6.8)	87 (6.0)
Retired	120 (21.0)	109 (7.5)
Sick or on a disability pension	13 (2.3)	41 (2.8)
Other	18 (3.1)	22 (1.5)
Occupation		
Manager	91 (15.9)	346 (23.9)
Professional	134 (23.4)	369 (25.5)
Technician or trade worker	32 (5.6)	88 (6.1)
Community or personal service worker	43 (7.5)	99 (6.8)
Clerical or administrative worker	110 (19.2)	198 (13.7)
Sales worker	74 (12.9)	168 (11.6)
Machinery operator and driver	12 (2.1)	30 (2.1)
Labourer	46 (8.0)	85 (5.9)
Small business operator	30 (5.2)	63 (4.4)
Marital status		
Single or never married	129 (22.6)	389 (26.9)
Separated or divorced	28 (4.9)	117 (8.1)
Widowed	6 (1.0)	18 (1.2)
Married or living with partner (de facto)	409 (71.5)	922 (63.8)
Household composition		
Single person	70 (12.2)	238 (16.5)
One parent family with children	26 (4.5)	147 (10.2)

Couple with children	226 (39.5)	625 (43.2)
Couple with no children	217 (37.9)	308 (21.3)
Group household (i.e. living with two or more people to whom you are NOT related)	33 (5.8)	128 (8.9)
Annual personal income		
$0 to $19,999	110 (19.2)	197 (13.6)
$20,000 to $39,999	125 (21.9)	264 (18.3)
$40,000 to $59,999	115 (20.1)	257 (17.8)
$60,000 to $79,999	83 (14.5)	233 (16.1)
$80,000 to $99,999	63 (11.0)	163 (11.3)
$100,000 to $119,999	23 (4.0)	99 (6.8)
$120,000 to $139,999	14 (2.4)	71 (4.9)
$140,000 to $159,999	15 (2.6)	80 (5.5)
$160,000 to $179,000	10 (1.7)	31 (2.1)
$180,000 or more	14 (2.4)	51 (3.5)
Annual household income		
$0 to $19,999	23 (4.0)	77 (5.3)
$20,000 to $39,999	69 (12.1)	158 (10.9)
$40,000 to $59,999	99 (17.3)	195 (13.5)
$60,000 to $79,999	60 (10.5)	184 (12.7)
$80,000 to $99,999	80 (14.0)	180 (12.4)
$100,000 to $119,999	66 (11.5)	180 (12.4)
$120,000 to $139,999	49 (8.6)	128 (8.9)
$140,000 to $159,999	38 (6.6)	145 (10.0)
$160,000 to $179,000	24 (4.2)	77 (5.3)
$180,000 or more	64 (11.2)	122 (8.4)
Residence		
Capital city and surrounds	349 (61.0)	1005 (69.5)
Regional town with more than 10,000 persons	171 (29.9)	345 (23.9)
A rural or remote location	52 (9.1)	96 (6.6)
Relationship to gambler		
Current spouse/partner	227 (39.7)	370 (25.6)
Former spouse/partner	12 (2.1)	106 (7.3)
Father or Father in-law	38 (6.6)	113 (7.8)
Mother or Mother in-law	33 (5.8)	72 (5.0)
Son	28 (4.9)	46 (3.2)
Daughter	9 (1.6)	25 (1.7)
Sister/brother	49 (8.6)	123 (8.5)
Grandparent	8 (1.4)	25 (1.7)
Other family member or relative	37 (6.5)	137 (9.5)
Friend	94 (16.4)	345 (23.9)
Work colleague	13 (2.3)	60 (4.1)
Other	24 (4.2)	24 (1.7)

Gambling harms experienced due to someone else's gambling were assessed using 24 binary-scored items (Table 5.2) covering six domains of harm (financial [4-items], relationship [6], emotional/psychological [5], health [3], work/study [3], and social deviance [3]). When completing the survey, participants were reminded to answer the questions based on the person whose gambling negatively affected them *the most*. This ensured the participant only reflected on one person when completing all harms items. The selection of the 24-items used was guided by earlier formative work (ACIL Allen Consulting et al., 2017; Li et al., 2017; Hing et al., 2022) on the basis of item prevalence among AOs, and item content suitability for an AO-specific measure. This prior work established that harms to AOs varied markedly in terms of their prevalence, and also in terms of their relationship to the latent factor of harm, and the PGSI. Symptomatology that is 'idiosyncratic', with low prevalence and low mutual associations with other harms or the PGSI is highly unlikely to contribute to a scale with good psychometric properties. For example, 'bankruptcy' not included for evaluation, based on possessing a discrimination parameter of only 1.37, a prevalence of only 3.7 per cent even for those affected by problem gamblers, and a correlation with the PGSI of .08.

Table 5.2. Abbreviations, full item content, and domain categories of candidate gambling harm items

Abbreviation	Item	Domain
Red. Spending	Reduction of my available spending money	Financial
Red. Savings *	Reduction of my savings	Financial
Late Bills **	Late payments on bills (e.g. utilities, rates)	Financial
Red. Ess. Exp.+	Less spending on essential expenses such as medications, healthcare and food	Financial
Time+	Used my work or study time to attend to issues caused by their gambling	Work/Study
Red. Perf. **	Reduced performance at work or study (i.e. due to tiredness or distraction)	Work/Study
Lack Prog.	Lack of progression in my job or study	Work/Study
Red. Sleep Worry **	Loss of sleep due to stress or worry about their gambling or gambling-related problems	Health
Stress Prob. **	Stress related health problems (e.g. high blood pressure, headaches)	Health
Dep. **	Increased experience of depression	Health
Hopeless. **	Feelings of hopelessness about their gambling	Emo/Psych
Escape *	Thoughts of running away or escape	Emo/Psych
Anger **	Felt angry about not controlling their gambling	Emo/Psych
Distress *	Felt distressed about their gambling	Emo/Psych
Vulner.	Felt insecure or vulnerable	Emo/Psych
Red. Enjoy **	Got less enjoyment from time spent with people I care about	Relationships
Belittle *	Felt belittled in my relationships	Relationships
Red. Events	Spent less time attending social events (non-gambling-related)	Relationships
Inc. Tension *	Experienced greater tension in my relationships (suspicion, lying, resentment, etc.)	Relationships
Inc. Conflict *	Experienced greater conflict in my relationships (arguing, fighting, ultimatums)	Relationships
Threat End. **	Threat of separation or ending a relationship/s	Relationships
Violence *	Had experiences with violence (including family/domestic violence)	Soc. Deviance
Chil. Negle. *	Didn't fully attend to the needs of children	Soc. Deviance
Took Mon. **	Took money or items from friends or family without asking first	Soc. Deviance

Note: ** Non-zero lasso regression coefficient (top 10 items: GHS-10-AO), * Non-zero lasso regression coefficient (ranked 11-18 & included in GHS-20-AO), + additional items included in the GHS-20-AO. See Table 5.4 for lasso regression coefficients.

Quality of life was assessed using the WHOQOL-BREF (World Health Organization, 1996): The WHOQOL-BREF is a 26-item measure developed by the World Health Organization (WHO) and each item is measured on a five-point scale. The first two items assess general quality of life. The remaining 24-items cover four domains including physical health, psychological, social relationships, and environment. After reverse scoring and transforming the relevant items, total scores for the four domains can range from 4 to 20. A higher score represents higher levels of quality of life for a given domain. An average quality of life score was also computed using equally weighted scores from each of the four domains.

The SF-6D is a measure of *health utility* and has been used to assess numerous health conditions (Brazier et al., 2004). It is derived from the SF-12 self-report survey (Burdine et al., 2000) and the SF-6D measures six domains including physical functioning, role limitations, social functioning, pain,

mental health, and vitality. Resulting health utility coefficients can range between 0.345 and 1.000 (Hunger et al., 2011).

Several single-item indicators were also measured relating to smoking frequency, recreational drug use, and being diagnosed with a mood, anxiety, personality, or other mental health disorder (separate binary indicators). Excessive alcohol consumption was measured using the three-item AUDIT-C (Reinert & Allen, 2002).

5.2.3 Analysis

The R statistical programming environment was used for all analyses (R Core Team, 2020). The psychometric process for item selection was largely identical to that described for the GHS-20 (Chapter 4), and followed a framework that is explained and justified in detail elsewhere (Chapter 2). However, it differed in that relatively few candidate items were available to choose from: only 24 passed our screening criteria of being suitably prevalent in prior surveys. Also, the GHS-20 was developed as a superset of the GHS-10 (SGHS), which already existed, so no item selection was done for the first 10 items, only benchmarking. Thus, item selection for the AO versions followed a converse pattern: the best 10 performing items were selected on statistical criteria for GHS-10-AO, but only 4 selection degrees of freedom were available for the GHS-20-AO. Thus, the item content of the latter was principally (but not entirely) determined a-priori. However, a similar benchmarking process was followed for both scales.

Briefly reprising the measurement framework described in Chapter 2, the principal objective is to establish an argument for a direct causal link between a given self-report gambling screen and an external measure of health utility, such as the SF-6D. For gambling harm measures, the definition of harm involves a decrement to one's health and wellbeing. Thus, health utility also provides the key validation metric for item selection and external validity. Genuine experiments, in which one group is 'given' gambling problems / harms, and then compared to a control group, are obviously neither practical nor ethical. However, something conceptually similar can be accomplished via a quasi-experimental methodology. First, two groups are distinguished in terms of whether they currently experience harm from gambling. Individuals within these groups are then weighted proportional to their *propensity* to experience harm (inversely in the case of the harmed group), based on probabilities estimated from a multivariate regression model. It is important to identify and include as many risk factors as possible in this model. This weighting then should largely balance out *selection effects*; i.e. exogenous factors that may lead to one being harmed. Using this weighted dataset, another regression is used to predict health utility from the harms measure, while also controlling for known comorbidities that might lead to health decrements. Thus, the approach leads to a far more conservative estimate than a simple association that can be subject to these aforementioned confounds. Further, since participants were not required to make a subjective judgement about the impact of gambling, and indeed were unaware that the purpose of the study was to estimate this relationship, calculated health utility decrements are not subject to inflation due to perceived stigma or other response framing biases.

For item selection, the above framework can be easily modified such that individual candidate items, rather than a scale sum, are used in the second step. For convenience, we first remove estimated effects of comorbid conditions, and calculate unique effects of each candidate item via regression on the residuals. It is also convenient to employ the *lasso* (Tibshurani, 1996), a regularised variant of regression, that also allows the user to restrict coefficients to be zero or negative. These two properties make the beta coefficients far more interpretable in terms of their relative importance in

explaining unique decrements in the outcome. In sum, item selection is done via a method that aligns precisely with the definition of gambling-related harm: life outcomes caused by gambling that leads to measurable decrements in an external benchmark of health and wellbeing.

Finally, internal reliability of the candidate item sets was investigated using coefficient *omega*, a modern reliability metric that also encompasses unidimensionality (Flora, 2020). This coefficient is closely related to hierarchical factor analysis, in which a common underlying general factor is proposed, along with 3 or more 'nuisance' sub-factors, which describes any residual correlations among items; for example, due to similar item content or lack of unidimensionality. For completeness, we also employ latent trait modelling using the *ltm* package (Rizopoulos, 2006), which describes the properties of items in terms of their severity and discrimination with respect to a latent general factor of harm. We used the R statistical programming environment (R Core Team, 2020) for all analyses.

5.3 Results

Figure 5.1 displays the matrix of tetrachoric correlations between the 24 AO harm items evaluated. Items are sorted such that those with higher mutual correlations are placed close together. The magnitude and direction of the correlations were quite homogenous, with a minimum inter-item correlation of .58, maximum = .83, mean = .66, SD = .08 and IQR [.62, .69]. To make the pattern visually informative, a three-level colour scaling was applied centred at 0.50. Certain pairs (located adjacent in Figure 5.1) had particularly strong inter-correlations, likely due to similar item content, e.g. *Experienced greater conflict in my relationships (arguing, fighting, ultimatums)* and *Experienced greater tension in my relationships (suspicion, lying, resentment, etc.).* In general, some clustering was apparent around affect, relationship stress, work/study, and financial impacts.
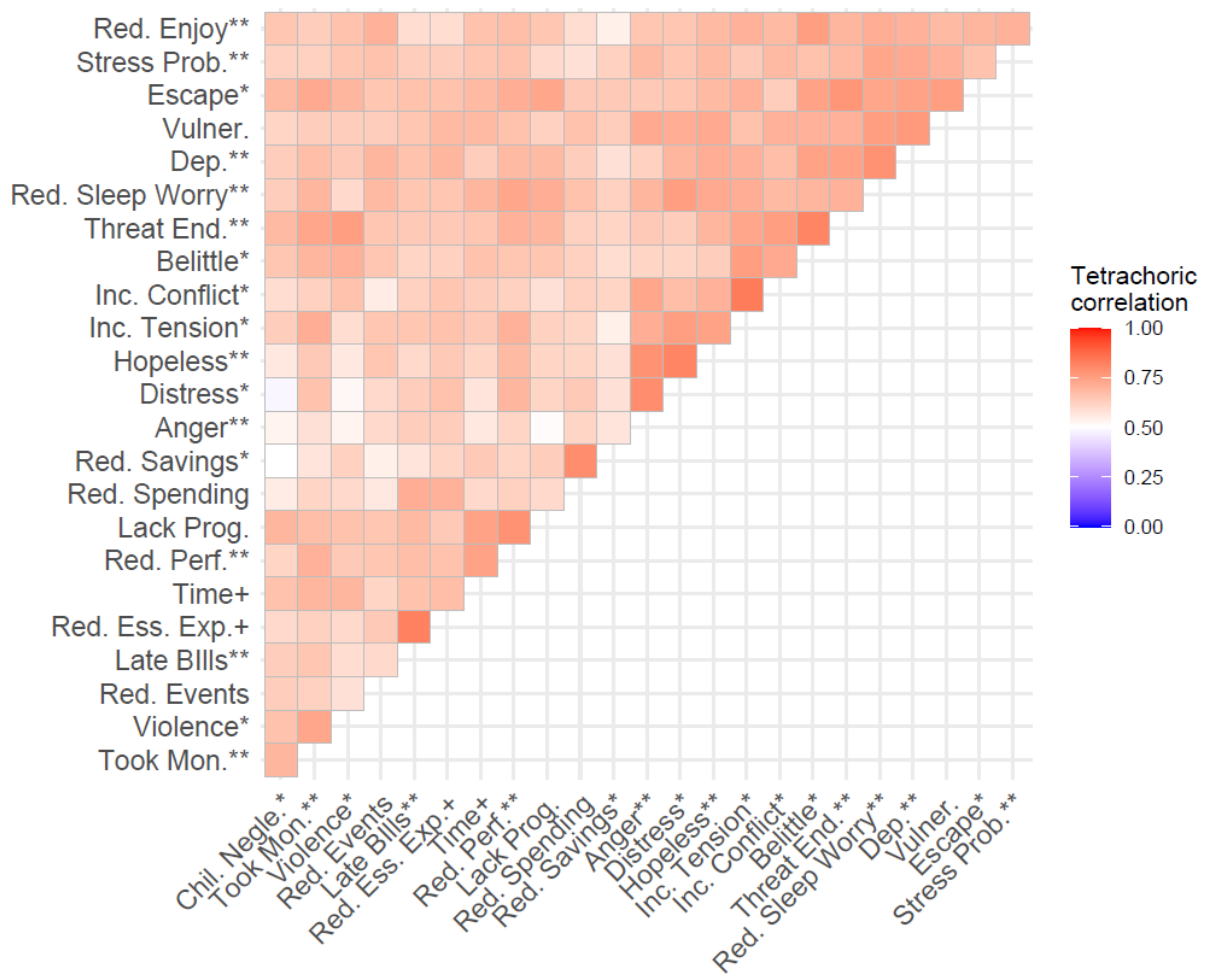
Figure 5.1. Visualisation of tetrachoric correlations among candidate gambling harm items

Examining the harm correlation matrix further, alpha reliability for the candidate set of 24 items was .98 and beta (the minimum split-half reliability) was high at .89. We calculated coefficient omega at .91, using a hierarchical factor analysis with one general factor and four 'nuisance' subfactors, with loadings shown in Figure 5.2. All items loaded strongly on the general factor (.74 - .83), and relatively lower on subfactors (.20 - .51), with eigenvalues of the factors as follows: g: 14.69, F1:0.96, F2: .67, F3: 0.68, F4:.058. Although the sub-factors accounted for very little pseudo-variance (<1.0), the loading structure appeared clearly related to the item content: F1: psychological and emotional distress, F2: time reallocation from other life commitments, F3: relationship stress, F4: financial impacts. In sum, the original 24 item set was very reliable and unidimensional, the loadings on the general factor were uniformly high, and limited sub-factor structure was found relating to different life domains of impact.

Figure 5.2. Hierarchical CFA general and subfactor loading for candidate harm items
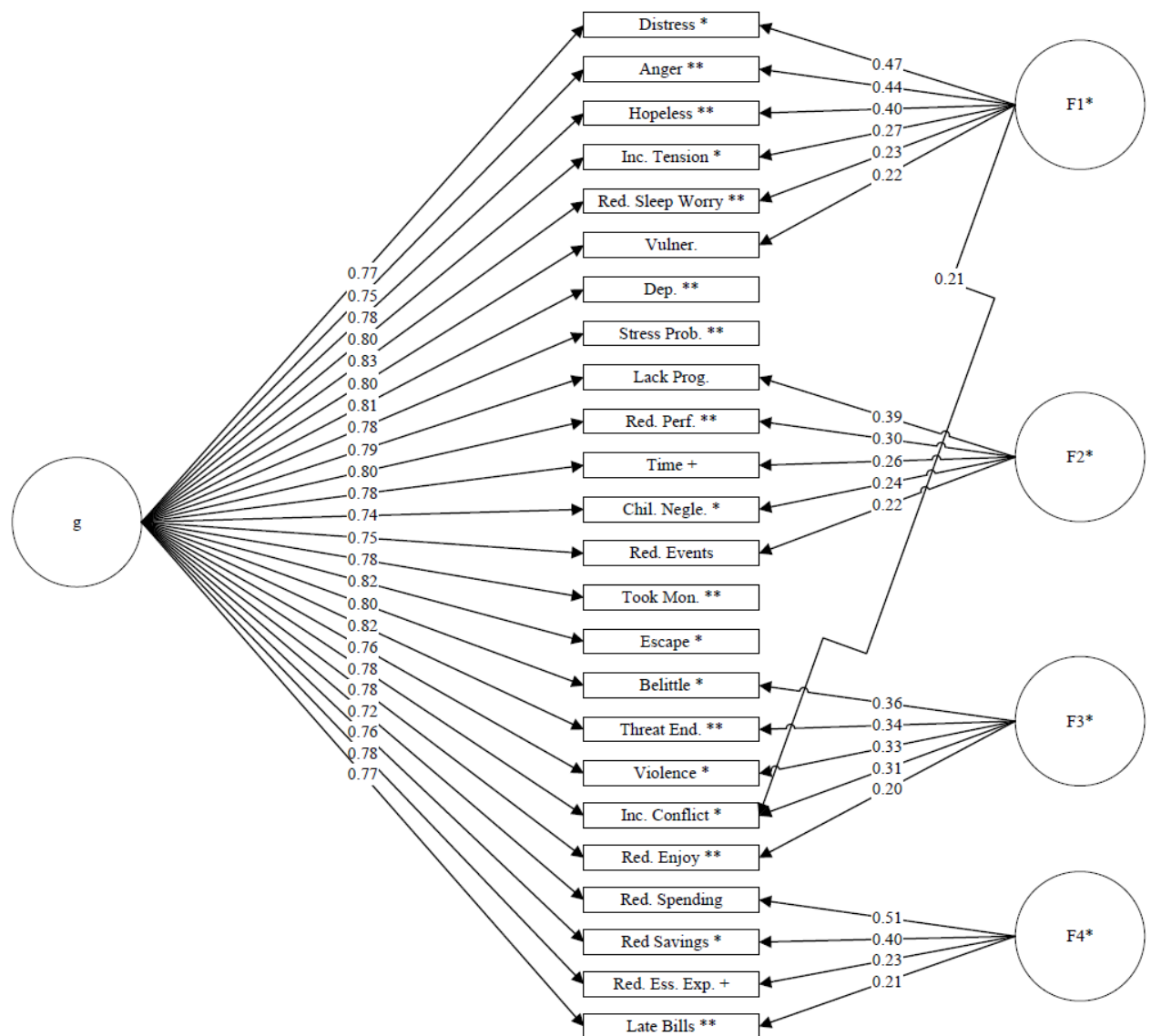
Further details on item performance are provided by latent trait modelling and summarised in Table 5.3. The table describes the point-biserial correlation of each item with the latent factor $r(\Theta)$, correlation of each item with the external benchmark of health utility r(SF-6D), as well as severity and discrimination parameters. Consistent with the factor analysis, there was a high degree of homogeneity among items with respect to correlations with the latent factor, and there was also a remarkable degree of homogeneity with respect to bivariate correlations with the SF-6D. However, items that were more prevalent and less severe (e.g. *Reduction of my savings*) tended to have slightly lower correlations with both the latent factor and the SF-6D benchmark. In noting this, it should be borne in mind that all else being equal, less prevalent items possess less information than more prevalent items. That is, a perfectly discriminant item at the very upper end of the severity spectrum discriminates among fewer cases than a moderately good discriminant item in the centre of the spectrum. Nevertheless, the candidate items appeared to be located at a broad range of severities; ranging from *Felt distressed about their gambling*, at the lower bound, to *Had experiences with violence (including family/domestic violence)*, at the upper end of the severity spectrum.

Table 5.3. Summary of LTM parameters for candidate gambling harm items

	$r(\Theta)$	r(SF-6D)	2P(α)	2P(β)	N
Red. Spending	.44	-.29	-0.73	1.87	778
Red. Savings*	.40	-.30	-0.99	1.77	695
Late Bills**	.48	-.31	-1.89	2.28	523
Red. Ess. Exp.+	.47	-.31	-1.45	2.30	629
Red. Perf.**	.53	-.35	-1.97	2.52	536
Time+	.50	-.31	-2.44	2.49	434
Lack Prog.	.50	-.32	-2.45	2.43	424
Distress*	.46	-.33	-0.47	2.26	875
Anger**	.41	-.28	-0.74	2.14	797
Hopeless**	.52	-.32	-0.99	2.41	752
Vulner.	.54	-.33	-1.51	2.63	652
Escape *	.57	-.35	-2.36	2.91	505
Red. Sleep Worry**	.56	-.35	-1.33	2.72	700
Stress Prob.**	.50	-.32	-1.70	2.41	584
Dep.**	.54	-.39	-1.37	2.70	690
Inc. Tension*	.53	-.35	-1.00	2.54	761
Inc. Conflict*	.49	-.31	-1.18	2.41	707
Red. Events	.45	-.28	-1.43	2.06	607
Red. Enjoy**	.51	-.34	-1.40	2.31	643
Belittle*	.55	-.34	-2.10	2.71	534
Threat End.**	.59	-.34	-2.42	3.06	512
Took Mon.**	.52	-.35	-2.46	2.46	427
Violence *	.47	-.33	-2.73	2.33	359
Chil. Negle.*	.44	-.30	-2.31	2.10	407

	Correlations				
	$r(\Theta)$	r(SF-6D)	2P(α)	2P(β)	N
$r(\Theta)$	-	-.78	-.38	.95	-.21
r(SF-6D)		-	-.24	-.74	.09
2P(α)			-	-.44	.98
2P(β)				-	-.24

Note: $r(\Theta)$ correlation with the latent harm factor, r(SF-6D) correlation with the SF-6D, 2P(α) the intercept or severity parameter, 2P(β) the slope or discrimination parameter, N the number of positive responses recorded in the present dataset, ** Non-zero lasso regression coefficient (top 10 items: GHS-10-AO), * Non-zero lasso regression coefficient (ranked 11-18 & included in GHS-20-AO), + additional items included in the GHS-20-AO. See Table 5.4 for lasso regression coefficients.

All 24 harm items were included in five lasso regressions predicting the residual scores on the SF-6D and each subscale of the WHOQOL-BREF, after removing variance explained by socio-demographic factors (gender, age[3rd degree polynomial], country of birth, being unable to work due to a disability, illicit drug use, tobacco consumption, and the presence of a clinically diagnosed mental disorder excluding gambling problems), with a non-positive constraint on beta coefficients. Regularised coefficients are displayed in Table 5.4, sorted with respect to average magnitude. A total of 18 items yielded non-zero unique effects on at least one of the outcomes. It should be emphasised that the regularisation process entails that the estimates are conservative and take into account information

provided by all other items. Thus, while it provides a convenient procedure for ranking and selecting items, caution should be exercised in interpreting relative magnitudes of coefficients. The items with the largest average magnitudes were selected to comprise the GHS-10-AO, and a further 8 items with non-zero coefficients were selected for the GHS-20-AO. A final two items were selected by the authors for the GHS-20-AO from the remaining 6 items, based principally on maximising coverage of under-represented domains (financial and work/study). Of the financial items, the more severe item *Less spending on essential expenses such as medications, healthcare and food* was chosen, on the grounds of face validity. Of the work/study items, *Used my work or study time to attend to issues caused by their gambling* was selected based on being a more immediate outcome of gambling, as compared to *Lack of progression in my job or study*.

Table 5.4. Penalised lasso coefficients for simultaneous regressions predicting health and quality of life outcomes on candidate harms

Harms			Outcome				
Category	Item		SF-6D	WHOQOL-BREF			
				Phys.	Psych.	Relations.	Environ.
Health	Dep.	**	-0.06	-0.11	-0.13	-0.10	-0.14
Relationships	Red. Enjoy	**	-0.08	-0.06	-0.03	-0.06	-0.04
Financial	Late Bills	**	0.00	0.00	0.00	0.00	-0.08
Soc. Deviance	Took Mon.	**	-0.08	0.00	0.00	0.00	0.00
Health	Red. Sleep Worry	**	-0.02	-0.06	0.00	0.00	0.00
Emo/Psych	Hopeless	**	0.00	-0.01	-0.02	-0.01	-0.02
Emo/Psych	Anger	**	0.00	0.00	-0.03	-0.03	0.00
Health	Stress Prob.	**	-0.02	-0.05	0.00	0.00	0.00
Work/Study	Red. Perf.	**	-0.06	0.00	0.00	0.00	0.00
Relationships	Threat End.	**	-0.04	0.00	0.00	0.00	0.00
Emo/Psych	Escape	*	-0.03	0.00	0.00	0.00	0.00
Relationships	Inc. Tension	*	-0.03	0.00	0.00	0.00	0.00
Relationships	Inc. Conflict	*	0.00	0.00	0.00	-0.03	0.00
Relationships	Belittle	*	0.00	0.00	0.00	0.00	-0.03
Financial	Red. Savings	*	-0.02	0.00	0.00	0.00	0.00
Emo/Psych	Distress	*	-0.02	0.00	0.00	0.00	0.00
Soc. Deviance	Chil. Negle.	*	-0.01	0.00	0.00	0.00	0.00
Soc. Deviance	Violence	*	0.00	-0.01	0.00	0.00	0.00
Financial	Red. Spending		0.00	0.00	0.00	0.00	0.00
Financial	Red. Ess. Exp.	+	0.00	0.00	0.00	0.00	0.00
Work/Study	Time	+	0.00	0.00	0.00	0.00	0.00
Work/Study	Lack Prog.		0.00	0.00	0.00	0.00	0.00
Emo/Psych	Vulner.		0.00	0.00	0.00	0.00	0.00
Relationships	Red. Events		0.00	0.00	0.00	0.00	0.00

Note: ** Non-zero lasso regression coefficient (top 10 items: GHS-10-AO), * Non-zero lasso regression coefficient (ranked 11-18 & included in GHS-20-AO), + additional items included in the GHS-20-AO.

Having completed item selection, we checked the reliability and validation performance of the two scales. Table 5.5 shows the bivariate correlations of the two scales, as well as the 'other half' of the GHS-20-AO: the set-difference of these items with the GHS-10-AO. Both halves and the GHS-20-AO showed almost identical correlations with the SF-6D (-.47 / -.48) and the WHOQOL-BREF (-.25 / -.26). The correlation between the sums of the two 10-item halves of the GHS-20-AO was .89. The coefficient alpha for the GHS-10-AO was .89, and .94 for the GHS-20-AO.

Table 5.5. Bivariate correlations of harm scales with health and quality of life measures

	GHS-20-AO	GHS20-AO*	GHS-10-AO	SF-6D	WHOQOL-BREF
GHS-20-AO	-				
GHS-20-AO* (Extra items only)	.97	-			
GHS-10-AO	.97	.89	-		
SF-6D	-.48	-.47	-.47	-	
WHOQOL-BREF	-.26	-.25	-.25	.51	-

Note: N = 2018, All correlations significant $p < .01$.

Next, we implemented the propensity and causal models to calculate the decline in AO health utility, balancing for socio-demographic risk factors and controlling for major co-morbidities. The reader is referred to Chapter 2 for a description of this framework, and Chapter 4 for a more detailed description of the implementation with respect to gamblers. Table 5.6 summarises the coefficients for these models, employing a logistic linear regression for the shared propensity model, and OLS causal models predicting health utility on the weighted dataset, using GAM smooth terms for either the GHS-10-AO and GHS-20-AO. The F-statistics in both cases were between 50 and 70, passing the threshold for significance by some margin. The slightly lower F-statistic for the GHS-20-AO can be attributed to the slightly higher number of effective degrees of freedom (edf in Table 5.6) to accommodate non-linear features in the longer scale. The GAM framework allows us to separate out the linear and non-linear (smooth) terms, and thereby test whether the fitted effect for health utility on the gambling harm scores departs significantly from linearity. For both scales, the relationship departed significantly from linearity, GHS-10-AO: F(edf = 1.283) = 0.729, p = 0.0106, GHS-20-AO: F(edf = 2.08) = 1.364, p = 0.0018. Therefore, we employed the estimates from the GAM smooth for calculating the inferred SF-6D decrements, conditional on GHS-10-AO and GHS-20-AO score. These are graphically illustrated in Figure 5.3 (dotted lines show the linear relationship for reference), and a scoring table is provided in Appendices 4 & 5, along with instructions for administration.

Table 5.6. Model summaries and beta coefficients for propensity and causal models

		Propensity Logistic P(GHS-20-AO>0)	Causal OLS SF-6D	Causal OLS SF-6D
		Smooth terms: F (edf)		
GHS-10-AO			68.2 (2.28)**	
GHS-20-AO				53.3 (3.08)**
		Linear terms: b (SE)		
Intercept		2.25 (0.27)**	0.77 (0.01)**	0.77 (0.01)**
Age	Linear	-0.03 (0.003)**	0.24 (0.12)*	0.25 (0.12)*
	Quadratic		-0.12 (0.12)	-0.11 (0.12)
	Cubic		-0.08 (0.11)	-0.08 (0.11)
Gender	Male	-	-	-
	Female	-0.26 (0.12)*	-0.02 (0.001)**	-0.01 (0.001)**
Location	Metro	-		
	Regional	-0.29 (0.12)*		
	Remote	-0.24 (0.20)		
Marital status	Never	-		
	Sep. / Div.	0.84 (0.25)**		
	Widowed	0.57 (0.49)		
	Married / de-facto	0.65 (0.21)**		
Household	Single	-		
	Single parent	0.36 (0.25)		
	Couple with child.	-0.52 90.24)*		
	Couple no child	-0.95 (0.24)**		
	Group h.h.	0.26 (0.24)		
Country of birth	Overseas		-	-
	Australia		-0.02 (0.001)*	-0.02 (0.001)*
Education	Secondary or less	-		
	Trade/Cert	-0.15 (0.14)		
	Tertiary	0.09 (0.14)		
	Postgrad	0.51 (0.19)**		
Personal income		0.14 (0.03)**		
Household income		-0.13 (0.03)**		
Sick /disability pension	No	-	-	-
	Yes	0.56 (0.35)	-0.12 (0.02)**	-0.12 (0.02)**
Alcohol consumption (AUDIT-C)	Non-drinker		-	-
	Non-risky		0.01 (0.01)	0.01 (0.01)
	Risky		0.01 (0.01)	0.01 (0.01)
Recreational drug use	No		-	-
	Yes		-0.05 (0.01)**	-0.04 (0.01)**
Cigarettes per day	0		-	-
	< 10		-0.01 (0.01)	-0.01 (0.01)
	10+		-0.03 (0.01)**	-0.03 (0.01)**
Past year diagnosis of psychological disorder…	Mood		-0.04 (0.01)**	-0.04 (0.01)**
	Anxiety		-0.04 (0.01)**	-0.06 (0.01)**
	Personality		-0.03 (0.01)*	-0.03 (0.01)*
	Any other		-0.02 (0.01)*	-0.03 (0.01)*
R^2			0.34	0.35

Note:* $p < 0.05$; ** $p < 0.01$
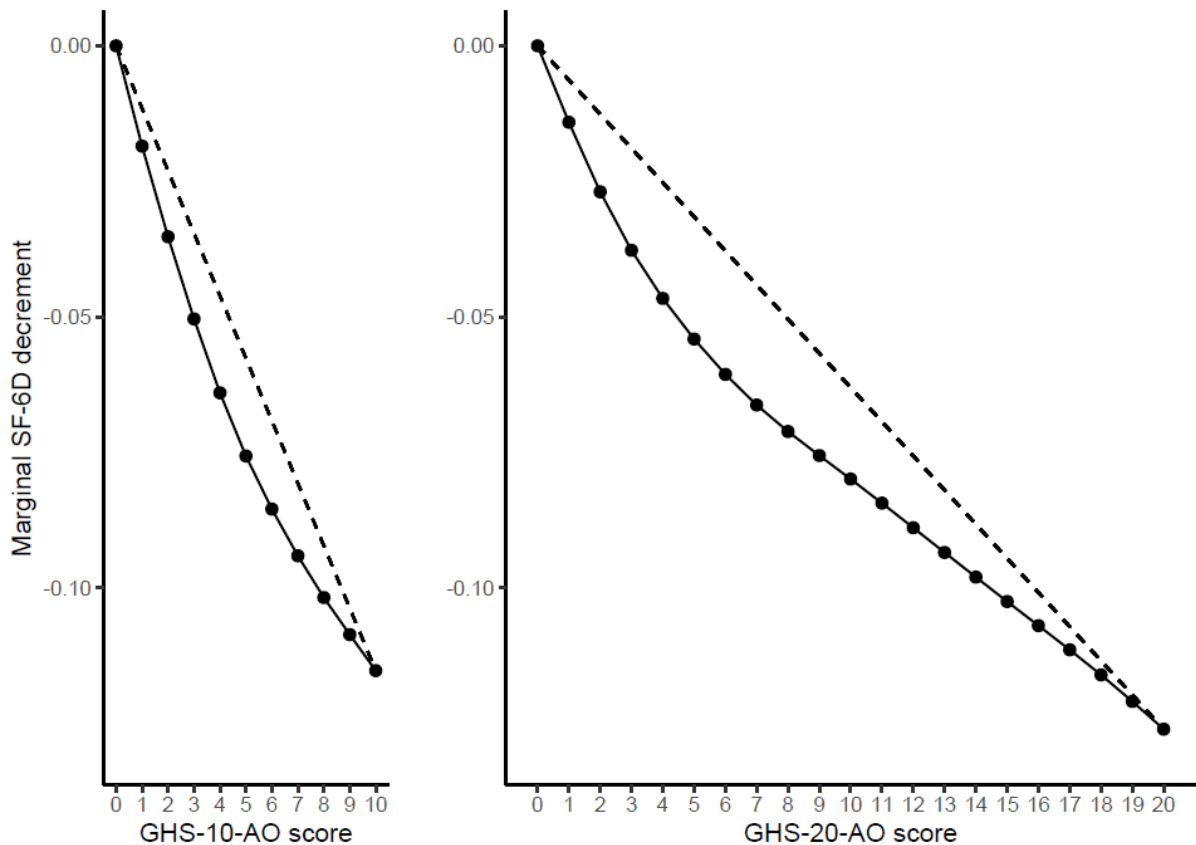
Figure 5.3. SF-6D decrements conditional on GHS-10-AO and GHS-20-AO score

Note: Dashed reference line indicates departure from linearity.

5.4 Discussion

Humans are social creatures, and we depend upon one another in mutually supportive relationships across all domains of life. Significant problems arising from gambling inexorably disrupt these connections; diminishing our capacity to provide for others and increasing the need for others' support. For AOs, psychological and emotional impacts and deterioration of the quality of their relationships inevitably follow. As outlined in the introduction, a great deal of research has described the features of gambling harm to AOs. However, this work is the first to quantify the *degree* of impact to AO health and wellbeing, conditional on impacts being reported. This formed the basis for the development and validation of a short- and long-form version of the GHS tailored to AOs: the GHS-10-AO and the GHS-20-AO.

Hitherto, it was logically possible to discount reported symptomatology from AOs as either being relatively non-impactful or being in-truth largely the result of common risk factors or co-morbidities rather than the gambling itself. It is also legitimate to note the effect of response framing and stigma towards gambling, which might lead to an AO over-reporting impact, or over-attributing the degree to which gambling was the root cause. We argue that the methods applied here effectively address all these objections. The key criterion, the SF-6D, is the most well-accepted benchmark for assessing health and wellbeing and yields a standard metric to gauge the impact of health conditions that is grounded in the concept of utility. Respondents were not required to subjectively gauge the degree to which the gambling problems were the cause of their total quality of life; these effects were

determined via statistical association. Finally, in our view, propensity case weighting and control for co-morbidities represent the most robust practical approach to estimating the unique direct effect: **GHS-*X*0-AO → SF-6D**.

The estimated conditional decrements for AO from gambling harm are somewhat like those estimated for gamblers, showing a broadly linear negative gradient with some convexity. This convexity was expected since, logically, saturation of effect must occur at some point: neither gambling problems nor their impacts can grow indefinitely. However, the gradient for AOs is somewhat less than for gamblers, in line with theory that predicts that gamblers do not 'pass on' 100 per cent of their impacts to those around them. However, since the scales employ different indicators, scores on the GHS scales, such as the GHS-20 and the GHS-20-AO, are not directly comparable, unlike the SF-6D. Family or paired studies would be required to explore the precise dynamics through which harm is transmitted to those in the gamblers' social network. The present study aimed to make a general-purpose instrument for AOs, and accordingly, although we measured a range of relationship types (e.g., spouse, adult child), this moderating factor was intentionally left out of analyses. However, the SF-6D decrement scoring provides the tool for these questions to be explored in future research.

In comparing the GHS-10 to the PGSI in the prior chapter, we established some arbitrary bands (or thresholds) to mirror the three different severity categories of the PGSI. Given there is no equivalent comparison instrument for the AO measures, such an arbitrary grouping was not done in this case. We re-iterate that all GHS measures are intended to be dimensional or continuously scored with respect to health utility, and we see little benefit at present to setting arbitrary thresholds.

Likewise, we recommend the paired use of GHS scales for gamblers and AOs in population prevalence surveys. Both instruments fill a gap in terms of an outcome- or impact-focused measure of an unhealthy relationship with gambling; representing the key metric that jurisdictions are tasked with minimising and one that is only indirectly measured by conventional gambling problems measures. The 20-item measures are most appropriate when some detail is needed about the domains of harm experienced (e.g., financial, emotional/psychological), whereas the 10-item versions are useful for saving time on survey administration. Both instruments take advantage of the metric property of SF-6D health utility scores: they may be added up into population-aggregate measurements of impact. This common metric also allows decrements to gamblers and AOs to be compared or consolidated, meaning that harm to all gamblers and all AOs can be aggregated into a single measure of Years Lived with Disability (YLD) due to gambling for the underlying population. When this is done, it will be of great interest to note the relative contribution of harm to gamblers and harm to AOs to the population-wide burden. The use of these scales would represent a significant advance over the conventional approach of monitoring the prevalence of problem gamblers for the purpose of monitoring progress towards minimising harm from gambling.

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Chapter 6. Does the lived experience of gambling accord with quantitative self-report scores of gambling related-harm?

6.1 Introduction

Previous research has used a range of quantitative methods to estimate the extent and distribution of gambling-related harm in the Australian state of Victoria (Browne et al., 2016). This research has, for example, suggested that the extent of harm for the most severely affected gamblers might be similar to that of bipolar disorder or alcohol use disorder (Browne et al., 2017). Furthermore, Browne and Rockloff (2018) have estimated that up to half of all gambling-related harm is occurring to individuals who are not problem gamblers as classified by the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). This last result occurs because the distribution of gambling-related harm is generally skewed in the population such that a substantially higher number of low- and moderate-harm gamblers exist compared to high-harm gamblers. This is an example of the "prevention paradox" from the public health field, and replicates similar findings for other disease states. For example, the distribution of heart disease in the population has the majority of incidences occurring to people who do not belong in a high-risk category but are at low risk and have heart disease simply because they are unlucky (Rose, 1992). Furthermore, another study has validated a 10-item scale for measuring gambling-related harm in the population, known as the "Short Gambling Harms Screen" (SGHS; (Browne et al., 2018). This scale is intended as a unidimensional measure of gambling-related harm. Other commonly-used problem-gambling scales such as the "Problem Gambling Severity Index" (PGSI; (Ferris & Wynne, 2001) contain items relating to behavioural addiction in addition to measuring harm and are therefore not specific to the task of measuring harm (Browne & Rockloff, 2019). Importantly for the present research, the SGHS has been subject to a number of critiques from other researchers that attempt to cast doubt on the validity of the scale for measure harm as opposed to opportunity costs (Delfabbro & King, 2019).

Any quantitative self-report measure uses a number of conceptual and statistical assumptions that can affect its ability to provide a valid measurement of the underlying construct (Rust & Golombok, 2014). For example, each item will provide different response options to a participant, such as "never", "sometimes", "most of the time", and "almost always" as used by the PGSI (Ferris & Wynne, 2001). These response options are each given a numerical score, in this case 0, 1, 2, or 3, respectively. This allows the PGSI to measure each of its nine items on a scale of severity, such as "Have you borrowed money or sold anything to get money to gamble?". In comparison, the SGHS's ten items are scored over two responses, simply "yes" and "no" (Browne et al., 2018). Researchers have therefore critiqued the SGHS for its lack of sensitivity to the severity of each of its ten harms (Delfabbro & King, 2019). Although this particular feature of the SGHS has been addressed in follow-up work which suggested that any effect of this response scale is relatively minor (McLauchlan et al., 2020), there are other potential critiques.

There are many ways a person can be harmed by their gambling, which can vary in terms of severity. Yet, as a quantitative self-report measure the SGHS provides the same weight to a "yes" response to the item, "Less spending on recreational expenses such as eating out, going to movies or other entertainment" as to the item "Felt ashamed of my gambling" (Browne et al., 2018). It is possible that the psychological distress associated with the latter, for example, is more severe than the reduction of recreational expenses associated with the former. It has been argued that several of the SGHS's

items, such as the first example item, reflect what an economist would call a rational "opportunity cost" (Delfabbro & King, 2019). In the rational actor model from economics, an individual consumer will spend their recreational budget on whatever it is that brings them the most satisfaction (Varian, 1999). If a rational consumer decides to spend $30 on a Friday evening on an electronic gambling machine, then this must be because they anticipated more satisfaction from gambling than alternative leisure activities, such as going to the movies. Therefore, it has been argued that a response of "yes" to these opportunity cost items need not correspond to genuine instances of gambling-related harm (Delfabbro & King, 2019). In response to this critique, researchers have compared the SGHS with another alternative 10-item measure of gambling-related harm with items of "unimpeachable" levels of face validity (Murray-Boyle et al., 2021). This research suggested that these "opportunity cost" harms nonetheless are efficient indicators of undeniably severe harms.

However, all of this research might be subject to another critique: that short quantitative measures might fail to accurately capture the lived experience of a condition as varied as gambling-related harm. For example, researchers have used qualitative methods to identify up to 72 unique potential harms from gambling (Langham et al., 2016). Although statistical techniques can be used to select candidate items that are the best predictors of the underlying latent construct of gambling-related harm (Browne et al., 2018), these procedures are not infallible. A short quantitative measure might produce "false positives", where someone appears to be experiencing high levels of harm but such harms are not substantive (such as from the earlier opportunity cost argument). But measures might also produce "false negatives", where someone who is actually experiencing harm scores low on the measure due to issues such as the stigma around admitting to harm. These potential issues might be especially significant with a condition as varied and multifaceted as gambling-related harm, a number of aspects of which have been highlighted by previous qualitative research (Cassidy et al., 2013; Deans et al., 2016; Hing et al., 2021; McCarthy et al., 2021; Reith & Dobbie, 2013).

The present work therefore took a mixed methods approach to use qualitative methods to validate the scores and resulting categorisations from the SGHS (see Chapter 3). The purpose of the study was to produce detailed descriptions of the lived experiences of people who are - presumably - harmed by gambling in differing degrees. If the SGHS is a valid measure of harm, the descriptions of experiences of harmed gamblers should align with their scores on the scale. Importantly, gamblers who score low on the SGHS should subjectively have some description of their lives being impacted negatively by gambling to counter the argument that some or most of these gamblers are only experiencing opportunity costs – and not harm. Should the lived experiences of participants be found to accord with the levels of harm identified by the SGHS, then this accordance would signify a form of qualitative validation of the SGHS.

6.2 Method

6.2.1 Participants

Thirty gamblers were recruited from the quantitative stage of this project (see Chapter 4). All participants had agreed to be recontacted for a telephone research interview. Recruitment criteria for the current study included being aged 18+ years, residing in Australia, having gambled[1] within the past 12 months, and providing informed consent.

The sample was stratified by SGHS (Browne et al., 2018) score to ensure it included gamblers across the harm spectrum (from no harm to high harm). We aimed to recruit approximately equal numbers across individuals who scored 0, 1-2, 3-5, and 6-10 on the SGHS. The rationale for selecting these scoring categories was based on findings from Chapter 3 which showed significant decrements for SGHS scores 1-2 (decrement of -0.020), 3-5 (-0.062), and 6-10 (-0.109) (see Chapter 3 for further information). It was important to include participants who scored zero harm as control cases and to also evaluate the potential for the SGHS measure to produce false negatives. Where possible we also aimed to have a diverse representation of ages and genders within each subsample. Characteristics of participants are presented in Table 6.1.

Table 6.1. Characteristics for gamblers

SGHS group	ID	SGHS score	PGSI score	Gender	Age
No harm	G1	0	0	M	50
	G10	0	0	M	73
	G11	0	0	M	59
	G12	0	0	F	43
	G20	0	0	M	32
	G21	0	0	M	40
	G30	0	0	F	37
Low harm	G2	2	0	F	67
	G3	2	0	F	73
	G9	2	0	M	73
	G22	1	0	F	49
	G23	1	0	F	63
	G24	1	2	F	36
	G25	2	2	M	33
	G26	1	1	F	36
Moderate harm	G5	4	1	F	39
	G6	5	5	F	71
	G13	4	8	M	48
	G16	4	8	M	31
	G18	3	5	M	52
	G19	5	6	M	55

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[1] Gambling included participating in at least one of the following activities within the past 12 months: race betting, electronic gaming machines, casino table games, sports betting, informal private betting for money, Keno, bingo, esports betting and fantasy sports betting.

	G27	3	1	M	58
	G4	6	5	M	37
	G7	7	3	F	70
	G8	7	10	M	67
High harm	G14	6	14	M	30
	G15	8	13	F	29
	G17	10	24	M	35
	G28	8	24	M	36
	G29	9	11	M	43

6.2.2 Procedure

Ethical approval for the current study was granted by the CQU Human Research Ethics Committee (#22830). Participants were invited into the study via an email which included an information sheet and informed consent information (Appendix 6). All interviews were conducted via telephone and scheduled at a time convenient to the participant. Interviews were conducted by a researcher with several years' experience in gambling research. Participants provided verbal informed consent prior to the interview and were compensated for their time with a $50 shopping voucher. Participants were also offered helpline information at debrief.

Semi-structured interviews were conducted between May and July 2021 and involved probes that encouraged the participant to describe the role that gambling played in their lives (Appendix 7). Probes included gambling's importance and its relationship relative to their hobbies, activities, and social relationships. Participants were asked to describe potential harms from gambling, as well as any positive impacts experienced from their gambling. Previous qualitative research has shown that gambling-related harm is a multidomain construct (Langham et al., 2016). Nevertheless, quantitative research has shown that of Langham et al.'s (2016) categories, "social deviance" harms such as criminality or neglect of children are substantially less common than other domains; for example financial harms (Browne & Rockloff, 2018). Furthermore, despite harms being describable across multiple domains (financial, relationship, etc.), people who experience harm in one domain are likely to also have harms in another. Measured harms are a unitary construct whereby harms do not tend to cluster within one domain but are rather just as likely to be spread across domains., Therefore, the interviews focused on financial, relationship, emotional/psychological, health, and work/study harms (Langham et al., 2016). Harms related to criminal activity were not explicitly queried due to ethical/privacy concerns. However, the interviews also gave participants opportunities to talk about impacts outside of these categories, and allowed participants the space to reflect on more general issues, such as the impact that they thought gambling had on society in general. Finally, participants were asked about the types of gambling that they had engaged in and any gambling-related harms (including items from the SGHS) they had endorsed in the previous survey from which the participants were recruited (see Chapter 4).

Interviews were digitally recorded and lasted between 15 and 53 minutes, with a mean length of 31 minutes. The recordings were transcribed and anonymised to remove any personally identifying information (e.g., names and specific locations).

6.2.3 Data analysis

Interview transcripts were imported into Nvivo software version 20 and analysed using reflexive thematic analysis (Braun & Clarke, 2019). First, the transcripts were read and reread so the analyst could familiarise themself with the data. During this stage, numerous quotes were selected for the generation of an initial set of codes, reflecting patterns of shared meaning across the data. Major themes across the entire sample of potential financial, relationship, emotional, health, and work/study harms were derived deductively, based on Langham et al. (2016) and Browne et al. (2018). However, the way that each of these themes were expressed in each individual harm group via the relevant sub theme for that group was arrived at "inductively", as being developed purely from the interview transcripts. This provisional set of themes was then discussed with other members of the research team, whose input led to further refinement in terms of the scope and interpretation of these generated themes. The analyst then used this feedback to reflect both on the set of transcripts and the generation of the themes. Given that the research team has performed a variety of previous qualitative and quantitative research on gambling related harm, an important part of this process involved the team's reflection on how their own experiences might impact the generation of themes. This inclusion of reflexivity into the theme generation process was designed to ensure that as full a spectrum of themes as possible could be generated from the data, thereby minimising the influence of overly relying on a single researcher's dominant perspective (Braun & Clarke, 2019). All authors agreed on the final set of themes. Additional steps were taken to increase the trustworthiness of the findings. The sample size was relatively large for a qualitative study, which enabled exploration of themes across different SGHS scores, and increased the likelihood of achieving saturation for themes. The triangulation in reporting across the semi-structured interviews and participants' previous self-report scores on the SGHS enhanced the dependability of the findings. It should be noted, however, that the initial thematic analysis was conducted without reference to SGHS scores in order not to introduce bias into the construction of categories. The use of direct quotes enhanced their authenticity.

Given that the research question was to explore how participants' self-reports of gambling correspond to their responses on the SGHS, the results were stratified with respect to the SGHS: no (0), low (1 or 2), moderate (3 to 5), and high (6+) harm. Table 6.1 also shows participants' PGSI scores, indicating that 12 were non problem gamblers, 5 were low risk gamblers, 5 were moderate risk gamblers, and 8 were problem gamblers (Ferris & Wynne, 2001). The Pearson pairwise correlation between SGHS and PGSI per-person total scores was 0.842, which is considered high, suggesting that the two measures were similar. Table 6.2 shows the sub themes for each harm group based on our analysis. These findings are discussed below.

Table 6.2. Sub themes for each harm group

Group	Sub themes
No harm	Gambling as just another leisure activity in financial terms
	A glue for maintaining and creating relationships
	A healthy leisure activity without emotional consequences or impact on work/study
Low harm	Gambling is still a way to build relationships
	Gambling is financially within budget, but the potential for regret appears
	Gambling can still bring emotional benefits, but also small regrets
Moderate harm	Gambling was still seen as something to bring them closer to other people
	Serious financial harms were experienced occasionally
	A range of negative emotional impacts

	Occasional health and work/study harms
	Negative effects on finances
	Emotional strains caused by loss chasing
High harm	Loss chasing affected their relationships with others
	Negative impacts on health experienced by a majority of this group
	Work/study affected for some high harm gamblers

6.3 Results

6.3.1 No harm

This group of seven gamblers reported experiencing no harms as a consequence of their gambling. Instead, they said that gambling was just another leisure activity that did not create any financial difficulties for them. Instead, gambling was a source of enjoyment for them, which they took part in due to its ability to enhance social activities and relieve stress. This is consistent with their "no harm" categorisation from the SGHS.

6.3.1.1 Gambling as just another leisure activity in financial terms

None of this group reported any issues with their household budgets in managing the financial cost of gambling against other expenses. The financial sub theme for this group could be expressed in economic terms that their expenditure on gambling was an "opportunity cost", in that it only reduced their potential expenditure on other consumer activities, to which gambling was actively preferred in the moments that it was chosen (Delfabbro & King, 2019):

> *No as I say, I don't think to me, there's any detrimental effects other than the fact that I'm wasting my money. Some people collect stamps and spend a fortune on that (G10).*

For this group, gambling was just another leisure activity, and there was no risk of spending more than they had intended to on gambling. In other words, they experienced no temptations to "chase their losses" (Zhang & Clark, 2020), and were able to keep their losses within affordable limits: '*I can afford to have a go' (G1)* and '*it's like pocket money' (G21)*:

> *Before I leave the house, I know whether I want to go or not. And if I feel like it's gonna be a problem with my finances, I don't go at all… If things were to get worse with my finances, I would easily completely change all the gambling that I'm doing (G12).*

6.3.1.2 A glue for maintaining and creating relationships

Gambling was a positive for this group when it came to their relationships with other people. This positive effect on relationships is perhaps not surprising given that in financial terms gambling expenditure represented just another leisure activity for them. Leisure activities are often enjoyed because a shared experience can bring people together. The relationship sub theme for this group was that gambling was seen as something that brought them closer to groups of people as diverse as their partner, their family members, friends, and colleagues.

For some participants, gambling brought them closer to their partner and strengthened social bonds with others. This increased closeness could occur through a shared interest and a topic of conversation and friendly banter:

I guess my husband and I have bonded a lot more over that sport [NRL] now because we can actually have a conversation about the different players and what's going on in different teams and that - outside of gambling (G30).

Colleagues and friends, and also me and my wife ... dates, we come together, clubs, the RSL, we have dinner or something and then we go into the app and put some money into horses, yeah (G21).

It's just a social thing, just something to do when you're either with people, or even if you're not … like my brother lives interstate so we'll be on the phone or something and we might put a bet on or something at the same time and just like to bond over, I guess (G20).

6.3.1.2 A healthy leisure activity without emotional consequences or impact on work/study

Given that for this group, gambling was something that could always be kept within budget and helped bring them closer to other people, there were no perceived negative emotional consequences (*"Like I don't get excited or sad or anything like that"; G11*), and could act as a way of relieving stress, just like other recreational activities:

I would say: it is fun. Say after work, some sort of an excitement and fun, socialising. Takes out all the stress from work. When I go with my wife it doesn't create any problems at all. We spend a lot of time together. It's like a fun activity that takes out all the stress (G21).

6.3.2 Low harm

The eight gamblers in the low harm group scored 1 or 2 (out of 10) on the SGHS. Their experiences were similar to the no harm group in that gambling was still seen as a fundamentally social activity which could relieve stress and came without any negative impacts on health or work/study. However, the chief novel theme in this group was that some low harm gamblers experienced some regrets over their level of financial expenditure, which had the potential to affect them emotionally.

6.3.2.1 Gambling is still a way to build relationships

As with the no harm group, most participants (five) in the low harm group saw gambling as something that brought them closer to family, friends and work colleagues:

The other positive I've had was playing 2UP on ANZAC Day with my kids and we all had a good time. I think we lost about 10 bucks in the end … it wasn't really a big gamble, but it was fun because it was ANZAC Day and it was an activity we did with the kids (G22).

For me a part is to make enough, or exaggerate enough, how the whole good feel, getting with people, laughing, being part of a crowd - when you live alone, it's significant (G2).

6.3.2.2 Gambling is financially within budget, but the potential for regret appears

Gambling was still largely seen by the low harm group as a leisure activity, with gambling expenditure competing with other recreational activities in the "opportunity cost" sense (Delfabbro & King, 2019):

I see gambling as a recreational thing as well, so I mean if I'm spending on that then I'm not going to the movies. Or I'm not you know going out for dinner or something like that. Because I've spent it this way instead (G26).

However, one participant (out of eight) thought that all the money that she had spent on gambling might have brought greater satisfaction if it had gone on other recreational expenses, such as taking more holidays:

Part of me thinks 'could that be spent on something else'? Like it's not like I'm eating into mortgage money, but I think that frivolous money, could that be spent on something else, so it's not like I'm spending our utilities money but it does go through my head that … if I add that up over the years what could I have spent that on … a trip away or something? (G24).

6.3.2.3 Gambling can still bring emotional benefits, but also small regrets

Two participants noted the emotional benefits from gambling, and how the benefits it brought them were overall worth the expenditure:

I go with the intention of 'most of the times you're gonna lose anyway'. So generally, I lose and I'm like 'oh well that's okay, I had a good time, we enjoyed ourselves, so it's okay' (G26).

In contrast, two other participants noted some small regrets about gambling losses, such as being *"disappointed in myself" (G22)*. However, the financial amounts were small, and they did not report any more severe harms such as damage to relationships or health, and nor did it affect their work/study:

And I think that's my money that I'm allowed to spend so it's kind of like a psychological merry go round. 'Oh, I shouldn't do that.' 'Oh, but it's my money.' 'But oh, if only…' (G24).

6.3.3 Moderate harm

The seven gamblers in the moderate harm group reported more negative experiences overall than those in the no harm and low harm groups. Moderate harm gamblers still found that gambling was on average something that brought them closer to other people. However, financial harms in the moderate harm group moved beyond mere regrets; serious effects on household budgets were occasionally experienced by about half of the moderate harm group. Furthermore, moderate harm gamblers experienced a range of emotions from their gambling, but with a skew towards negative emotions. Moderate harm gamblers were also the first group to, upon occasion, report more severe harms to either health or work/study.

6.3.3.1 Gambling was still seen as something to bring them closer to other people

Like the two lower harm groups, moderate harm gamblers still saw gambling as something that on balance brought them closer to other people, and an activity that could help reduce feelings of loneliness. No participants in this group explicitly reported issues with their relationships with others occurring from gambling, whereas two participants explicitly reported benefits of increased social bonding from gambling:

There's certainly positives. I think the biggest one is, for me is that social aspect. Like being a sports person, all your mates they're interested in a certain type of sport. We always go 'did you see the basketball last night', 'I need the Bucks to win tonight because it's in me multi', and then all of a sudden you wake up and did the Bucks win for me mate? … and 'oh yeah that's awesome', 'good on ya man'. So I think that's probably biggest positive, more so than the money or anything (G16).

Well, it sort of gets me out and about, sort of a certain element of socialising – a little bit at the casino more at the pokie lounge, you have a chat with the regulars there and the nice girls make you a cup of coffee and come around with a little fruit salad and things like, so it just gets one out into the community a bit and chatting with other people (G19).

6.3.3.2 Serious financial harms were experienced occasionally

Just under half of participants (three) in the moderate harm group occasionally experienced serious financial harms which impacted their living situation. This was definitely a more severe pattern than was observed in the two previous groups. However, it is important to note that this unique financial-harm sub theme was only felt occasionally, and was generally not chronic:

I can think of one month, in particular, where I just wasn't on a hot streak. I was on a cold streak, just got pumped and I remember like looking at the bank account like 'god am I going down this again?'. Like 'am I going down this path of really bad gambling?' and I sat back and spoke to the missus about it … you just sorta went 'okay we're not gonna go out, you need to have a think about what you're gambling on' (G16).

Oh, actually, I did, and I found I had to get an advance on a pension. So, I haven't done it since because it was humiliating, I hate the idea of borrowing money. I've always had enough to pay bills / everything, I've never had to … and I found it really shocking. So, I'm much more disciplined now (G6).

6.3.3.3 A range of negative emotional impacts

Compared to the two previous groups, moderate harm gamblers experienced a range of negative emotional impacts from their gambling. One participant explicitly mentioned the emotional benefits from gambling (*"It's made time more pleasant"; G6*). However, it was more common for participants in this group (three participants) to mention emotional difficulties from their gambling, including worry that they were losing control over their gambling (*"am I going down that same path again?" G16*) and guilt (*"a waste of time … I should've been doing something else" G19*). Negative emotions about their gambling were expressed by half of the group (four participants):

Generally, when I'm losing. During and then afterwards I get angry with myself and then I'm like 'right it's done, you gotta stop thinking about it' because I just end up ruminating and getting annoyed and that feels terrible, so I do sort of put a cap on it and say, 'right it's done you just gotta forget about it' (G27).

6.3.3.4 Occasional health and work/study harms

Finally, two participants mentioned more significant occasional harms on either their health or work/study, which are rarer harms (Browne & Rockloff, 2018) that did not occur in either the no harm or low harm groups (*"Oh my god why did I spend, why did I do that, why did I do that? Then you can't sleep."; G6*). For one participant, gambling led to a negative impact on their work:

Yes. That sort of relates back to the other thing of just spending too much time on it and feeling a bit guilty about it and that I should've been spending it on work or other things … because I'm at the pokie lounge or casino instead of at work (G19).

6.3.4 High harm

The eight gamblers in the high harm group all reported serious financial harms that affected their living situation, and these harms were often chronically reoccurring. Gambling losses caused all eight high harm gamblers to feel emotional strains, which could be magnified by periods of loss chasing or pre-existing psychological vulnerabilities. Most high harm gamblers (six out of eight) reported that gambling negatively affected their relationships with members of their family, and also experienced negative effects on their sleep or health in general (five out of eight). High harm gamblers were also more likely to experience negative effects on their work/study than the lower risk groups (three out of eight).

6.3.4.1 Negative effects on finances

All eight participants in the high harm group reported negative effects on their finances from gambling. Compared to the negative financial effects reported by some participants in the low and moderate harm groups, the harms could be noticeably more severe in this group. Some participants in this group did report some similar financial harms to lower risk gamblers, such as expenditure exceeding the opportunity cost level. However, the unique sub theme in this group is how financial harms could also become much more severe, including the complete loss of discretionary spending power and savings for a period of years:

I lost basically all my income. So I was, I wouldn't say 'smart', but I was cautious enough to not go above my budget… like I never went into a debt. I never spent what I didn't have so I'm happy I never went down this alley. But I was able to calculate basically my next payday would be next Tuesday, I need to pay my rent blah blah blah, but I still have that much of the money, so sometimes I put my account into zero knowing that the next day will be a payday and that I will cover my rent. So yeah, it killed all my savings so for the time being that I had these gambling problems I haven't been able to save for almost three years, four years (G28).

Furthermore, the chronic strain from repeated financial losses affected other high harm gamblers too and involved unwanted debt and also the unwanted expenditure of an inheritance. These are chronic strains that were not reported by any lesser harmed gamblers:

Yeah, so it was a few years ago that I guess gambling's always one of those things that you think you're always gonna win and I had a credit card that I sorta maxed out using to bet. And then eventually got to the point where I had to tell my wife so that was the main experience … I obviously ended up racking up a bit of debt that had to be paid off in the end (G29).

Quite an impact. I'd received some inheritance money, so I was using quite a bit of that. And unfortunately, that dwindled down (G7).

6.3.4.2 Emotional strains caused by loss chasing

All eight participants in the high harm group also felt emotional strains from their gambling. Although these participants could often feel moments of happiness after a big win, these positives were overall outweighed by the negative effects of losing. The unique emotional sub theme in this group was the emotional effects from periods of "loss chasing" (Zhang & Clark, 2020), where attempts to recoup losses led to further losses and additional strain:

It did start to play on my mind a lot. Particularly as some of those losses were mounting. And I just felt like well there's always another weekend and I'm sure we'll get it right again. It did start to play on my mind. Especially when financially, I was sitting there looking at it going, 'uh okay what I was expecting to happen financially hasn't really worked out that way. And so now I'm going to have to dig us out of this'. Yeah, that's where it was sort of the worst (G17).

But it was up and down up and down always with the anxiety that this is all the money that I lost. I wanna get it back so it was more of, um, yeah try to remedy the problem, but it was getting worse and worse (G28).

6.3.4.3 Loss chasing affected their relationships with others

The unique relationship sub theme in this group was how the financial losses and emotional strains from gambling could affect their relationships with others. This theme was expressed in various ways by six out of eight participants in this group. Importantly, for this group, gambling led to difficulties with others, either by a loss of attentional focus, or by the lies and deception brought on by loss chasing:

I guess it's all around that thing when you're not winning that you're, yeah as I said before, you get angry, you get frustrated very easily, but yeah it affects your relationships with your family and friends and you sort of always sitting there on your phone, so people know something's going on. And you're always there wondering where you're gonna get some more money to try and get your wins back and those type of things (G29).

They say 'where have you been, how much did you spend?', and then you go and dodge your way around that and had enough to get through the fortnight. It does cause you to tell lies, I guess (G8).

6.3.4.4 Negative impacts on health experienced by a majority of this group

A majority of participants in the high harm group (five out of eight) reported at least one significant health impact. For a majority of this five, the impact was felt through a negative effect on their sleep. However, their descriptions of the embodied nature of gambling's effect on them were richer than

what was provided by the single gambler in the moderate harm group. Their descriptions evoked the potentially all-encompassing nature of gambling related harm:

I would say sleep definitely because you would think about certain things, and you know gambling is a part of that. Eating potentially, you'd comfort eat to make yourself feel good again I suppose, but not so much in that space. It would be more so your sleep side of things and because you've got a load of wheels turning in your head obviously about a whole heap of life issues and that obviously compounds it and adds to it (G14).

Um, when I was gambling hard, unfortunately it became more of an addiction than a hobby that I enjoyed. So, my body was asking me to do it… And many time I would just wake up in the middle of the night with anxiety attacks (G28).

6.3.4.5 Work/study affected for some high harm gamblers

Finally, three participants in the high harm group mentioned how gambling affected them at work, which was a higher proportion of this group than the single participant in the moderate harm group. This highlights how high harm gamblers can experience their gambling related harm wherever they are. Although these participants may not have been gambling at work, the financial losses, associated worries, increased social isolation, and health impacts affected their performance at work:

And sometimes I lost focus and then I went into a place I was not allowed to go into, and then of course my managers would be like 'what the hell are you doing in there?' … Yeah. So I had to have a really massive stress to control, otherwise I would just have burst into tears in the middle of work, yeah (G28).

Yeah, so um I suppose distracted by bets that I had on, during office hours. So not primarily using office hours to do that activity but I might have had something that I'd put on previously or checking scores between meetings kind of thing. So, I found myself not being able to give full focus to what I was here to do which is worse. So that had a big impact on me (G14).

6.4 Discussion

Previous research has aimed to describe the distribution and extent of gambling related harm in the population (Browne et al., 2016). However, most of this research has used quantitative measures, such as the SGHS (Browne et al., 2018), which has been criticised on the basis of face validity of some constituent items. Specifically, Delfabbro and King (2019) have argued that harms included in the SGHS might reflect non substantive harms, or rational economic "opportunity costs", or potentially lead to false negatives due to the multidimensional nature of gambling related harm (Langham et al., 2016). However, in response to the opportunity cost critique, we found that only the no harm group had zero regrets about their level of gambling expenditure. This is the only group consistent with an opportunity cost explanation of gambling expenditure, as rational actors never regret their decisions (Varian, 1999). Participants in all groups from low harm onwards had at least some regrets about their level of gambling expenditure. The current research analysed 30 in depth interviews across the spectrum of harm, in order to characterise the lived experience of those who fall into different ranges based on the SGHS. The findings are summarised within and then across the four groups.

In accordance with previous findings that gambling can improve health and wellbeing for some people due to the psychological and social benefits derived from entertainment (Latvala et al., 2019; Rockloff et al., 2019), the no harm group described their gambling as just another leisure activity that they chose to spend modest amounts on, in preference to some alternative leisure activities. Gambling provided social benefits, being an enjoyable shared interest and pastime that strengthened family and friendship bonds. No negative emotional or vocational consequences were reported. In the low harm group, gambling was still said to be a shared social activity that was fun, strengthened relationships, and was financially affordable. However, the potential for regret appeared in this group's accounts. Some participants felt guilt and had disappointments in themselves, and regrets that their gambling expenditure could have been used for more satisfying activities. The moderate harm group generally reported that gambling was still a social activity with social benefits, but occasional serious financial harms were reported that impacted on household budgets. They also reported negative emotional responses to gambling, such as concern they were losing control over their gambling, and anger, annoyance and rumination over gambling losses. Some participants also reported that gambling negatively affected their sleep and work. All participants in the high harm group reported serious, persistent and reoccurring financial impacts from their gambling, including loss of savings and debt. Chasing gambling losses was frequently reported, leading to emotional distress and strain on some personal relationships. Most high harm participants reported detriments to their health, such as anxiety and sleep disturbance. Some participants also reported that being distracted and stressed by gambling impacted on their work. These experiences reflect an increasing concentration in the higher harm groups of the individual costs of gambling identified in public health models (Latvala et al., 2019), including financial problems, impaired work performance, relationship problems, emotional stress, and physical symptoms.

Patterns in each domain of harm were observed across the four quantitatively assigned harm groups. Financial effects of gambling started at pure opportunity costs for the no harm group, proceeded to mild regrets for some in the low harm group, and then to occasional financial harms for those moderately harmed and finally chronic financial harms in the high harm group. Gambling had positive effects on gamblers' relationships in the no and low harm groups, before becoming more neutral for moderate harm gamblers, and sharply negative for high harm gamblers. Emotional effects were either neutral or positive for no harm gamblers, small negatives appeared for low harm gamblers, before becoming more significant for moderate harm gamblers. All high harm gamblers experienced quite severe negative emotional effects. Health harms were only first reported for one moderate harm gambler and were experienced by most high harm gamblers. Work/study harms were quite similar to health harms, although were perhaps slightly less common. Overall, the lived experience of gambling harm across all domains of harm became noticeably more severe as SGHS scores increased.

For a qualitative study, the sample of 30 can be considered sizeable and is a strength of the research. However, the study also has limitations. The experience of gambling harms can be idiosyncratic, and despite the healthy sample size, we did not observe concrete evidence of saturation. The sample size per harm group is smaller, and this increases the risk that differences between the harm groups may reflect random fluctuations in sampling rather than genuine differences between the harm groups. Our priority in the conduct of the interviews was to ask non-leading and non-loaded prompting questions. However, the study authors have attempted to reflect on how their own position in the production of gambling related harm research may have affected the interviews and the conclusions drawn from them. Nevertheless, all qualitative research contains an aspect of subjectivity, and these results should also be replicated by other investigators. In particular, replication across different populations is important, as these results may be specific to the location, time, or characteristic demographics of the Australian participants. Participants for the initial study were originally recruited with the help of a panel provider for an earlier quantitative study (see Chapter 4), and this may have also impacted the obtained results. Recruitment of gamblers more directly from the community may help ameliorate

potential concerns around participants who take part in gambling research in return for financial compensation (Pickering & Blaszczynski, 2021). Finally, stratification was only performed over SGHS group. Although participants' SGHS and PGSI scores had a high positive correlation, we did not explore sub theme variation across PGSI categories. Obtaining an accurate and unbiased picture of the experiences of affected gamblers demands triangulation of data from multiple methodologies. Future studies should continue to use a range of methodologies to explore gambling related harm beyond self-report surveys, such as the use of anonymous bank data (Muggleton et al., 2021).

6.4.1 Conclusion

An exclusive focus on quantitative self-report measures of gambling harm can lead to uncertainty as to what the scores genuinely mean in terms of the lived experience of those experiencing the impacts. Semi-structured interviews can be thought of as a form of 'ground truth' with which to evaluate these scores. We found that increasing SGHS scores accorded closely with more negative descriptions of interactions with gambling given by the gamblers themselves. Those scoring zero reported positive effects and almost no negative impacts, but individuals with higher positive scores tended to report increasingly serious financial, emotional and relationship issues, with those scoring the highest also reporting health and work/study problems. The results shed a new light on the spectrum of gambling related harm, and illustrate how a mixed methods approach can improve the understanding of gambling related harm. Importantly, the study found that gamblers nominating only 1 or 2 harms on the short gambling harms screen expressed some guilt, disappointments or regret about their gambling. This finding undermines the argument that the SGHS measures opportunity costs and not real negative consequences from gambling.

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Supplemental analysis

At the time of recruiting participants for the qualitative interviews the 20-item Gambling Harm Scale (GHS-20) (as described in Chapter 4) was not available. Therefore, interviews were originally stratified by SGHS (GHS-10) scores. The supplemental analysis below was conducted ad-hoc to examine the validity of the GHS-20 and Table 6.3 below compares total SGHS (GHS-10) & GHS-20 scores.

Table 6.3 SGHS (GHS-10) and GHS-20 scores

SGHS group	ID	SGHS (GHS-10) score	GHS-20 score
No harm	G1	0	0
	G10	0	0
	G11	0	0
	G12	0	0
	G20	0	0
	G21	0	0
	G30	0	0
Low harm	G2	2	3
	G3	2	2
	G9	2	2
	G22	1	1
	G23	1	1
	G24	1	5
	G25	2	3
	G26	1	1
Moderate harm	G5	4	4
	G6	5	8
	G13	4	5
	G16	4	4
	G18	3	6
	G19	5	7
	G27	3	3
High harm	G4	6	9
	G7	7	9
	G8	7	9
	G14	6	18
	G15	8	8
	G17	10	20
	G28	8	14
	G29	9	12

The rank order correlation between the two gambling-harm measures was high at 0.967 ($p <.001$). The high correlation between the SGHS (GHS-10) and GHS-20 provides further support for the GHS-20 as a reliable measure of harm which accurately reflects the narratives of affected and unaffected gamblers.

Chapter 7. Differences in the lived experience of affected others' (AO) levels of gambling-related harm, depending on life circumstances and the nature of the relationship

7.1 Introduction

A majority of past research into gambling-related harm has aimed to measure the extent of harm faced by gamblers as a result of their own betting (Browne et al., 2017; Browne et al., 2016; Markham et al., 2016; Muggleton et al., 2021). But at least in terms of the absolute number of people affected, there may well be many more "affected others" (henceforth "AOs") experiencing gambling-related harm than gamblers who are harmed. One early study of harm to AOs by Goodwin et al. (2017) suggested that the typical problem gambler affects an average of six other people in their life. However, even the quantitative measurement of gambling-related harm accruing to gamblers themselves is in an early stage of development, with current approaches having been subject to critique from some researchers (Delfabbro & King, 2019). Given the additional complexities introduced by the nature of the relationship of the AO to the gambler, it is perhaps not surprising therefore that the quantitative measurement of gambling-related harm to AOs is even less developed, with a range of disparate estimates with respect to the scale of harm found in the literature (Tulloch et al., 2021a).

A key debate in assessing and conceptualising gambling-related harm is the extent to which harm is felt by those meeting the threshold for problem gambling versus lower-risk gamblers (Browne & Rockloff, 2018; Delfabbro & King, 2017). Research on harm to AOs also has this issue, with some studies only looking at AOs of gamblers in treatment (Dowling et al., 2014; Ferland et al., 2021), other studies considering AOs of lower-risk gamblers (ACIL Allen Consulting et al., 2017), and some others using an unknown severity of gambling problems; for example by asking AOs about people in their lives who are "fairly heavy gamblers" (Centre for Social and Health Outcomes Research and Evaluation & Te Ropu Whariki, 2008). But AO research must also decide on which relationship types to consider for AOs, with some studies looking only at partners, others also including family members (e.g., sister, aunt, etc.), and some also considering friends/colleagues (Tulloch et al., 2021a). Consequently, estimates of AO harm prevalence vary widely. One Australian study estimated that 1.4 per cent of the population were AOs living in the same household as someone categorised as a "problem gambler" (Tulloch et al., 2021b). By comparison, a Canadian sample led to an estimated prevalence of 2.0 per cent for household AOs and a further 12.7 per cent for non-household AOs, who could be either family members or friends living separately from the gambler (Tulloch et al., 2021b). Similar rates of these two types of AO have also been found in Finland (Castrén et al., 2021; Salonen et al., 2016).

The quantitative measurement of gambling-related harm to gamblers, as opposed to AOs, often relies on the use of self-report questionnaires, such as the "Problem Gambling Severity Index; PGSI" (Ferris & Wynne, 2001) or the "Short Gambling Harms Screen; SGHS" (Browne et al., 2018). However, this approach involves a number of assumptions, including that gamblers will truthfully and accurately report their experiences, which are potential issues given the established memory biases in problem gambling (Toneatto et al., 1997) and the potential for stigma and shame around gambling (Horch & Hodgins, 2008; Yi & Kanetkar, 2011). Another issue with self-report questionnaires is the selection

and weighting of items. For example, the SGHS has been criticised for having a number of perceived low-severity harms (Delfabbro & King, 2019), such as "Less spending on recreational expenses such as eating out, going to movies or other entertainment", that are given the same quantitative weight as potentially more severe item such as, "Felt ashamed of my gambling". Critiques such as these have spurred researchers to consider a range of alternative quantitative measurements of gambling-related harm to accruing to gamblers (Browne et al., 2022; McLauchlan et al., 2020; Murray Boyle et al., 2021).

This report's previous chapter took a different approach, by qualitatively exploring the lived experience of gamblers across the range of harm levels as according to the SGHS, using a sample of 30 gamblers. Rather than focusing on issues of item selection and weighting, the previous chapter aimed to explore whether there were tangible differences in the experiences of gamblers – as described in their own words – across quantitatively derived levels of harm. Clear and substantive differences were identified. The no harm group described gambling as a social leisure activity which helped them to relieve stress. Gambling was still social and pleasurable in the low harm group, although some participants in this group did express worries occurring from occasional instances of high spending on gambling. Participants in the moderate harm group still gained social benefits from gambling, although their potential for financial and emotional issues was greater, and this could occasionally affect their ability to sleep or performance at work. Participants in the high harm group experienced chronic financial and emotional issues from their gambling, which also affected their relationships with partners, family members, and friends. Most gamblers in the most severe category, that is, those who reported the presence of many negative outcomes on the quantitative measure, also described that gambling had affected their health. This overall pattern of harm is similar to what has been found previously quantitatively (Browne & Rockloff, 2018), and helps to provide an additional form of ground-truth validation to the SGHS.

This chapter mirrors the previous chapter by qualitatively exploring the lived experience of people who had a close relationship with a gambler, taken across each level of harm as implied by a quantitative self-report measure. This exercise served as a validity check for the current form of existing self-report measures for AOs; or, if new issues are identified, help direct the search for potential improvements. However, a less clear-cut story might be anticipated given that relatively less is known regarding the characteristics of the optimal quantitative measure of gambling-related harm for AOs.

The Short Gambling Harm Screen for Concerned Significant Others (SGHS-CSO) was designed from a candidate set of 68 items and a population-representative sample which yielded 204 CSOs of gamblers who had been harmed (ACIL Allen Consulting et al., 2017), which is smaller than the number of gamblers used in creating the SGHS (Browne et al., 2018). Furthermore, any quantitative self-report measure has a number of limitations, including the risk of false negatives, where a participant scores zero on the measure but actually experienced some harm. When created, the SGHS-CSO yielded a false negative rate of 3.4 per cent compared to the full 68 items, which may be a relatively imprecise estimate given the small sample size (ACIL Allen Consulting et al., 2017). Furthermore, the SGHS-CSO may also lead to false positives, whereby a participant reports "yes" to several harm items, and yet their lived experience of gambling related-harm was relatively mild. Or they may attribute their own quality of life problems to someone else's gambling. This is an issue for which qualitative validation may be especially well suited.

Previous quantitative investigations reveal surprisingly few differences arising from the nature of the AO's relationship to the gambler. For example, one study found that being a AO had a constant negative impact on the AO's welfare, irrespective of their relationship to the gambler (Tulloch et al., 2021b). Another study found only some differences between friends/colleagues and other AOs, with no significant differences between partners and other family members (Dowling et al., 2014). Another

report found that close family members suffered the greatest impacts, followed by close friends, with extended family members and work-associates reporting no negative impacts (Centre for Social and Health Outcomes Research and Evaluation & Te Ropu Whariki, 2008). By contrast, a qualitative study on problem gamblers in treatment found a different picture (Ferland et al., 2021). That study revealed that AOs, across all harm domains, were more affected the closer their relationship was to the gambler: AOs who were partners or were cohabiting with the gambler had more harmful experiences than AOs who were not. For example, a financial harm for an aunt might be the occasional lending of small amounts of money without repayment, but for a partner might be the need to pay all household bills or the loss of significant joint savings. This suggests that quantitative studies may fail to identify significant between-group differences if the measures fail to adequately capture this gradient of harm. For example, the SGHS-CSO item, "Reduction of my available spending money", could be responded to with "yes" if the participating CSO lost $10 or $10,000 to the gambler, and the probability of either of these two losses occurring might depend on the closeness of the AO's relationship with the gambler. However, the qualitative studies investigating AOs of gamblers have predominantly looked at specific relationships to the gambler, such as partners (Klevan et al., 2019; Kwan et al., 2020; Mazzoleni et al., 2009), children (Darbyshire et al., 2001; Patford, 2007a), parents (Patford, 2007b) or family members sharing a house with a gambler (Wurtzburg & Tan, 2011), or have only investigated people affected by gamblers meeting the threshold for "problem gambling" (Ferland et al., 2021; Mathews & Volberg, 2013).

The present study therefore aims to more expansively explore how the lived experience of gambling-related harm varies across SGHS-CSO scores within each of the three main relationship types to the gambler: current partner, family member, and friend/colleague.

7.2 Method

7.2.1 Participants

Thirty people who had a close relationship with a gambler and who had agreed to be recontacted for an interview were recruited from the quantitative stage of this project (see Chapter 5). All participants were aged 18+ years, resided in Australia, had a close relationship with someone who had gambled in the past 12 months, and provided informed consent. Participants could be gamblers themselves, however in the interview it was emphasised that the focus was on harm experienced due to someone else's gambling and not their own. Where there was ambiguity the interviewer clarified instances whether the harm related to the person they had a close relationship with.

The sample varied over two main relevant features (Table 7.1). The first feature was their SGHS-CSO score (ACIL Allen Consulting et al., 2017), measuring the extent to which they had been affected by someone else's gambling, and which varied from zero to nine (out of a possible score of 10). These scores placed participants in one of four groups: no harm (0), low harm (1-2), moderate harm (3-5), and high harm (6+). This scoring system mirrors the scoring for the SGHS instrument for gamblers (Browne et al., 2018). The sample was stratified to include between seven and nine participants in each of these harm groups. The second main feature was the nature of the AO's relationship to the gambler in their life, and the sample was also approximately stratified to provide balance over this feature within each harm group. First, some participants talked about their partner's gambling, and there were between one and three of these participants within each harm group. Second, there were between two and four participants within each harm group who talked about the gambling of one of their family members, such as their sister's, father's, daughter's, or brother-in-law's gambling. Finally,

between one and two participants within each harm group talked about a non-family member whose gambling they had been affected by, such as a friend or colleague. It was not possible to perfectly balance the sample across these two dimensions, given the need to also recruit participants across a range of ages and genders. This diversity of 'relationship to the gambler' reflects the diverse interpretations of AOs used across the previous literature (Tulloch et al., 2021a).

Table 7.1. Participant characteristics

SGHS-CSO group	ID	SGHS-CSO score	Gambler was their:	Gender	Age
No harm	22	0	Partner	F	29
	23	0	Partner	F	40
	24	0	Partner	M	56
	25	0	Sister	F	54
	29	0	Sister	F	27
	27	0	Friend	M	64
	30	0	Friend	F	43
Low harm	17	2	Partner	M	73
	19	1	Partner	F	42
	21	2	Father	F	41
	20	1	Daughter	F	54
	1	1	Nephew	M	58
	18	2	Sister-in-law	F	63
	15	2	Colleague	M	65
Moderate harm	11	5	Partner	F	37
	9	5	Father	F	49
	12	3	Brother	F	57
	7	4	Aunt	F	46
	14	3	Brother-in-law	M	70
	8	4	Friend	M	68
	10	4	Friend	F	70
High harm	3	8	Partner	F	29
	5	7	Partner	M	62
	6	8	Partner	F	35
	2	6	Brother	F	31
	4	7	Brother	M	73
	13	9	Brother	F	50
	26	8	Brother	F	29
	16	6	Friend	M	29
	28	7	Friend	F	58

7.2.2 Procedure

Ethical approval for the current study was granted by the CQU Human Research Ethics Committee (#22830). Participants were recruited via an email invitation which included an information sheet about the study (Appendix 6). Interviews were conducted by telephone by a researcher with several years' experience in conducting gambling research. Participants received a $50 shopping voucher for their time, provided informed consent prior to the interview, and were also provided with helpline information at debrief.

The interview guide (Appendix 8) was wide-ranging and aimed to situate gambling within the context of the participant's and the gambler's lives, and their relationship with one another. The interviews did not just focus on the negatives from gambling, but rather encouraged participants to reflect on any positives as well. The interview guide contained prompts on potential harms across: financial, relationship, emotional, health, and work/study domains. These are the same domains used in the previous chapter, and were based on a previous qualitative investigation (Langham et al., 2016). Participants were also encouraged to reflect on any harms that they had self-reported in the previous quantitative aspect of the project that they were recruited from (see Chapter 5). Interviews were conducted between August – October 2021, and ranged from 23 to 61 mins (mean 37 mins). Recordings were transcribed and anonymised prior to analysis.

7.2.3 Data analysis

Participants were grouped first by relationship type, with the spectrum of harm being analysed within that given relationship type. Findings were grouped in this way as the literature suggests that relationship type may be an important factor through which harm is moderated (Centre for Social and Health Outcomes Research and Evaluation & Te Ropu Whariki, 2008; Dowling et al., 2014; Ferland et al., 2021). Interview transcripts were imported into Nvivo software and analysed using the method of reflexive thematic analysis (Braun & Clarke, 2019). After an initial round of coding, a set of initial themes was shared with the other authors. Discussion of these proposals led to suggestions which allowed the first author to further refine these themes. All authors agreed on the final set of themes and their interpretation.

It was anticipated that broad themes based on financial, relationship, emotional, and work/study domains would be derived deductively from the data, based on previous quantitative research into gambling-related harm (Browne & Rockloff, 2018), and similar to the practice followed in the previous chapter. However, an emergent finding was that, although harms occurred across these domains, their presence was strongly moderated by the nature of the participant's life circumstances and relationship with the gambler. For example, a AO in the low harm group experienced significant harms to work/study, because they were affected by a close work colleague's gambling. In the previous chapter, this was a type of harm only experienced at higher levels of gambling-related harm, but was experienced by this participant because of the nature of their relationship with the gambler. Therefore, key sub themes within each relationship type were derived inductively, being based purely on the present data. These sub themes are summarised in Table 7.2, and the findings are discussed in greater depth in the following section. Due to the intersectionality of AO experiences, each of which moderated the extent of harm experienced by the participant, each participant's experiences are briefly described within the broader themes of their relationship type and harm category.

Table 7.2. Sub themes for each relationship type

Relationship type	Sub themes
Friends/colleagues	A closer relationship with the gambler was associated with AO harm
	A healthy relationship with gambling decreased the AO's harm
	A more comfortable position in life decreased the AO's harm
Family members	Inter-generational patterns of harm and comorbid addictions contributed to AO harm
	Helping strategies can reduce the impacts of harm for the whole family
	Distancing themselves from a gambler who refused help as a last resort for reducing the AO's harm
Partners	Solitary partner gambling associated with AO harm
	Weak household financial positions and shared financial resources associated with AO harm
	Broader support structures help reduce gambler and AO harm

7.3 Results

7.3.1 Harm to friends/colleagues is moderated by the strength and type of relationship with the gambler, and the AO's life circumstances or own gambling

The sample contained seven participants who were a friend or colleague of a person who gambles and were spread across all four harm categories from the SGHS-CSO. The extent to which a friend/colleague was harmed by another person's gambling was related to the extent to which that person also gambled. This is very similar to the results from the previous chapter, where a gambler's own harm increased with their level of gambling. However, the picture for friend/colleague AOs was also more complex, reflecting the AO's own life circumstances, their relationship with gambling, and their relationship with the person who gambled. Participants were at higher risk of experiencing harm from their friend's/colleague's gambling if they were facing difficulties in their own life, if they themselves gambled heavily, and if they were especially close to the person.

The two participants in the **no harm** group reflected the diversity of these three factors. Participant 27 (male, 64 years-old) was of relatively high socioeconomic status, and spoke about a golfing friend. He reported a common trend, that the friendship increased his own gambling expenditure: *"possibly encourages me to gamble a little bit more because you know if we're on a golf trip together then I'll show a little bit more interest, where I can then go for months without even thinking about it. But that's more just to be part of the social aspect of it"*. But the participant could easily afford this increased expenditure, which came from very low baseline levels of the participant's usual gambling. The gambler's expenditure also appeared to be well within their own budget. Furthermore, although the friendship was old (20 years), the two people seemed of sufficiently high socioeconomic status that he would be unlikely to lend the gambler money or see his lifestyle affected were the friend's gambling to increase. The other friend/colleague in the no harm group was similar (Participant 30, female, 43 years-old). This participant rarely gambled, and was in a comfortable position in her life. Furthermore, the participant was talking about a friend at relative social distance: a friend of approximately five

years, who she mostly kept in touch with via social media. Although this friend showed some signs of excessive gambling, this did not influence the participant to gamble harmfully, and the tie was not close enough to trigger extreme emotions in the participant: *"I've been concerned, I haven't been distressed though… in a lot of ways it's none of my business, you know he's an adult he can make his own choices. But as a friend I was concerned".*

Participant 15 was in the **low harm** group (male, 65 years-old) and spoke about a former colleague. This participant did gamble, and his colleague's gambling led to some regrettable increases in the participant's own gambling, in particular given his need to keep a tight household budget: *"I only spent the allowance I had, I didn't go into money I had for bills ... because you know I had a wife at home. We had only one bank account, so if I got in there it would have affected them, so I didn't really do that".* However, the participant was able to control this gambling to limit the harm. Perhaps the main harm to the participant occurred because the colleague's gambling affected the participant's ability to complete joint work projects on time. While the previous chapter showed that harms to work/study generally only occur to gamblers experiencing the greatest number of harms, the AO participant experienced harm in this domain because of the nature of his relationship to the work colleague.

The two **moderate harm** participants had distinct experiences. Participant 8 (male, 68 years-old) was talking about a younger friend who lived in another state. This participant did not gamble and his father had suffered a longstanding gambling addiction, which likely made him especially sensitive to the gambling of others. The distance between the two people and nature of the relationship limited the extent of harm the participant experienced: *"I mean we're close, but I'm not his father, I'm not his uncle, not part of his family. . . so if I was going to start worrying about [it] to that extent then I would seriously think about continuing on with the relationship".* This is one participant for whom the lived experience of gambling-related harm appears less significant than the scoring implied by their SGHS-CSO responses, although it is difficult to know which representation is more accurate, as they are both self-reported. Participant 10 also did not gamble (female, 70 years-old), and talked about an older female family friend who had lost her home from gambling. The participant had at times lent this friend money, but did not regret this action and wished that she could have helped her friend more. However, as the relationship was relatively distant, and the participant did not gamble, there was only so much that the participant witnessed firsthand or could do for the friend. Despite these buffers, the participant felt distress driven by the extent of the friend's gambling: *"sometimes I get to sleep and then I'd wake up thinking about it and I'd have to get up and walk around or do something because I couldn't settle. The stomach would be going and … you know you'd be worried out of your mind actually".*

There were two friends/colleagues in the **high harm** group. The first (Participant 16, male, 29 years-old) spoke about a close member of his social circle, who was his nominated visitor during the Covid-19 lockdown. The participant also gambled, and nominated increases in his own gambling when in the company of this friend as a cause of mild harm: *"I reckon I could have bought a few extra things or some nicer clothes. You know if it's an extra 100, 150 bucks that might be a pair of shoes, something like that. I didn't really notice but, it would have been nice to have [that] sort of thing".* The friend's betting was said to affect the dynamic of their friendship circle: *"we'd buy some dinner or some snacks or something like that, and it wouldn't come back. Like he wouldn't get us a drink…. Or sort of sneak his own one in and then come back with a full one".* Finally, spending long evenings together on nights out, which included late night gambling venues, was said to affect the participant's health through a reduced amount of sleep. However, despite the participant nominating six out of ten potential harms on the SGHS-CSO, the harms within each domain appear relatively mild. This may be because of the nature of relationships between young males, which are perhaps weaker than those between for example cohabiting partners. Overall, this participant's lived experience of AO harm appeared milder than his assigned harm category implied. As noted previously, however, it is difficult

to know which report is most accurate. The interviewees may have minimised their experience of harm due to stigma, or contrarily the checklist of harms may be sensitive to minor and relatively insubstantial reports of harm.

The second friend/colleague in the high harm group reported seven out of ten potential harms on the SGHS-CSO (Participant 28, female, 58 years-old), and was high on all the aforementioned moderating factors. In this case, gambling seriously affected the participant's friend who also experienced loss of his home and a substance addiction. The participant was close to this person, having spent time caring for his children. She gambled herself, with her friend sometimes appearing on her payday to spend time together at gambling venues. This also led to the participant lending him money, or increases in her own gambling, both of which led to financial harms: *"I might not be able to buy the things that I need, food and stuff like that"*. The participant's household budget was also tight, and did not have much scope to absorb the costs of this friendship. Perhaps the main factor limiting the level of harm was that the participant's gambling was under control. However, this participant did seem to experience a high degree of AO harm from her friend both in terms of qualitative interview data and her SGHS-CSO score.

7.3.2 Family members recounted patterns of comorbid addictions and intergenerational gambling-related harm, which in some cases was reduced by either distancing themselves or helping the gambler

Family member AOs (excluding partners) often mentioned childhood experiences of gambling-related harm occurring from parental gambling. The amount of current harm that they experienced depended on their own life circumstances and those of the family member who gambled. It also varied with the closeness of the bond, with some family members being extremely close and others not. Some participants used this closeness to successfully help the family member to gamble more moderately, and this helped reduce the amount of harm they also experienced. However, some participants were unable to help, and many ended up distancing themselves from the person as an alternative way to reduce the amount of harm they experienced.

Two family members were in the **no harm** group. For one of these participants (Participant 29, female, 27 years-old), her sister's gambling was sufficiently low-stakes in comparison to her financial resources that it produced no risk of harm to either person: *"Overall, I don't see it as a hugely negative thing. But I think that also is because the gambling that I've observed is such a small proportion of what a person's income would be"*. For the other participant (Participant 25, female, 54 years-old), her sister's gambling had historically been excessive, and the participant had previously needed to send her money to cover a mortgage payment. However, the sister now sends the participant her spare money, which the participant looks after until the sister needs it for a large expenditure. This helped to reduce the sister's excessive gambling and reduce the level of harm that they both experienced.

Four family members were in the **low harm** group. Participant 21 (female, 41 years-old) lived with her father who gambled daily. Perhaps because of the proximity from living together, her father had at times borrowed money for gambling and not always paid her back. The gambling had also led to occasional mild confrontations: *"I have sort of said to him you know enough is enough. . . he might just sort of lash out as in 'leave me alone, I know what I'm doing, the tables will turn', and then he is fine"*. Participant 20 (female, 54 years-old) reported that her daughter's gambling led to her

"borrowing" money without repaying it every two weeks to gamble, which led to relationship difficulties between them and difficulties with the participant's sleeping. The daughter's gambling led to harm likely because she lived at home as the participant's carer, and did not have much of her own money. Participant 1 (male, 58 years-old) reported a history of numerous family members being heavily engaged in gambling. However, the harm he felt from his nephew's gambling was greatly reduced in the past year due to the participant's conscious decision to distance himself from the nephew. Finally, Participant 18 (female, 63 years-old) mentioned that her sister-in-law gambled a lot and that this had at one time led to a temporary breakup between the sister-in-law and her brother. However, the relationship between the participant and the sister-in-law was somewhat weak, and this meant that the sister-in-law's gambling, although heavy, did not really affect the participant to a large degree.

Four family members were in the **moderate harm** group. A distancing of the relationship had been the main harm reduction strategy for three of them. Participant 9 (female, 49 years-old) spoke about her father's long-term excessive gambling. However, her father's gambling was just one of many traits that caused issues between them. They were largely estranged, and this was the main factor reducing the harm experienced by the participant. Participant 12 (female, 57 years-old) had similar experiences when talking about her brother's gambling. While they had been very close at times, and she had tried to assist him, the brother's mixture of problems with gambling and alcohol led her to distance herself from him, and therefore she experienced less harm from his gambling. Participant 14 (male, 70 years-old) spoke about his brother-in-law's gambling. While the two had also been close for a while, the participant had reduced their interactions due to the brother-in-law's behaviours. Participant 7 (female, 46 years-old) spoke about her aunt's gambling, who she was still very close to. The aunt had a history of gambling a lot, but the participant did not see this as a cause of harm to the aunt: *"but I think it actually keeps her going, keeps her sane… I mean her kids are wealthy anyway, so they don't need any more money. So, if she wants to blow it, why not?".* The biggest harm to this participant was how this relationship increased her own level of gambling, which was then something that she passed onto her children:

> *"I could see the determination in her finger and in her face, that she was always like 'hit the button'. I always have that fond memory of that. And that kind of brushes off on me, because when I buy scratchies I'm like 'quick' 'quick' and then I do it to the kids 'quick' 'quick' 'scratch, scratch see if we can win', and that is emotionally hard and it's frustrating and it's quite sad too, because [with] gambling you always want to win. But you never win big, you just win small. God, I've been buying scratchies for a very long time."*

There were four family members in the **high harm** group. Participant 2 (female, 31 years-old), mentioned how she and her brother who gambled had grown up in an abusive family environment, with a father who gambled and that they had family tendencies towards addiction. The brother had also turned to gambling to try and make more money for his family. These vulnerabilities likely contributed to the harm felt by the brother, his family, and the participant, who had lent the brother's family money. However, the participant and her brother's wife did not distance themselves from him, and were able to provide him enough support to encourage him to find help and quit gambling. Participant 4 (male, 73 years-old) had some similarities when talking about his brother's gambling, in terms of parental gambling and family disruptions, and comorbid alcohol problems. The brother's gambling led to widespread harm in the family, including to his first wife, children, his mother, and the participant. Unlike the previous case, this participant never lent the brother money, as he disapproved strongly of the gambling. This was a problem that the brother was never able to confront, and attempts from the family to help him recognise this led to conflict. Therefore, the participant and the other family members all dissociated themselves from the brother. Participant 26 (female, 29 years-old) was similar, talking about how her brother's gambling started early in a house where the father

gambled. The brother took money both from the participant and other family members, which was never repaid, despite him having a high-paying job. The brother eventually reduced his gambling due to pressure from a new wife, and this and the participant distancing herself from him were the main factors that alleviated her harm. Finally, Participant 13 (female, 50 years-old) experienced ongoing harm from her brother's gambling. She felt sufficiently close to the brother to want to lend his family money, but she had relatively modest means, and because the excessive gambling was currently ongoing it caused her financial harm.

7.3.3 Household financial position, solitary versus joint gambling, and wider support structures moderate the extent of harm to partners

Interviewed partners of gamblers described patterns of impact that were strongly related to the severity of the gambling problems. For partners who described a significant degree of impact, it appeared that they might be experiencing more harm than the gambler themselves, as they had to play the role of the 'responsible one' in the relationship. At the lower end of the spectrum, the impacts to partners could manifest only in intermittent annoyance or worry. At the higher end, partners described significant obstacles to financial security, and the ability to carry on with essential duties involving work and children.

The three partners in the **no harm** group all gambled with their partner in social situations. This mirrors a finding from the previous chapter, where people who gambled without harm also tended to gamble socially with their partners. However, a novel finding from the current sample is that, in each of these three cases, one partner had a naturally lower inclination to gamble than the other. Both for Participant 22 (female, 29 years-old) and Participant 23 (female, 40 years-old), the partner tended to gamble more than the participant. In both these cases, the partner had previously gambled in a way that created financial difficulties, emotional problems, or relationship frictions. However, these two participants had worked with their partner to reduce their level of gambling to eliminate these problems and maintain the social benefits: *"with us now I've taught him how to do that. So we've managed and continually manage. . . prior to me, I think he used to go by himself"* (Participant 23). In the case of the third no harm participant, the partner was the one with the lower inclination to gamble: *"at the time if we're down at the club and I want to put twenty more in and she'd say we gotta go home"* (Participant 24, male, 56 years-old). That participant had in the past occasionally gambled more than he would have liked to,but had discussed the topic with his partner and co-developed strategies to gamble affordably, such as by keeping a separate fund for gambling winnings, which could only be spent on certain approved household expenditures. This case does raise the possible issue of reverse causation, as it suggests that more harm actually occurred for the partner than the person who completed the survey, which quantitative studies should consider for couples where both partners gamble.

The two **low harm** partners were both in relationships with more excessive gamblers, and yet each had certain protective factors limiting the harm that they experienced. Participant 17's (male, 73 years-old) wife of many years had secretly accumulated a large amount of gambling debt. And yet, this participant was wealthy enough and cared enough about his wife to only experience minimal effects: *"I wouldn't care if she run up $50,000, I'd still cover it"*. Although this participant did experience stress from this loss, he was also able to codesign a harm reduction strategy with his wife of low-stakes joint gambling sessions: *"now about once a month we'll both go to the club. We might have lunch, and then we'll put 20 bucks in the machine. But both of us together . . . and she now*

doesn't have the desire to go by herself at all". This example demonstrates the importance of joint gambling, and how it can, in comparison to solitary gambling, moderate the gambling and avoid secrecy in the relationship. Participant 19 (female, 42 years-old) was also cohabiting with an excessive gambler, but the relationship was only four years old, and did not involve joint bank accounts. Furthermore, the partner was largely able to afford the cost of gambling: *"he'll go to a casino, like thousands of dollars. Now can he afford that? Yeah absolutely, he's very well off"*.

By comparison, Participant 11 in the **moderate harm** group (female, 37 years-old), had been with her partner for 14 years and they had a child together. The partner's gambling was excessive: *"like he'll spend his last cent on it, and think of how to get home later"*. The partner gambled with friends and not in the company of the participant. The length of this relationship and shared childcare responsibilities meant that the partner's gambling had led to financial, emotional, relationship and health-related harms to the participant:

> *"It was like me kind of borrowing money to pay bills. Stress about if he would give me what we needed to pay for food and things like that … he's like 'oh we just won't eat' … and I'm like 'well that's not practical', and maybe at one stage holding a … I wouldn't call it an intervention … but dad kind of .. it became a habit of me asking him for money, and so he said 'I've gotta do something, you're my daughter', so he kind of told him about different places he could go get support".*

This access to support from her father helped reduce the extent of these harms and also appeared to help the partner to reduce his gambling. This wider support structure helped decrease the participant's harm to moderate levels.

There were three partners in the **high harm** group, as identified by the quantitative screen. For one of these participants (Participant 5, male, 62 years-old), the lived experience of harm seemed relatively mild. His partner's gambling was relatively modest, and well within their ample household budget: *"gambling has not impacted us to the fact that we suddenly couldn't pay a bill or anything like that. So in that respect it's not a problem, it's just I suppose what concerns me a little bit [is] her reliance on it"*. Instead, it appeared that this participant was struggling with other life issues around retirement, and a small loss of joint recreational time was a minor additional concern: *"It's something that I suppose is just a bit of an annoying habit"*. The participant may also have been especially sensitive to gambling, as he did not gamble himself. The other two partners, however, expressed more harmful narratives, as non-gamblers who dealt with significant financial impacts from a partner's solitary gambling. Participant 3 (female, 29 years-old, married) expressed how as being new to the workforce her husband's gambling greatly impacted their ability to save for a first house. This gambling also led to serious relationship and emotional harms as well as negative impacts on work: *"because we fought all week and I would be stressed and pissed off and not 100 per cent there at work because work itself was demanding"*. However, this participant was gradually able to help reduce the impacts of her husband's gambling through the help of her family support structures: *"I think it's been a fantastic help through all of that, I think."* Finally, Participant 6 (female, 35 years-old, engaged, one child together) experienced significant harms across the financial, relationship and emotional domains:

> *"We both earn exactly the same amount. He's not specifically the breadwinner any more than I am, but because of gambling I've always had to pick up the pieces financially… it had a massive impact on our finances… You should have heard some of this stuff he would tell me to get money from me, he was so desperate - but it was extremely painful… You know he lived here but he wasn't present, if that makes sense"*

Furthermore, this participant was unable to get support from her partner's family, and her daughter was also affected by the consequences of his gambling. Although her partner's gambling was more

under control now, the participant reported significant legacy harms based on a permanent loss to their household financial situation.

7.4 Discussion

This chapter explored the lived experience of 30 people close to gamblers, across the four harm categories assigned according to the SGHS-CSO (ACIL Allen Consulting et al., 2017), and across three main types of relationships: friends/colleagues, family members, and partners. These are two advantages over previous qualitative research on gamblers' AOs, which has focused on single relationship types (Darbyshire et al., 2001; Klevan et al., 2019; Kwan et al., 2020; Mazzoleni et al., 2009; Patford, 2007a; Patford, 2007b; Wurtzburg & Tan, 2011) or only on AOs of people meeting the threshold for problem gambling (Ferland et al., 2021; Mathews & Volberg, 2013). Like the previous chapter, AOs were affected by the extent to which the person they knew gambled. In terms of types of harms experienced, financial, emotional and relational harms were the most common, as consistent with previous quantitative research (ACIL Allen Consulting et al., 2017). However, the current study also found many AOs experienced an increase in their own gambling, which could also be considered a harm, albeit a potentially mild one. But in comparison to the previous chapter, which saw consistent patterns of harm across the four harm categories amongst gamblers themselves, the patterns of harm were much more complex amongst the gamblers' AOs, being moderated by the AO's own life circumstances, and the nature and closeness of their relationship. For example, while all high harm gamblers described in the previous chapter experienced financial harm, this harm could be absent to AOs if, for example, they refused to lend money to the person due to a moral dislike of gambling. However, this decision understandably tended to exacerbate other harms to their relationship. Many AOs, particularly partners, had helped the person to reduce their gambling to lower levels of harm for both parties; a common strategy to reduce harm to themselves and the gambler (Côté et al., 2018). Lower levels of social gambling were one way of achieving this outcome, but one participant (#25) also created a financial arrangement to stop her sister having access to gambling funds. Some AOs had been unable to do this, however, and had resorted to distancing themselves from the person. This trend was perhaps most noticeable amongst family members, as it is arguably a more complex decision for partners (Järvinen-Tassopoulos, 2020). Nonetheless, withdrawing-type coping strategies are also a technique that AOs commonly use to avoid harm (Chan et al., 2016; Petra, 2020).

Some previous quantitative literature shows surprisingly little differences in wellbeing based on AO relationship type (Dowling et al., 2014; Tulloch et al., 2021b). However, the present research suggests, at least with respect to the SGHS-CSO, that quantitative scores might be incommensurable across different AO relationship types. For example, Participant 16 scored 6/10 harms as a friend in the high harm group on the SGHS-CSO. However, his experiences of gambling in a young male friendship circle appeared less negative than Participant 11's, who scored 5/10 harms as a partner in the moderate harm group. Participant 16's harms occurred via a loss of spending power and loss of sleep because his friend's gambling encouraged him to stay out later at gambling venues. Both of these harms appear milder than Participant 11's, who experienced significant emotional and financial stress due to her partner's gambling. A refinement of scale items, for example to rule out a loss of money and sleep as being more proximally caused by the participant's own gambling could be one way of improving measures used to assess harm to AOs. This may also be relevant to the case where the participant gambled more than their partner who was the subject of the interview. However, at least within each relationship type, the SGHS-CSO did appear fairly monotonic, whereby a higher score represented a higher average level of current gambling-related harm. The study suggests that

controlling for other observable factors, such as the AO's own level of gambling, closeness to the gambler, and overall life situation, may help in the quantitative study of gambling-related harm to AOs.

The study had a few limitations which should be addressed in future work. Although the number of interviews (30) was high for a qualitative study, the intersectionality of experiences, for example the participant's type of relationship to the gambler, their age and gender, and their own level of gambling, meant there was a relatively low number of participants in each group of interest. The experience of gambling harms can be idiosyncratic, and this is magnified when the relationship to the gambler varies as well. Thus, despite the healthy sample size, we did not observe concrete evidence of saturation. The current study should therefore be considered an early exploration of the types of moderating factors that can impact on AOs' experiences of gambling harm, rather than a definitive survey of the full spectrum of lived experiences of gambling harm. The current study is particularly valuable in drawing attention to this intersectionality and the need for future work to address this limitation by either increasing the number of interviews, or exploring only a given subset of experiences (e.g., friends/colleagues) in greater depth. All participants were from Australia and were interviewed in 2021, so their experiences may be less relevant to other jurisdictions and times.

7.4.1 Conclusion

The current state of quantitative research into gambling-related harm to AOs is less developed than the equivalent investigation of gambling-related harm accruing to gamblers. The present qualitative study showed substantial differences in the lived experience of AOs depending on their relationship type to a gambler, and across the full spectrum of harm. The results suggest that the SGHS-CSO is a good proxy for AO harm within a given relationship type, but that quantitative comparisons of harm scores between different relationship types may not accurately reflect true levels of harm. The potential for differences in reporting by relationship type as a result of stigma should also be considered. Continued refinement of measures of harm to AOs would be valuable. Finally, the research showed numerous strategies that AOs deploy, such as joint gambling or taking charge of finances to help reduce harm to themselves and the person who gambles, or distancing themselves from the person to reduce their own levels of harm.

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Supplemental analysis

At the time of recruiting affected and unaffected others for the qualitative interviews the 10- and 20-item Gambling Harms Scale for Affected Others (GHS-10-AO; GHS-20-AO) (as described in Chapter 5) was not available. Therefore, interviews were stratified by SGHS-CSO scores. The supplemental analysis below was conducted ad-hoc to examine the validity of the GHS-10-AO and GHS-20-AO and Table 7.3 below compares total SGHS-CSO & GHS-10-AO / GHS-20-AO scores.

Table 7.3 SGHS-CSO and GHS-10-AO / GHS-20-AO scores

SGHS-CSO group	ID	SGHS-CSO score	GHS-10-AO score	GHS-20-AO score
No harm	22	0	0	0
	23	0	0	0
	24	0	0	0
	25	0	0	0
	29	0	0	0
	27	0	0	0
	30	0	0	0
Low harm	17	2	2	3
	19	1	0	2
	21	2	2	4
	20	1	2	5
	1	1	0	0
	18	2	1	3
	15	2	2	3
Moderate harm	11	5	3	6
	9	5	6	10
	12	3	4	6
	7	4	5	8
	14	3	2	4
	8	4	4	7
	10	4	3	5
High harm	3	8	7	12
	5	7	5	7
	6	8	7	14
	2	6	8	13
	4	7	5	10
	13	9	9	19
	26	8	5	10
	16	6	2	4
	28	7	5	10

The rank order correlation between the SGHS-CSO and GHS-10-AO was high at 0.928 ($p <.001$), and was also between the SGHS-CSO and GHS-20-AO at 0.936 ($p <.001$). The extremely high correlations between the measures provides support to the GHS-10-AO and GHS-20-AO as valid measures of gambling harm to AOs accurately reflecting the narratives for both affected and unaffected others.

Chapter 8. Elicitation of disability weights from narrative accounts associated with differing levels of gambling-related harm

8.1 Introduction

The previous chapters have outlined a systematic process to estimate health utility decrements from gambling problems via *indirect* elicitation. Indirect elicitation is the statistical association of harms with general measures of health utility that make no explicit mention of gambling activities. Advantageously, an indirect approach avoids the subjectivity and response framing effects that result from requiring participants to attribute the degree of life impacts caused by the gambling. However, despite these advantages, one disadvantage is that this approach is purely quantitative, and based on closed-form instruments in terms of both the Gambling Harm Scale (GHS) indicator, and the outcome of health utility, as measured by the SF-6D. Thus, there remains the possibility that, if a respondent is given the opportunity to fully describe and contextualise their relationship with gambling, this narrative might be inconsistent with that implied by quantitative scores derived from closed-form self-report measures.

Chapters 6 and 7 of this report have explored this issue by thematically analysing interview transcripts with gamblers and affected others (AO) at varying levels of harm. Thirty gamblers and thirty AOs were analysed separately in these two chapters, due to the different experiences of these two groups. For the gamblers, a clear pattern emerged where the number and severity of harms narrated in the interview correlated with their quantitative self-report score. A similar pattern emerged for the AOs, where the number and severity of harms narrated in the interview generally correlated with the quantitative self-report score. However, the relationships in this group were more nuanced, as any harms experienced by the AO depended also on the nature of their relationship. An older married spouse is likely to experience more harm from a given quantity of gambling than a younger friend, for example, due to an increased number of relationship, emotional, and financial ties with the gambler. These issues could have caused a misalignment between the quantitative self-report score and narrative for some participants, although the two still appeared consistent for a majority of participants. These findings may reflect the fact that more research has been done on harms to gamblers than to significant others (Tulloch et al., 2022).

Another approach to validating, gambling instruments like the Problem Gambling Severity Index (PGSI) have traditionally been by using clinical interviews to serve as a ground-truth for an individual suffering from gambling problems (Ferris & Wynne, 2001; Ladouceur et al., 2005). Although the GHS is not intended to be a clinical diagnostic instrument, it is still intended to be a reliable indicator of genuine harm. That is, higher scores imply a meaningful decrement to one's health and quality of life. Therefore, a similar form of expert evaluation is applicable, in which qualified persons evaluate narrative first-hand accounts of subjects' relationship with gambling, and independently judge the degree to which these experiences reflect decrements in health utility. The principal methodological difference when comparing the GHS with a clinical instrument is that experts are required to estimate a metric quantum of impact (i.e. utility decrement), rather than a binary classification (i.e. a clinical diagnosis).

There is a well-established methodological tradition in public health and health economics that employs elicitation protocols based on the evaluation of health state vignettes (Matza et al., 2021).

These vignettes can be algorithmically generated from reported symptomatology, and an elaboration of this approach was previously applied to gambling-related harm (Browne et al., 2017; Rawat et al., 2018). Alternatively, vignettes may be designed that describe the typical experience of living with a given condition, potentially encompassing a range of severities. For example, Kraemer et al. (2005) elicited health utility scores from a set of scenarios describing a spectrum of alcohol-related health states using the Time Trade Off (TTO), the Standard Gamble (SG) and Visual Analogue Scale (VAS).

Evaluation of a single descriptor describing, e.g., an "at-risk drinker", is appropriate when there is a strong consensus in the literature regarding the typical symptoms associated with a given health state category. However, in the field of gambling studies, no such consensus exists regarding differing categorical levels of gambling-related harm. Further, we have argued, along with others, that gambling harm is best conceptualised as a continuum (Ferris & Wynne, 2001). Finally, impacts from gambling are notoriously diverse and dependent on life circumstances (Langham et al., 2016; Muggleton et al., 2021), making the construction of an 'archetypal' experience quite difficult. This issue was previously addressed by Browne et al. (2017) and Rawat et al. (2018) by randomly sampling gamblers at varying severity levels, and algorithmically creating a large set of condition descriptors capturing this heterogeneity. In any case, it is a challenge to apply direct elicitation protocols to gambling harms to both (a) define discrete categorical severity levels, and (b) define an archetypal experience applicable to each level.

The study had two objectives:

1. Determine if experts, evaluating blinded descriptions of harm levels, rate the harm levels in the same order as the GHS classifications, and

2. Determine a set of disability weights via an alternative, independent method, and make a comparison of these weights to the statistically-derived GHS weights.

8.2 Method

This study required academic researchers and clinicians in the gambling field (henceforth *experts*) to review 60 transcripts from gamblers and affected others (AOs) who reflected on their experiences of varying levels of gambling-related harm. Experts were then required to attend an online interview where they evaluated the varying categories of gambling-harm using four elicitation protocols. Ethical approval for this study was granted by the CQU Human Research Ethics Committee (#23356). As an outline, the process involved the following steps:

1. Conducting interviews with a subset of gamblers and affected others (AOs) who responded to the quantitative surveys, stratified into bands with respect to gambling-related harm

2. Transcription and collation of the interviews

3. Eliciting blind expert judgements of the typical severity of the condition described in the transcripts for each band of gambling-related harm.

Although the elicited evaluations are represented as numeric utility decrements, the method can be understood as an expert validation of the closed-form quantitative survey, based on open-ended qualitative interview data (Chapters 6 & 7) from those with first-hand experience of gambling problems.

8.2.1 Participants

Six experts, including three researchers and three clinicians, were recruited from the authors' professional networks. Experts were deemed to have significant research or clinical expertise in the gambling field. Experts were emailed an invitation which outlined the requirements for the study (Appendix 9). A total of 9 invitations were sent to experts across three countries, and 3 experts were unable to participate. Given the substantial time commitments, and expertise of the participants, each expert was reimbursed with AU$1,500 for their time.

8.2.2 Transcripts

A total of 60 interview transcripts were used for evaluation. The anonymised transcripts were drawn from Chapters 6 and 7 of this report, wherein 30 gamblers and 30 AOs reflected on their lived experience of gambling and gambling-harm. Transcripts were stratified according to harm bands based on their scores on the preliminary gambling harm scales (SGHS / SGHS-CSO) as described in Chapters 6 and 7. For both groups, approximately equal numbers were achieved for the categories of no-harm, low-harm, moderate-harm, and high-harm (Table 8.1).

Table 8.1. Number of transcripts for each group for gamblers and AOs

Harm category	Gamblers	AOs
No-harm	7	7
Low-harm	8	7
Moderate-harm	7	7
High-harm	8	9

For the gambler and AO groups the harm categories were defined using the Short Gambling Harm Screen (SGHS; Browne et al., 2018) and Short Gambling Harm Screen for Concerned Significant Others (SGHS-CSO; ACIL Allen Consulting et al., 2017), respectively. The scoring system was equivalent for both measures where 0 = no-harm, 1 to 2 = low-harm, 3 to 5 = moderate-harm, and 6 to 10 = high-harm. The work in this chapter was performed concurrently to the development of the 20-item Gambling Harms Screen for the gamblers (GHS-20) and affected others (GHS-20-AO), and consequently these scales were not available at the time of recruitment. However, for the participants in this study, the rank order correlation between scores on the SGHS (now GHS-10) and GHS-20 were 0.967. The rank order correlation between the SGHS-CSO and GHS-20-AO was 0.936. With the rank ordering of scores on both sets of scales being almost identical, the findings can be applied to the revised instruments. Due to this overlap and collinearity in measures, we will subsequently refer to the quantitative scores associated with each transcript group collectively as 'GHS' scores.

The experts were provided with the transcripts at least one week before the online interview and asked to make general notes about their perceptions of the categories. In order not to bias the experts, evaluation was blinded; that is, there was no mention of harm categories when providing the transcripts. Rather, we referred to the categories as "bands". The experts were not told which band was which harm level, and the band numbers were different for each expert. For example, for one expert the high-harm band might be number 3, but for another it might be number 1.

8.2.3 Online interview

Experts individually participated in an online interview with a member of the research team. First, the researcher and expert discussed the expert's general thoughts about each of the bands for the gambler and AO groups. This was an informal discussion and mainly conducted for the purpose of refreshing the expert's memory regarding the upcoming tasks. Second, each of the bands for both groups was evaluated using the four elicitation protocols described below. Prior to undertaking each elicitation protocol, the researcher ran through some training examples using non-gambling related conditions to ensure the expert fully grasped how to complete the protocol correctly. The four elicitation protocols used were:

Visual analogue scale (VAS): Using a visual analogue scale, the experts rated the overall impact caused by gambling for each respective band. Ratings ranged from 0 (worst imaginable health state) to 100 (best imaginable health state) (EuroQuol Research Foundation, 2021). The VAS was converted into a standard disability weight via: $DW = (100 - VAS) / 100$.

Rank ordering: The experts completed a simple rank ordering task using a list of 20 health states. The health states were sourced from the Global Burden of Disease Study 2019 (Global Burden of Disease Collaborative Network, 2020), which varied with respect to disability weighting from low conditions (e.g. #1; asthma - controlled) to high (e.g. #20; schizophrenia - acute state). For each health state, the associated disability weight (DW) was not shown to experts, but the reference conditions were ordered with respect to the prior established DW, and a detailed description of symptomology was provided. Experts were asked to rank the impact of gambling, for each respective band, from a number relative to the other 20 conditions. The DW was then imputed based on the midpoint of the two conditions between which the experts placed each band.

Time trade-off (TTO): For each band, experts completed the TTO (Lugner & Krabbe, 2020). They were instructed to imagine they had 10 years left to live and asked how much time of this 10-year period they would be willing to give up in order to avoid the issues caused by gambling. Thus, the target answer would capture two equivalently valued counterfactuals: (a) living a further 10 years experiencing the issues described, (b) living some shorter amount of time, but avoiding those issues. The TTO was converted into a DW via: $DW = TTO / 10$.

Standard gamble (SG): The SG is a method which assesses the risk of death one would be willing to accept in order to avoid a certain outcome. For each band, experts reflected on the gambling impacts and provided the risk of death (expressed as a percentage) they would be willing to accept to avoid those issues. Given the outcome of the SG as a percentage, it was converted into a DW via: $DW = SG / 100$.

8.2.4 Data analysis

Ratings from each protocol were converted into a common disability weight (DW) from 0 (no impact) to 1 (maximal impact). We calculated means and medians, and ran OLS and robust regressions using the available factors: group (AO, gambler), harm band (none, low, moderate, high), protocol (rank ordering, SG, TTO, VAS), and expert ID (A-F). This 2x4x4x6 design yielded 192 elicited ratings for analysis. A full factorial model would fully saturate the data (i.e. zero residual degrees of freedom). However, we considered a group x band interaction, which fully fits the 8 available transcript groups (i.e., gamblers and AOs at 4 levels of harm each), and we also considered an expert x protocol interaction, which captures a 'nuisance' effect of experts responding differently depending on protocol.

After confirming significant differences across harm bands, and after controlling for variability across experts and elicitation protocols, we conducted a final robust regression to obtain estimates of decrements. Robust regression works by reducing the leverage of outliers with respect to the fitted residuals. Thus, the robust model excludes the interactive protocol x expert rating effects, conveniently allocating this variance to the residual terms, and making outliers subject to 'robustification'(Bertsimas & Copenhaver, 2018).

8.3 Results

Figure 8.1 plots mean and median elicited decrements for each transcript group. In all cases and in line with predictions, vignettes associated with increasing harm scores were associated with monotonically increasing elicited decrements. However, differences between mean and median curves are apparent. Table 8.2 summarises models with increasing accommodation of interactive effects. All harm bands were significantly different from the base category (no harm) for all OLS regressions. There was significant heterogeneity between protocols, between experts, and also a significant interactive effect explaining 14.5 per cent of variance in ratings, $F(15) = 4.67$, $p < 0.01$. Inspection of the residuals of the fully specified model (4) showed a high conformity to normality, confirming that this heterogeneity was the source of differences between calculated mean and medians in Figure 8.1.This implies that robustification of the mean elicited scores should yield more accurate estimates. Interestingly, there was no significant overall difference between AO and gambler bands, nor a significant group x band interaction effect, $F(3) = 0.401$, $p = .746$, indicating that there was no detectable difference in gradients for gamblers and AOs with respect to GHS harm band. In other words, there was no statistically significant difference between harm bands for AOs and gamblers, suggesting that a pooled estimate for both groups would be more robust.

With this information, we specified a robust simple main effects model, arriving at decrements for GHS bands of: Low: 0.084, Moderate: 0.187, High: 0.221 (Table 8.2, Column 1).
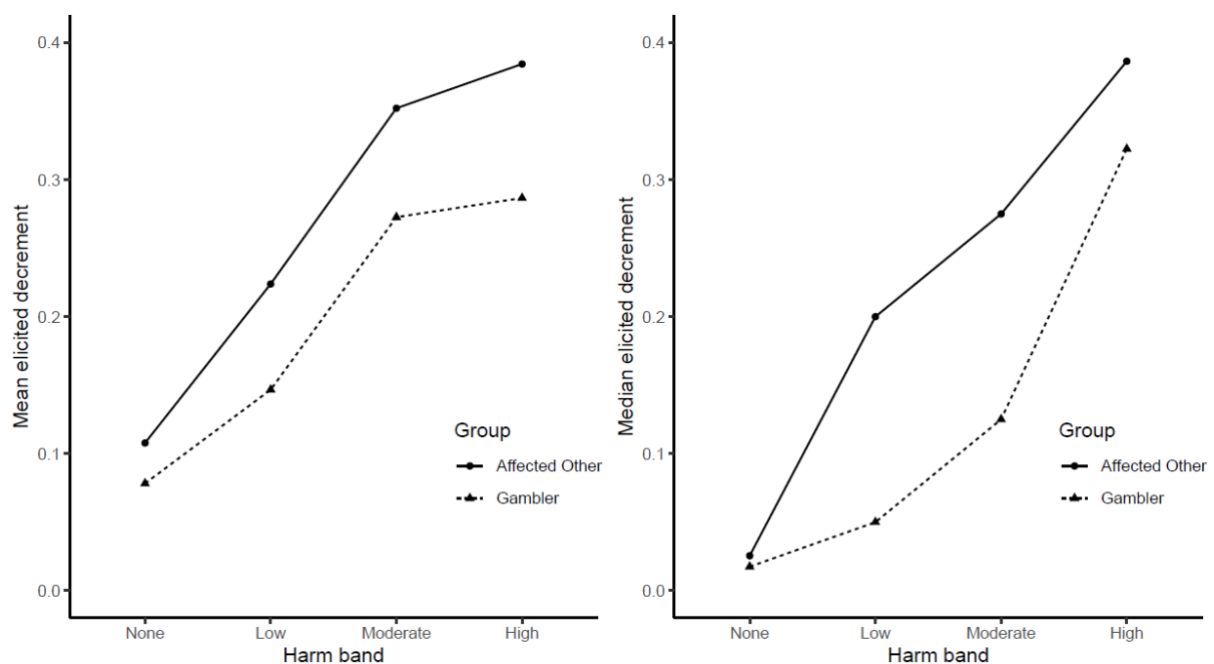
Figure 8.1. Mean and median elicited decrements for gamblers and affected others by harm band

Table 8.2. Robust and OLS regression models of elicited decrements

		Dependent variable: Elicited utility decrement			
		Robust (1)	**OLS (2)**	**OLS (3)**	**OLS (4)**
Group	AO	—	—	—	—
	Gambler	-0.060 (0.031)	-0.071** (0.026)	-0.030 (0.052)	-0.030 (0.046)
GHS Band	None	—	—	—	—
	Low	0.084* (0.033)	0.092* (0.037)	0.116* (0.052)	0.116* (0.046)
	Moderate	0.187** (0.033)	0.219** (0.037)	0.244** (0.052)	0.244** (0.046)
	High	0.221** (0.033)	0.243** (0.037)	0.277** (0.052)	0.277** (0.046)
Protocol	Rank	—	—	—	—
	SG	-0.123 (0.034)	-0.111** (0.037)	-0.111** (0.037)	-0.212** (0.079)
	TTO	-0.141 (0.034)	-0.133** (0.037)	-0.133** (0.037)	-0.459** (0.079)
	VAS	0.128 (0.034)	0.140** (0.037)	0.140** (0.037)	0.169* (0.079)
Expert ID	A	—	—	—	—
	B	-0.265** (0.041)	-0.252** (0.045)	-0.252** (0.045)	-0.350** (0.079)
	C	-0.285** (0.041)	-0.278** (0.045)	-0.278** (0.045)	-0.370** (0.079)
	D	-0.154* (0.041)	-0.087 (0.045)	-0.087 (0.045)	-0.402** (0.079)
	E	-0.282** (0.041)	-0.253** (0.045)	-0.253** (0.045)	-0.361** (0.079)
	F	-0.197** (0.041)	-0.173** (0.045)	-0.173** (0.045)	-0.158* (0.079)
Group x GHS Band				—	—
	Gambler x Low			-0.048 (0.074)	-0.048 (0.064)
	Gambler x Moderate			-0.050 (0.074)	-0.050 (0.064)
	Gambler x High			-0.068 (0.074)	-0.068 (0.064)
Expert x Method					—
	B x SG				0.048 (0.112)
	C x SG				0.089 (0.112)
	D x SG				0.450** (0.112)
	E x SG				0.069 (0.112)
	F x SG				-0.044 (0.112)
	B x TTO				0.329** (0.112)
	C x TTO				0.340** (0.112)
	D x TTO				0.733** (0.112)
	E x TTO				0.365** (0.112)
	F x TTO				0.188 (0.112)
	B x VAS				0.015 (0.112)
	C x VAS				-0.061 (0.112)
	D x VAS				0.077 (0.112)

E x VAS				0.002 (0.112)
F x VAS				-0.204 (0.112)
Constant	0.323** (0.041)	0.328** (0.047)	0.308** (0.052)	0.407** (0.063)
Observations	192	192	192	192
R^2		0.522	0.524	0.669**
Adjusted R^2		0.49	0.484	0.607
Residual Std. Error		0.180 (df = 179)	0.181 (df = 176)	0.158 (df = 161)
F Statistic		16.272** (df = 12; 179)	12.930** (df = 15; 176)	10.823** (df = 30; 161)

Note:* $p < 0.05$; ** $p < 0.01$

8.4 Discussion

This study involved a blinded evaluation of narratives provided by gamblers and AOs experiencing varying degrees of harm, as indicated by the GHS quantitative measures. All estimates of elicited utility decrements increased significantly and monotonically over the harm bands, indicating that the experts evaluated these blinded descriptions in the same order as scores on the GHS, answering the first study objective. Thus, we take these results as independent validation of the quantitative GHS measures: increasing scores correspond to meaningful differences in the narrative accounts of people and their relationship to gambling, in terms of the assessed likely impact on health utility. These results are consistent with our own qualitative assessment of the narratives when stratified by GHS score, as described in Chapters 6 and 7. As well as noting a systematic increase in severity for both gamblers and AOs over harm bands, we also noted that the impacts to those in moderate and severe bands were more clearly differentiated than those in the low harm (1-2 on the GHS-10) category. This is consistent with the elicited decrements, with the moderate- and high-harm decrements (0.187 and 0.221) being more than double than the decrement for those in the low-harm band (0.084). These weights answer the second objective. This pattern is similar to that found for the GHS-10 (previously SGHS), as reported in Chapter 3. Although the decrement for GHS-10 (1-2) band was significantly different from zero, it was small, at 0.020; and about 1/3 of the moderate band (3-5) decrement (0.062).

As expected, decrements assessed in this study via elicitation were systematically larger than those determined by statistical inference, as reported in Chapters 3 - 5. This is a common finding in the health utility literature (See Appendix 10 for a brief review),and is attributable to intrinsic methodological differences. Elicitation of utility decrements may be positively biased by the protocols employed, by response framing, stigma towards the condition, over-attribution by participants of impacts to the gambling rather than other causes, or similarly, a lack of accounting for co-morbid conditions or life-situations that may contribute to the experienced impacts. Nevertheless, one should be wary of assuming that attribution of impact via propensity score matching and statistical control for comorbidities is the ground truth for determining absolute magnitude of impact. That approach is arguably biased in a conservative direction, as gambling likely interacts with other life-stressors to ultimately contribute to lower health and quality of life.

Ultimately, given the ethical and practical impossibility of conducting a randomised control trial to isolate the specific impact of gambling-related harm, a general strategy of triangulation is recommended, by which evidence from multiple methodologies is integrated to yield consensus estimates (Munafò & Smith, 2018). The public health literature uses a mixture of direct and indirect

estimation techniques to estimate the impact of various conditions. For example, the Global Burden of Disease (GBD) project employs direct elicitation methods similar to those reported here, and adjusts for co-morbidities and antecedent factors via a separate computational step. Thus, more important than a singular methodology-independent absolute estimate, is to employ a consistent methodology when comparing the relative impact of different health-related issues. Thus, the results from the present study provide not only a useful source of independent expert validation of the GHS instruments, but also a complementary assessment of health utility scores, applicable when making comparisons to other conditions that are based on similar direct elicitation techniques. However, unless gambling is being compared to other conditions that also use direct elicitation techniques (TTO, SG, VAS, etc), we recommend the use of disability weights as estimated in Chapters 3 - 5.

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Chapter 9. Conclusions

This report has described a programmatic series of work to further our understanding and measurement of gambling-related harm, some of which involved quite technical methods. Therefore, it is useful to reprise and integrate the main findings in a non-technical format, to provide the reader with a plain-language explanation of the implications and conclusions.

First and foremost, the project validates three new scales for measuring gambling-related harm (GRH), the GHS-20, the GHS-10-AO, and the GHS-20-AO. The existing SGHS has been renamed the GHS-10 to fit in with this new naming structure. These scales provide short and longer assessments of GRH for both gamblers and affected others (AO). Psychometric properties of all scales are strong, and non-zero scores on all scales have been shown to predict unique decrements to health utility, even after balancing harmed and unharmed groups with respect to risk factors and controlling for comorbidities. Thus, this suite of assessment tools provides a strong foundation for assessment and monitoring of GRH. An important feature of these scales is that they are benchmarked to the recognised public health benchmark of health utility.

As well as serving as the key external benchmark of the validity of these scales, health utility has the property of being *summative*. That is, when applied to a population representative sample, decrements can be added-up over individuals to create a single index of the aggregate amount of harm experienced in a population. This provides an index to monitor the impacts of gambling to a community and an alternative to the current standard approach, which is to calculate the simple prevalence of problem gamblers. In addition, progress in reducing gambling-related harm as a result of interventions can be tracked using pre- and post-intervention measurement of GRH.

The principal use-case scenario of these scales is in population assessments of the impacts of gambling, as is routinely done in population-representative monitoring surveys in Victoria and other Australian jurisdictions. However, the scales also have an obvious role in research, when GRH is the main outcome of interest. It is also possible to explore the use of these measures in screening or clinical applications.

The primary methodology used in this project was that of 'indirect elicitation' of health decrements attributable to gambling. This contrasts with the 'direct elicitation' approach used in a major prior study funded by the VRGF (Browne et al., 2016), and also employed in a secondary stage in the present study that is described in Chapter 8. In short, indirect elicitation involves statistical estimation of the associative link between gambling and health, in which comparison groups are balanced with respect to risk factors, and potentially confounding co-morbidities are controlled for. This is based on data provided by participants experiencing GRH, but participants are not directly required to estimate the degree to which gambling caused the health impacts. Direct elicitation involves the evaluation of condition descriptions by a separate panel (either the public or experts), using public health protocols such as the Time Trade Off (TTO). While these two approaches are very different, neither method is inherently superior to the other. However, it is fair to say that direct methods are prone to being *anti-conservative* estimates, due to the potential for over-attribution of impacts to gambling. Direct elicitation makes implicit reference to a baseline state of perfect health and well-being, and is influenced by the stigma attached to the condition. Due to stigmatisation of gambling problems, people may not be willing to admit to how much gambling problems have affected them. Conversely, people may overestimate gambling effects on their lives as an excuse for a variety of other living problems that they experience. It may be impossible to know, in balance, which effect is more impactful. Nevertheless, the assumed high baseline of perfect health in the absence of gambling problems makes these estimates anti-conservative (i.e., probable over-estimates).

In contrast, indirect methods are likely *overly-conservative*, since the generic health outcome measures, such as the SF-6D, may not be sensitive to kinds of harms caused by gambling. Moreover, the statistical control procedure may winnow away legitimate direct effects of gambling on health. As discussed in Appendix 10, these methodological differences mean that direct and indirect elicited decrements will be scaled very differently, and cannot be directly compared. However, the fact that the same pattern of increasing health decrements with increasing non-zero GHS scores was found in every case, provides strong evidence that the scales are reliable and valid indices of GRH.

As mentioned above, this project complemented the main quantitative and indirect methods with qualitative interviews of gamblers and AO, stratified across the spectrum of impact. Qualitative interviews provide crucial first-person accounts of the experience of living with GRH. Again, the accounts given by harmed individuals showed a clear pattern of increasing severity with increasing GHS scores. This provides another independent source of evidence that higher scores on the GRH instruments are truly associated with a meaningful degree of impact. For AOs, the picture is complicated by the moderating effect of the type and strength of relationship to the gambler. This provides clear direction to an important line of research, which is to assess which kinds of relationships (e.g., spouse, co-worker, etc.) are likely to be associated with significant vulnerability to the transmission of harm.

The final stage of the project involved transcribing these stratified interviews and presenting them to a panel of experts for evaluation using standard direct elicitation public health protocols. Although the Browne et al. (2016) study also involved direct elicitation, our method here differed in important respects. In 2016, a very large sample of condition descriptions were algorithmically generated from quantitative data collected using the 72 item 'harms checklist'[1] (from which the GHS items were sourced). These were then randomly assigned to a similarly large public sample, and a smaller expert sample, from which health decrements were elicited using various protocols administered by web form. In the present study, the actual transcripts of direct interviews formed the condition descriptions, and elicitation protocols were undertaken during interviews with a smaller set of experts, who were given one-on-one training on the methodology beforehand. Thus, while the 2016 methodology was optimised to achieve a large dataset of elicitations based on a representative sample, the present methodology was optimised to achieve a smaller sample of higher quality elicitations based on detailed first-hand descriptions provided by gamblers and AOs. As with direct versus indirect elicitation, it is not possible to say definitively that one methodology is superior to another. These methods have different strengths and weakness that are mutually complementary. Nevertheless, both forms of direct elicitation showed a clear pattern of increasing health impact with respect to PGSI category (2016 study) and harm band (present study).

The diversity of methods employed by the present study and prior work is an intentional strategy to compensate for intrinsic *method variance*. That is, achieving different health decrements depends in part on the methods used. Nevertheless, using this method of triangulation, we achieve the strongest possible evidence for the increasing health impacts of gambling with increasing GHS scores. However, there is no universally agreed-upon convention or gold standard for assessing health utility decrements. The choice of method depends somewhat on the purpose for which the estimates are to be used. For example, if gambling is to be integrated into a Global Burden of Disease (GBD) framework, then decrements for other conditions in this framework are determined via direct elicitation, and comorbidity discounting is handled separately via simulation procedures employed by the World Health Organization (WHO). In this case, directly elicited utility decrements should be employed to maintain consistency with these methods. On the other hand, if gambling is to be evaluated in isolation (that is, without accounting for comorbidities separately), then the indirect

[1] A comparison between the 72-item checklist and GHS instruments is provided in Appendix 11

elicited decrements (i.e. the scoring provided for the GHS measures provided in the appendices to this report) should be used. The important caveat is that when comparing absolute decrements, as opposed to relative differences, only 'apples to apples' comparisons should be made, when comparing gambling to other conditions, or comparing results across different studies. In short, only direct elicitation measures can be compared with one-another when using the same or broadly similar methods, and likewise for indirect-elicitation.

These complications regarding method variance should not distract from the fact that multiple methods employed in this program of research have consistently found increasing impacts to health with increasing GHS scale scores. This methodological triangulation provide assurance that the GHS suite of measures provides a meaningful index of GRH, and we recommend their use in future prevalence surveys and other research.

To someone with a hammer, everything looks like a nail. In the past two decades the utility of the Problem Gambling Severity Index has contributed much to our understanding of gambling problems. Nevertheless, there is an inherent weakness in seeing gambling problems exclusively through the lens of the symptoms associated with a gambling disorder. Measuring gambling harm has the distinction of directly tracking the outcome that we most fervently hope to ameliorate: the harms that make people's lives less productive and enjoyable. Importantly, it is not practically possible to measure the effect of gambling disorders on affected others without understanding the harms that they experience. Affected others may not have their own gambling problems but rather suffer by virtue of their relationship to the gambler. The principal contribution of this present research is to provide a new set of tools that can change the conversation around gambling, including its regulation, treatment, and potential public-health policy approaches. With these new tools in hand there is the opportunity to foster better regulation and remediation of gambling in Australia.

References

Browne, M., Langham, E., Rawat, V., Greer, N., Li, E., Rose, J., . . . Best, T. (2016). *Assessing gambling-related harm in Victoria: A public health perspective*. Melbourne: Victorian Responsible Gambling Foundation.

Appendices

Appendix 1. Online survey – Information sheet and questionnaire

The impact of gambling harm on health and wellbeing

Thank you for your interest in this study. This research is funded by the Victorian Responsible Gambling Foundation and approved by the CQUniversity Human Research Ethics Committee (22341). The market research company *Qualtrics* is assisting with recruitment.

In the current study we are aiming to measure the impact of gambling harm on health and wellbeing.

We are seeking responses from:
- People who have gambled in the past 12 months, and/or
- People who have had a close relationship with someone who has gambled in the past 12 months, or
- People who do not gamble <u>and</u> who do not have a close relationship with someone who has gambled in the past 12 months.

Please note we are only seeking a certain number of responses from each group.

Additional requirements for you to participate are that you:
- Are aged 18 years or over
- Live in any state or territory of Australia, **expect for Victoria.**

The questionnaire will take about 15 – 20 minutes to complete and includes questions about:
- Demographics (such as your age and gender)
- Questions about your health and wellbeing
- Harms you <u>may</u> have experienced due to gambling (either your own or someone else's)

If you wish to read more details about this study, please click the button below. Otherwise, please indicate your consent to proceed with the survey.

If you have any questions, please contact the research team at <u>v.rawat@cqu.edu.au</u>

Would you like to see more details about the study?
- Yes (goes to next page)
- I do not wish to see more details and I consent to participating in this study

ADDITIONAL INFORMATION

How your confidentiality will be protected
Your responses will be combined with hundreds of other people's responses, therefore no one might be able to guess your identity in any publication associated with this project.

At the end of the survey you will be invited to take part in a follow up interview. If you choose to agree, then you will be asked for your name and contact details. You are under no obligation to take part in an interview and you may provide a pseudonym (a fake name) if you prefer. Please be assured that none of your personal information will be included in any publications.

Participation is voluntary
Your participation in this study is completely voluntary. Should you wish to withdraw at any stage prior to submitting responses you are free to do so without penalty.

How you will receive feedback
Information about the results of the research will be made available through CQUniversity's gambling research Facebook page - https://www.facebook.com/cquegrl/

Where you can get further information
If you want further information or have any questions, please contact Vijay Rawat: v.rawat@cqu.edu.au You can also contact the Ethics Coordinator for any complaints at CQUniversity's Office of Research: 07 4923 2603.

If you experience discomfort at any point during the survey, you can contact the **Gambling Helpline on 1800 858 858** or **www.gamblinghelponline.org.au** or **Lifeline on 13 11 14**. These are free and confidential help services that operate 24 hours a day, 7 days a week. You may also seek support from your personal General Practitioner (GP).

Project team
The study is being conducted by:
CQUniversity: Professor Matthew Browne, Professor Matthew Rockloff, Professor Nerilee Hing, Dr Alex Russell, Dr En Li, Dr Philip Newall, Mr Cailem Murray-Boyle, Mr Vijay Rawat
La Trobe University: Associate Professor Steve Begg

Do you consent to participating in this study?
- Yes (goes to next page)
- No (screened out)

Overview of survey (not shown to participants)

The table below provides an overview of the main survey sections and logic.

Survey section	Group A: Gamblers	Group B: AOs	Group C: Controls
Screening	√	√	√
Gambling behaviour	√		
Harms (Gamblers)	√		
Harms (AOs)		√	
Demographics	√	√	√
Outcomes	√	√	√
Co-morbidities	√	√	√
Risk factors	√	√	√
Future research (qual)	√	√	

- Red text in this document indicates programming notes and is not shown to participants

SCREENING

S1. Do you reside in Australia?

- Yes
- No (Screen out)

S2. What is your age?

_____ years (validate numeric, max 100)

*If under 18 years, screen out

S3. In which state or territory do you mainly reside?

- New South Wales
- Victoria (screen out)
- Queensland
- South Australia
- Tasmania
- Northern Territory
- Australian Capital Territory
- Western Australia

S4. What is your gender?

- Male
- Female
- Other

MESSAGE

Please note that on some pages of this survey it will not be possible to use the back button to change your responses, so please answer all questions carefully.

S4.1. Apart from raffles, lottery tickets or instant scratch tickets, have you gambled* in the past 12 months?

* Gambling includes race betting, pokies, casino table games, sports betting, informal private betting for money (e.g. playing cards at home), Keno, bingo, eSports betting, and fantasy sports.

- No
- Yes (Assign to gambler group)

*If yes to S4.1 above

S4.2. Thinking about the last <u>12 months,</u> how often:

	Never	Sometimes	Most of the time	Almost always
Have you bet more than you could really afford to lose?				
Have you needed to gamble with larger amounts of money to get the same feeling of excitement?				
When you gambled, did you go back another day to try to win back the money you lost?				
Have you borrowed money or sold anything to get money to gamble?				
Have you felt that you might have a problem with gambling?				
Has gambling caused you any health problems, including stress or anxiety?				
Have people criticised your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?				
Has your gambling caused any financial problems for you or your household?				
Have you felt guilty about the way you gamble or what happens when you gamble?				

S5.1. Have you had a close relationship* with someone who has gambled (excluding raffles, lottery tickets or instant scratch tickets), in the past 12 months?

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

- No (Assign to Control group)
- Yes (Assign to AO group)

*If yes to S5.1 above

S5.2. The next few questions are about **the person who gambled with whom you had a close relationship with**. If you aren't sure, please answer to the best of your knowledge.

Thinking about the last <u>12 months,</u> how often:

	Never	Sometimes	Most of the time	Almost always
Have they bet more than they could really afford to lose?				
Have they needed to gamble with larger amounts of money to get the same feeling of excitement?				
When they gambled, did they go back another day to try to win back the money they lost?				
Have they borrowed money or sold anything to get money to gamble?				
Have they felt that they might have a problem with gambling?				
Has gambling caused them any health problems, including stress or anxiety?				
Have you or other people criticised their betting or told them that they had a gambling problem?				
Has their gambling caused any financial problems for them or their household?				
Have they felt guilty about the way they gamble or what happens when they gamble?				

GAMBLING BEHAVIOUR

1. In the last 12 months, how often have you spent money:

	Not at all in the past 12 months	Less than once a month	Once a month	2-3 times a month	Once a week	2-3 times a week	4 or more times a week
1. On Australian lotteries, such as Tattslotto, Oz Lotto, Powerball or Pools							
2. Buying raffle tickets, sweeps or other competitions							
3. Betting on horse or harness racing or greyhounds – including the Melbourne Cup, Spring racing or on trackside virtual racing, but NOT including all sweeps							
4. Playing pokies or electronic gaming machines							
5. On scratch tickets							
6. Betting on casino table games such as blackjack, roulette, and poker							
7. Betting on sports – such as AFL or cricket, but NOT including all sweeps, fantasy sports, and esports							
8. On informal private betting – like playing cards at home							
9. Betting on Keno							
10. Entering a prize-draw competition by phone where there was a phone-charge for entry							
11. Betting on bingo							
12. Betting on eSports events							
13. Betting on fantasy sports games							
14. Other gambling activity (please specify) _____							

*If the only gambling people do is on raffles, lottery tickets, instant scratch tickets, or prize draws, screen out

HARMS (GAMBLERS)

1. During the last 12 months, did any of these **financial** issues occur **as a result of your gambling?**

Item	No	Yes
1. Reduction of my available spending money		
2. Less spending on recreational expenses such as eating out, going to movies or other entertainment		
3. Reduction of my savings		
4. Sold personal items		
5. Increased credit card debt		
6. Late payments on bills (e.g. utilities, rates)		
7. Less spending on essential expenses such as medications, healthcare and food		

2. During the last 12 months, did any of these **work/study** issues occur **as a result of your gambling**?

	No	Yes
8. Used my work or study time to gamble		
9. Reduced performance at work or study (i.e. due to tiredness or distraction)		
10. Was absent from work or study		

3. During the last 12 months, did any of these **health** issues occur **as a result of your gambling**?

	No	Yes
11. Loss of sleep due to spending time gambling		
12. Didn't eat as much or often as I should		
13. Increased experience of depression		

4. During the last 12 months, did any of these **emotional/psychological** issues occur **as a result of your gambling**?

	No	Yes
14. Had regrets that made me feel sorry about my gambling		
15. Felt like a failure		
16. Felt ashamed of my gambling		
17. Felt distressed about my gambling		

18. Felt insecure or vulnerable		
19. Felt worthless		

5. During the last 12 months, did any of these **relationship** issues occur **as a result of your gambling**?

20. Spent less time with people I care about		
21. Spent less time attending social events (non-gambling-related)		
22. Experienced greater tension in my relationships (suspicion, lying, resentment, etc.)		
23. Social isolation (felt excluded or shut-off from others)		
24. Experienced greater conflict in my relationships (arguing, fighting, ultimatums)		
25. Threat of separation or ending a relationship/s		

6. During the last 12 months, did any of these **other** issues occur **as a result of your gambling**?

26. Reduced my contribution to religious or cultural practices		
27. Promised to pay back money without genuinely intending to do so		
28. Had experiences with violence (including family/domestic violence)		
29. Didn't fully attend to the needs of children		
30. Took money or items from friends or family without asking first		
31. Petty theft or dishonesty in respect to government, business, or other people (not family/friends)		

7. Please consider each issue which occurred and answer 1) how much of a problem this issue was for you and 2) how much this issue was caused by your gambling.

Item	How much of a problem was this for you?					How much was this caused by your gambling?				
	Not a problem	A minor problem	A moderate problem	A major problem	A very serious problem	Not caused by my gambling	Slightly caused by my gambling	Somewhat caused by my gambling	Mostly caused by my gambling	Totally caused by my gambling
pipe through items here for the items where 'yes' was selected in questions 1 – 6										

8. Earlier you mentioned that you have engaged in these forms of gambling, and that you have experienced some degree of harm.

What type of gambling has caused you the **most** harm?

*Insert activities selected at Q1 (Section: Gambling Behaviour) where response was anything other than 'not at all in the past 12 months'

* Question only displayed if any harm item from the checklist was 'yes'

If these questions have raised issues for you, you are able to take a break. Please close your browser and when you are ready simply open the link on the same browser. You will be able to continue where you left off.

If you need to speak to someone you can contact the **Gambling Helpline on 1800 858 858** or **www.gamblinghelponline.org.au** or **Lifeline on 13 11 14**. You may also seek support from your personal General Practitioner (GP).

HARMS (AOs)

1. In the past 12 months how many people in total have you had a close relationship with who have gambled? _____ (If 0 screen out)

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

2. Thinking about the other person whose gambling has negatively affected you **the most**, what best describes their relationship to you?

   - Current spouse/partner
   - Former spouse/partner
   - Father or Father in-law
   - Mother or Mother in-law
   - Son
   - Daughter
   - Sister/brother
   - Grandparent
   - Other family member or relative
   - Friend
   - Work colleague
   - Other (please specify) _____

3. Still thinking about the same person, do you depend on each other:

	No	Yes
Emotionally		
Financially		
To handle joint responsibilities (e.g. looking after children)		

4. For the following questions please think about the other person whose gambling negatively affected you **the most**.

During the last 12 months, did any of these **financial** issues occur **as a result of their gambling**?

Item	No	Yes
1. Reduction of my available spending money		
2. Reduction of my savings		

3. Late payments on bills (e.g. utilities, rates)		
4. Less spending on essential expenses such as medications, healthcare, food		

5. During the last 12 months, did any of these **work/study** issues occur **as a result of their gambling**?

5. Reduced performance at work or study (i.e. due to tiredness or distraction)		
6. Used my work or study time to attend to issues caused by their gambling		
7. Lack of progression in my job or study		

6. During the last 12 months, did any of these **emotional/psychological** issues occur **as a result of their gambling**?

8. Felt distressed about their gambling		
9. Felt angry about not controlling their gambling		
10. Feelings of hopelessness about their gambling		
11. Felt insecure or vulnerable		
12. Thoughts of running away or escape		

7. During the last 12 months, did any of these **health** issues occur **as a result of their gambling**?

13. Loss of sleep due to stress or worry about their gambling or gambling-related problems		
14. Stress related health problems (e.g. high blood pressure, headaches)		
15. Increased experience of depression		

8. During the last 12 months, did any of these **relationship** issues occur **as a result of their gambling**?

16. Experienced greater tension in my relationships (suspicion, lying, resentment, etc.)		
17. Experienced greater conflict in my relationships (arguing, fighting, ultimatums)		
18. Spent less time attending social events (non-gambling-related)		
19. Got less enjoyment from time spent with people I care about		

20. Felt belittled in my relationships		
21. Threat of separation or ending a relationship/s		

9. During the last 12 months, did any of these **other** issues occur **as a result of their gambling**?

22. Took money or items from friends or family without asking first		
23. Had experiences with violence (including family/domestic violence)		
24. Didn't fully attend to the needs of children		

10. Please consider each issue which occurred and answer 1) how much of a problem this issue was for you and 2) how much this issue was caused by their gambling.

Item	How much of a problem was this for you?					How much was this caused by their gambling?				
	Not a problem	A minor problem	A moderate problem	A major problem	A very serious problem	Not caused by their gambling	Slightly caused by their gambling	Somewhat caused by their gambling	Mostly caused by their gambling	Totally caused by their gambling
pipe through items here for the items where 'yes' was selected in questions 4 – 9										

If these questions have raised issues for you, you are able to take a break. Please close your browser and when you are ready simply open the link on the same browser. You will be able to continue where you left off.

If you need to speak to someone you can contact the **Gambling Helpline on 1800 858 858** or **www.gamblinghelponline.org.au** or **Lifeline on 13 11 14**. You may also seek support from your personal General Practitioner (GP).

DEMOGRAPHICS

1. In which country were you born?
   - Australia
   - Other

2. What language do you mainly speak at home?

   - English
   - Other

3. Are you of Aboriginal or Torres Strait Island origin?
   - No
   - Yes

4. What is the highest educational qualification you have received?
   - No schooling
   - Did not complete primary school
   - Completed primary school
   - Year 10 or equivalent
   - Year 11 or equivalent
   - Year 12 or equivalent
   - A trade, technical certificate or diploma
   - A university or college degree
   - Postgraduate qualifications

5. Which of the following best describes what you currently do?
   - Work full-time
   - Work part-time or casual
   - Full-time student
   - Unemployed and looking for work
   - Full-time home duties
   - Retired
   - Sick or on a disability pension
   - Other

6. What best describes your usual main occupation when working?
   - Manager
   - Professional
   - Technician or trade worker
   - Community or personal service worker

- Clerical or administrative worker
- Sales worker
- Machinery operator and driver
- Labourer
- Small business operator

7. Which of the following best describes your current marital status?
   - Single or never married
   - Separated or divorced
   - Widowed
   - Married or living with partner (de facto)

8. Which of the following best describes your household?
   - Single person
   - One parent family with children
   - Couple with children
   - Couple with no children
   - Group household (i.e. living with two or more people to whom you are NOT related)

9. What do you estimate your personal annual income was last year, before taxes?

   - $0 to $19,999
   - $20,000 to $39,999
   - $40,000 to $59,999
   - $60,000 to $79,999
   - $80,000 to $99,999
   - $100,000 to $119,999
   - $120,000 to $139,999
   - $140,000 to $159,999
   - $160,000 to $179,000
   - $180,000 or more

10. What do you estimate your household annual income was last year, before taxes?
    - $0 to $19,999
    - $20,000 to $39,999
    - $40,000 to $59,999
    - $60,000 to $79,999
    - $80,000 to $99,999
    - $100,000 to $119,999
    - $120,000 to $139,999
    - $140,000 to $159,999
    - $160,000 to $179,000
    - $180,000 or more

11. Do you live in:

- Capital city and surrounds
- Regional town with more than 10,000 persons
- A rural or remote location

The next two questions ask about your height and weight. Please round your answers to the nearest number.

12. What is your height (in cm)? _____

13. What is your weight (in kg)? _____

OUTCOMES

We'd now like to ask a few questions about your general health

SF-12 Questionnaire

Choose one option for each questionnaire item.

1. In general, would you say your health is:

- Poor
- Fair
- Good
- Very good
- Excellent

The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so, how much?

	No, not limited at all	Yes, limited a little	Yes, limited a lot
2. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf			
3. Climbing **several** flights of stairs			

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

	No	Yes
4. **Accomplished less** than you would like		

	No	Yes
5. Were limited in the **kind** of work or other activities		

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

	No	Yes
6. **Accomplished less** than you would like		
7. Didn't do work or other activities as **carefully** as usual		

8. During the **past 4 weeks**, how much did **pain** interfere with your normal work (including both work outside the home and housework)?

- Not at all
- A little bit
- Moderately
- Quite a bit
- Extremely

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks**…

	None of the time	A little of the time	Some of the time	A good bit of the time	Most of the time	All of the time
9. Have you felt calm and peaceful?						
10. Did you have a lot of energy?						
11. Have you felt downhearted and blue?						

12. During the **past 4 weeks**, how much of the time has **your physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

- None of the time
- A little of the time
- Some of the time
- Most of the time
- All of the time

WHO-QOL-BREF

This assessment asks how you feel about your quality of life, health, or other areas of your life. If you are unsure about which response to give to a question, please choose the one that appears most appropriate. This can often be your first response.

Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life **in the last two weeks**.

Please read each question, assess your feelings, and select the number on the scale for each question that gives the best answer for you.

		Very poor (1)	Poor (2)	Neither poor nor good (3)	Good (4)	Very good (5)
1(G1)	How would you rate your quality of life?					

		Very dissatisfied (1)	Dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Satisfied (4)	Very satisfied (5)
2 (G4)	How satisfied are you with your health?					

The following questions ask about **how much** you have experienced certain things in the last **two weeks**

		Not at all (1)	A little (2)	A moderate amount (3)	Very much (4)	An extreme amount (5)
3 (F1.4)	To what extent do you feel that physical pain prevents you from doing what you need to do?					
4 (F11.3)	How much do you need any medical treatment to function in your daily life?					
5 (F4.1)	How much do you enjoy life?					
6 (F24.2)	To what extent do you feel your life to be meaningful?					

		Not at all (1)	A little (2)	A moderate amount (3)	Very much (4)	Extremely (5)

7 (F5.3)	How well are you able to concentrate?					
8 (F16.1)	How safe do you feel in your daily life?					
9 (F22.1)	How healthy is your physical environment?					

The following questions ask about **how completely** you experience or were able to do certain things in the last **two weeks**

		Not at all (1)	A little (2)	Moderately (3)	Mostly (4)	Completely (5)
10 (F2.1)	Do you have enough energy for everyday life?					
11 (F7.1)	Are you able to accept your bodily appearance?					
12 (F18.1)	Have you enough money to meet your needs?					
13 (F20.1)	How available to you is the information that you need in your day-to-day life?					
14 (F21.1)	To what extent do you have the opportunity for leisure activities?					

		Very poor (1)	Poor (2)	Neither poor nor good (3)	Good (4)	Very good (5)
15 (F9.1)	How well are you able to get around?					

The following questions ask you to say how **good or satisfied** you have felt about various aspects of your life over the last **two weeks**

		Very dissatisfied (1)	Dissatisfied (2)	Neither satisfied nor dissatisfied (3)	Satisfied (4)	Very satisfied (5)
16 (F3.3)	How satisfied are you with your sleep?					
17	How satisfied are					

(F10.3)	you with your ability to perform your daily living activities?					
18 (F12.4)	How satisfied are you with your capacity for work?					
19 (F6.3)	How satisfied are you with yourself?					
20 (F13.3)	How satisfied are you with your personal relationships?					
21 (F15.3)	How satisfied are you with your sex life?					
22 (F14.4)	How satisfied are you with the support you get from your friends?					
23 (F17.3)	How satisfied are you with the conditions of your living place?					
24 (F19.3)	How satisfied are you with your access to health services?					
25 (F23.3)	How satisfied are you with your transport?					

The following question refers to **how often** you have felt or experienced certain things in the last **two weeks**.

		Never (1)	Seldom (2)	Quite often (3)	Very often (4)	Always (5)
26 (F8.1)	How often do you have negative feelings such as blue mood, despair, anxiety, depression?					

CO-MORBIDITIES

Think about the past **12 months** when answering this question.

1. How often do you have a drink containing alcohol?

   - Never
   - Monthly or less
   - Two to four times a month
   - Two to three times a week
   - Four or more times a week

Still think about the past **12 months** for the next two questions.

2. How many standard drinks containing alcohol do you have on a typical day when you are drinking?

   - 1 or 2
   - 3 or 4
   - 5 or 6
   - 7 to 9
   - 10 or more

3. How often do you have six or more standard drinks on one occasion?

   - Never
   - Less than monthly
   - Monthly
   - Weekly
   - Daily or almost daily

4. Have you used recreational drugs (e.g. marijuana, ecstasy, speed) in the past **12 months**?

   - No
   - Yes

5. Do you currently smoke cigarettes?

   - No
   - Yes

6. How many cigarettes per day do you smoke?

    - 10 or less
    - 11 to 20
    - 21 to 30
    - 31 or more

7. In the past 12 months, have you been diagnosed by a health professional (e.g., by a doctor, psychiatrist, psychologist) with any of the following?

	No	Yes
Mood disorder (e.g. major depressive disorder, dysthymic disorder, bipolar disorder)		
Anxiety disorder (e.g. obsessive compulsive disorder, panic disorder, generalised anxiety disorder, post-traumatic stress disorder, social phobia)		
Personality disorder (PD) (e.g. paranoid PD, schizoid PD, schizotypal PD, antisocial PD, borderline PD, histrionic PD, narcissistic PD, avoidant PD, dependent PD, obsessive-compulsive PD)		
Other mental health disorder (e.g. intermittent explosive disorder, kleptomania, psychotic disorder, somatoform disorder, adjustment disorder, attention deficit hyperactivity disorder)		

RISK FACTORS

We'll now ask you some general questions about yourself and your life

1. How important is religion or spirituality in your life?

    - Not important at all
    - Somewhat important
    - Moderately important
    - Very important
    - Extremely important

2. Please read each statement and select how often this applies to you. Do not spend too much time on any statement. Answer quickly and honestly.

Item	Rarely/Never	Occasionally	Often	Almost always/Always
I plan tasks carefully				
I do things without thinking				

I don't "pay attention"				
I am self-controlled				
I concentrate easily				
I am a careful thinker				
I say things without thinking				
I act on the spur of the moment				

The next two questions relate to your childhood

3. Which of the following best describes your family composition when you were a child growing up?
   - One parent family
   - Two parent family
   - Other family

4. When you were a child growing up, how often did any of the adults in your household gamble?
   - Never
   - Sometimes
   - Often
   - Very often

5. How often do your friends or co-workers talk about gambling?
   - Never
   - Sometimes
   - Often
   - Very often

6. What is the highest educational qualification your father received?
   - No schooling
   - Did not complete primary school
   - Completed primary school
   - Year 10 or equivalent
   - Year 11 or equivalent
   - Year 12 or equivalent
   - A trade, technical certificate or diploma
   - A university or college degree
   - Postgraduate qualifications
   - Don't know

7. What is the highest educational qualification your mother received?
   - No schooling
   - Did not complete primary school
   - Completed primary school

- Year 10 or equivalent
- Year 11 or equivalent
- Year 12 or equivalent
- A trade, technical certificate or diploma
- A university or college degree
- Postgraduate qualifications
- Don't know

The next few questions are some brain teasers. Don't spend too much time on any question

1. A bat and a ball cost $1.10 in total. The bat costs a dollar more than the ball. How much does the ball cost? _____ cents

2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ minutes

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days

4. If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together? _____ days

5. Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class? _____ students

6. A man buys a pig for $60, sells it for $70, buys it back for $80, and sells it finally for $90. How much has he made? _____ dollars

7. Simon decided to invest $8,000 in the stock market one day early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon has:

   a) broken even in the stock market

   b) is ahead of where he began

   c) has lost money

FUTURE RESEARCH

1. We will be conducting some follow up telephone interviews regarding this topic during 2021 and possibly 2022. The telephone interview would go for no longer than 1 hour and you will receive a $40 shopping voucher for your time. Unfortunately we will not be able to interview everyone who volunteers and we will only contact those who are selected.

Would you like to be invited to participate in a follow up interview?

- No
- Yes

If yes to Q1 above:

2. Please provide your contact details so we may contact you about an interview. Your details will be kept confidential and you can change your mind at any point about participating.

Name:

Telephone:

Email address:

End page

Thank you for taking the time to complete this survey.

If gambling is a problem for you or others, please call the Gambler's Helpline 1800 858 858 or go to www.gamblinghelponline.org.au for free, confident advice, available 24/7. If this questionnaire has raised any other issues for you, please call Lifeline on 13 11 14. You may also seek support from you General Practitioner (GP).

Appendix 2. Item content and scoring instructions for the GHS-10

Presentation instructions

- The information below includes the wording, item content, and presentation of the GHS-10.
- Where possible the presentation order of the 10 items should be randomised

During the last 12 months, did any of these issues occur as a result of **your gambling**?

Item	No	Yes
Reduction of my available spending money		
Less spending on recreational expenses such as eating out, going to movies or other entertainment		
Reduction of my savings		
Sold personal items		
Increased credit card debt		
Had regrets that made me feel sorry about my gambling		
Felt like a failure		
Felt ashamed of my gambling		
Felt distressed about my gambling		
Spent less time with people I care about		

Scoring instructions

- A 'no' response to an item should be coded as 0 and a 'yes' response coded as 1.
- Sum scores for all of the 10 items; total scores should range from 0 to 10
  - Higher scores indicate higher levels of gambling-harm and the associated SF-6D decrement for each score is presented in the table below

GHS-10 score	SF-6D decrement
0	0
1	-0.035
2	-0.066
3	-0.089
4	-0.107
5	-0.119
6	-0.126
7	-0.132
8	-0.139
9	-0.146
10	-0.155

Appendix 3. Item content and scoring instructions for the GHS-20

Presentation instructions

- The information below includes the wording, item content, and presentation of the GHS-20.
- Where possible the presentation order of the 20 items should be randomised

During the last 12 months, did any of these issues occur as a result of **your gambling**?

Item	No	Yes
Reduction of my available spending money		
Less spending on recreational expenses such as eating out, going to movies or other entertainment		
Reduction of my savings		
Sold personal items		
Increased credit card debt		
Less spending on essential expenses such as medications, healthcare and food		
Used my work or study time to gamble		
Reduced performance at work or study (i.e. due to tiredness or distraction)		
Was absent from work or study		
Increased experience of depression		
Had regrets that made me feel sorry about my gambling		
Felt like a failure		
Felt ashamed of my gambling		
Felt distressed about my gambling		
Felt insecure or vulnerable		
Felt worthless		
Spent less time with people I care about		
Social isolation (felt excluded or shut-off from others)		
Experienced greater conflict in my relationships (arguing, fighting, ultimatums)		
Promised to pay back money without genuinely intending to do so		

Scoring instructions

- A 'no' response to an item should be coded as 0 and a 'yes' response coded as 1.
- Sum scores for all of the 20 items; total scores should range from 0 to 20
  - Higher scores indicate higher levels of gambling-harm and the associated SF-6D decrement for each score is presented in the table below

GHS-20 score	SF-6D decrement
0	0
1	-0.011
2	-0.023
3	-0.034
4	-0.045
5	-0.056
6	-0.066
7	-0.077
8	-0.087
9	-0.096
10	-0.104
11	-0.112
12	-0.118

13	-0.124
14	-0.129
15	-0.132
16	-0.136
17	-0.139
18	-0.143
19	-0.146
20	-0.155

Appendix 4. Item content and scoring instructions for the GHS-10-AO

Presentation instructions

- The information below includes the wording, item content, and presentation of the GHS-10-AO.
- Where possible the presentation order of the 10 items should be randomised

Screening

In the past 12 months have you had a close relationship with someone who has gambled?*

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

- No
- Yes

GHS-10-AO

During the last 12 months, did any of these issues occur to you **as a result of their gambling**?

If there is more than one person, think about the person who's gambling negatively affected you the most.

Item	No	Yes
Late payments on bills (e.g. utilities, rates)		
Reduced performance at work or study (i.e. due to tiredness or distraction)		
Loss of sleep due to stress or worry about their gambling or gambling-related problems		
Stress related health problems (e.g. high blood pressure, headaches)		
Increased experience of depression		
Feelings of hopelessness about their gambling		
Felt angry about not controlling their gambling		
Got less enjoyment from time spent with people I care about		
Threat of separation or ending a relationship/s		
Took money or items from friends or family without asking first		

Scoring instructions

- A 'no' response to an item in the GHS-10-AO should be coded as 0 and a 'yes' response coded as 1.
- Sum scores for all of the 10 items; total scores should range from 0 to 10
    - Higher scores indicate higher levels of gambling-harm due to someone else's gambling and the associated SF-6D decrement for each score is presented in the table below

GHS-10-AO score	SF-6D decrement
0	0
1	-0.019
2	-0.035
3	-0.050
4	-0.064
5	-0.076
6	-0.086
7	-0.094
8	-0.102
9	-0.109
10	-0.115

Additional notes

- An alternative way of phrasing the screening question is:

In the past 12 months how many people in total have you had a close relationship with who have gambled?* ___

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

This alternative method captures the total number of gamblers with whom the respondent has a close relationship with. This additional information was captured during the data collection for the present validation study. However, it is our view that either format can be employed without loss of instrument validity.

Appendix 5. Item content and scoring instructions for the GHS-20-AO

Presentation instructions

- The information below includes the wording, item content, and presentation of the GHS-20-AO.
- Where possible the presentation order of the 20 items should be randomised

Screening

In the past 12 months have you had a close relationship with someone who has gambled?*

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

- No
- Yes

GHS-20-AO

During the last 12 months, did any of these issues occur to you **as a result of their gambling**?

If there is more than one person, think about the person who's gambling negatively affected you the most.

Item	No	Yes
Reduction of my savings		
Late payments on bills (e.g. utilities, rates)		
Less spending on essential expenses such as medications, healthcare and food		
Used my work or study time to attend to issues caused by their gambling		
Reduced performance at work or study (i.e. due to tiredness or distraction)		
Loss of sleep due to stress or worry about their gambling or gambling-related problems		
Stress related health problems (e.g. high blood pressure, headaches)		
Increased experience of depression		
Feelings of hopelessness about their gambling		
Thoughts of running away or escape		
Felt angry about not controlling their gambling		
Felt distressed about their gambling		
Got less enjoyment from time spent with people I care about		
Felt belittled in my relationships		
Experienced greater tension in my relationships (suspicion, lying, resentment, etc.)		
Experienced greater conflict in my relationships (arguing, fighting, ultimatums)		
Threat of separation or ending a relationship/s		
Had experiences with violence (including family/domestic violence)		
Didn't fully attend to the needs of children		
Took money or items from friends or family without asking first		

Scoring instructions

- A 'no' response to an item in the GHS-20-AO should be coded as 0 and a 'yes' response coded as 1.
- Sum scores for all of the 20 items; total scores should range from 0 to 20
  - Higher scores indicate higher levels of gambling-harm due to someone else's gambling and the associated SF-6D decrement for each score is presented in the table below

GHS-20-AO score	SF-6D decrement
0	0
1	-0.014
2	-0.027
3	-0.038
4	-0.047
5	-0.054
6	-0.061
7	-0.066
8	-0.071
9	-0.076
10	-0.080
11	-0.084
12	-0.089
13	-0.094
14	-0.098
15	-0.103
16	-0.107
17	-0.111
18	-0.116
19	-0.121
20	-0.126

Additional notes

- An alternative way of phrasing the screening question is:

In the past 12 months how many people in total have you had a close relationship with who have gambled?* ___

* 'Close relationship' is often a family member, is one in which you know each other well, you care about each other, and you depend on each other.

This alternative method captures the total number of gamblers with whom the respondent has a close relationship with. This additional information was captured during the data collection for the present validation study. However, it is our view that either format can be employed without loss of instrument validity.

Appendix 6. Qualitative interviews – Information sheet

The impact of gambling harm on health and wellbeing – Interviews.

INFORMATION SHEET

Thank you for previously taking part in our online survey and agreeing to be invited to this follow-up study. This research is funded by the Victorian Responsible Gambling Foundation and approved by the CQUniversity Human Research Ethics Committee (22830).

In the current study we are aiming to conduct interviews to further discuss your experiences with gambling and gambling harm.

We are wanting to interview:

- Adults aged 18+ years
- Who are residing in Australia
- Who participated in the previous online survey component of this broader research project, and
- Who are willing to participate in a telephone interview

Interviews will be done by phone at a mutually convenient time, and involve a conversation with a friendly and experienced interviewer. Each interview will last between 30 - 60 minutes. We'll ask about the role of gambling in your life (either your own gambling or the gambling of someone close to you) and any positive/negatives you might have experienced as a result of gambling. All interviews will be audio-recorded.

After the interview, we will send you a $50 electronic shopping voucher.

Because we are conducting only a limited number of interviews, we may not be able to interview everyone who is interested in participating. We are therefore asking for **expressions of interest** in participating, and we will subsequently contact you if you have been selected for an interview.

If you have any questions, please contact the project officer (Mr Vijay Rawat) at v.rawat@cqu.edu.au

Further details about the study can be found on the next page.

ADDITIONAL INFORMATION

How your confidentiality will be protected
We will have some personal details (such as your name and contact details) which we will only use to arrange and conduct an interview. This study also requires linking some of your responses to health questionnaires from the online survey to the interviews that will be conducted. However, we will de-identify your interview responses so that nobody can identify you. Your responses will be combined with those of other participants so no one will be able to tell what your individual answers were. The anonymous data will be stored securely and indefinitely by CQUniversity.

Participation will not prejudice you in any way
Your participation in this study is completely voluntary. Should you wish to withdraw at any stage you are free to do so without prejudice or penalty.

How you will receive feedback
Information about the results of the research will be made available through CQUniversity's gambling research Facebook page - https://www.facebook.com/cquegrl/

Where you can get further information
If you want further information or have any questions, please contact Vijay Rawat: v.rawat@cqu.edu.au You can also contact the Ethics Coordinator for any complaints at CQUniversity's Office of Research: ethics@cqu.edu.au

If you experience discomfort at any point during the survey, you can contact the **Gambling Helpline on 1800 858 858** or **www.gamblinghelponline.org.au** or **Lifeline on 13 11 14**. These are free and confidential help services that operate 24 hours a day, 7 days a week. You may also seek support from your personal General Practitioner (GP).

Project team
The study is being conducted by:
CQUniversity: Professor Matthew Browne, Professor Matthew Rockloff, Professor Nerilee Hing, Dr Alex Russell, Dr En Li, Dr Philip Newall, Mr Cailem Murray Boyle, Mr Vijay Rawat
La Trobe University: Associate Professor Steve Begg

Appendix 7. Interview guide - Gamblers

Introduction

- Interviewer to introduce themselves/affiliation and confirm speaking to the correct participant

- Mention research is funded by Victorian Responsible Gambling Foundation and explain aims of the research

- Confirm participant has read the information sheet and confirm details for gift voucher distribution

- Explain privacy/confidentiality and obtain consent to record the interview

- Note: Check in with participant periodically throughout the interview about how they're doing speaking about the issues and offer breaks as necessary. Also prompt the participant to reflect on the same timeframe to when they completed the previous online survey.

Gambling

- Topics: activities; frequency; expenditure; location; time spent

- Importance of gambling (prompts: role that gambling plays in your life; comparative to other recreational activities / hobbies)

- Reasons for gambling (prompts: financial, social, excitement, escape, ego boost)

- General attitudes towards gambling

Financial domain

- Impact of gambling on finances

- Prompts: What you thought about the money you were spending on gambling; how you felt about the money you were spending

- Any limits / budget set? If yes – any instances of over-spending? What were the subsequent impacts

- Follow up on any financial harm items endorsed in previous survey to obtain more detail about the impacts

- Any financial positives/benefits due to gambling?

Relationship domain

- Gambling habits of those close to you (family/friends/etc.) and frequency of gambling together with others vs alone

- Impact of gambling on relationships

- Prompts: How aware were others are of your gambling; Has anyone commented on your gambling; Anyone been impacted due to your gambling; Have you been impacted by someone else's gambling

- Follow up on any relationship harm items endorsed in previous survey to obtain more detail about the impacts

- Any benefits to your relationships due to gambling?

Emotional/Psychological domain

- Impact of gambling on emotional/psychological wellbeing

- Prompts: Feelings when gambling; any regrets or guilt; feelings when winning; feelings when losing; urges;

- Follow up on any emotional/psychological harm items endorsed in previous survey to obtain more detail about the impacts

- Any emotional/psychological positives/benefits due to gambling?

Health domain

- Impact of gambling on health

- Prompts: Sleep quality/quantity; stress; eating; alcohol/tobacco

- Follow up on any health harm items endorsed in previous survey to obtain more detail about the impacts

- Any health positives/benefits due to gambling?

Work/Study domain

- Impact of gambling on work/study

- Prompts: Being late; using work/study time to gamble; reduced performance

- Follow up on any work/study harm items endorsed in previous survey to obtain more detail about the impacts

- Any work/study positives/benefits due to gambling?

Other questions

- Any other harms experienced which haven't already been covered?

- Other positives due to gambling?

- Any harm minimisation practices implemented (e.g. settling limits, not taking credit card, etc.)?

- Any lifetime experience of experiencing problems/harm?

- Any experience of seeking help from professional services?

- Happy with current gambling behaviour or anything that you'd like to change about it?

End

- Ask if final thoughts not already covered

- Thank participant. Explain how they will receive their voucher. Where they can access the findings once published. Remind them of help service information

Appendix 8. Interview guide – Affected Others

Introduction

- Interviewer to introduce themselves/affiliation and confirm speaking to the correct participant

- Mention research is funded by Victorian Responsible Gambling Foundation and explain aims of the research

- Confirm participant has read the information sheet and confirm details for gift card

- Explain privacy/confidentiality and obtain consent to record the interview

- Note: Check in with participant periodically throughout the interview about how they're doing speaking about the issues and offer breaks as necessary. Also prompt the participant to reflect on the same timeframe to when they completed the previous online survey. Mention that the participant may not know the answers to all questions (particularly those which relate to their significant other) which is okay.

Relationship

- Confirm the type of relationship who the participant nominated in the online survey (e.g. spouse, family member, friend, etc.).

- Describe the nature of the relationship (prompts: length of time known each other; closeness; living together; how they got to know each other)

Gambling

- Background of their significant other's gambling. Prompts: activities; frequency; expenditure; location; time spent; reasons for gambling; motivations; importance

- Whether the participant gambles themselves? If yes, prompt for the above topics and whether they gamble together with their significant other.

- General attitudes towards gambling

Financial domain

- Impact of gambling on finances (for yourself or for them)

- Prompts: What you thought about the money they were spending on gambling; instances of spending more than intended and the subsequent impacts; importance of winning to them; borrowing money

- Follow up on any financial harm items endorsed in previous survey to obtain more detail

- Any financial positives/benefits due to gambling?

Relationship domain

- Impact of gambling on relationships

- Prompts: How aware were you/others of their gambling; has anyone commented on their gambling; impacts to you/others; how much of their gambling was social / with others

- Follow up on any relationship harm items endorsed in previous survey to obtain more detail about the impacts

- Any benefits to your relationships due to gambling

Emotional/Psychological domain

- Impact of gambling on emotional/psychological wellbeing

- Prompts: How you felt about their gambling; feelings when they won; feelings when they lost

- Follow up on any emotional/psychological harm items endorsed in previous survey to obtain more detail about the impacts

- Any emotional/psychological positives/benefits due to gambling?

Health domain

- Impact of gambling on health

- Prompts: Sleep quality/quantity; stress; eating; alcohol/tobacco; concerns

- Follow up on any health harm items endorsed in previous survey to obtain more detail about the impacts

- Any health positives/benefits due to gambling?

Work/Study domain

- Impact of gambling on work/study

- Prompts: Being late; using work/study time to attend to issues caused by their gamble; reduced performance

- Follow up on any work/study harm items endorsed in previous survey to obtain more detail about the impacts

- Any work/study positives/benefits due to gambling?

Other questions

- Any other harms experienced which haven't already been covered?

- Other positives due to gambling?

- Any harm minimisation practices they implement (e.g. settling limits, not taking credit card, etc.)?

- Apart from that person, have you been affected by anyone else's gambling?

- If their gambling affected you how did you deal/cope? Sources of support (social/professional).

- Happy with their current gambling behaviour or anything that you'd like to change about it?

End

- Ask if final thoughts not already covered

- Thank participant. Explain how they will receive their voucher. Where they can access the findings once published. Remind them of help service information

Appendix 9. Expert elicitations – Information sheet

Assessing gambling-related harm through expert elicitations.

INFORMATION SHEET

Thank you for your interest in this study. This research is funded by the Victorian Responsible Gambling Foundation and approved by the CQUniversity Human Research Ethics Committee (23356).

In the current study we are conducting online interviews with gambling clinicians and gambling researchers to evaluate your perceptions of gambling related-harm.

What the study will require

1. The study will require you to read a total of 60 transcripts. These transcripts will be from interviews conducted with gamblers and affected others relating to their experiences of gambling harm. We expect this task will take two full days, however you will be given one full week to have read all the transcripts.

2. The following week a Zoom meeting will be scheduled with you and a member of the research team at a mutually convenient time. The interview is expected to last approximately 2 hours and involves you evaluating the transcripts using four elicitation techniques (e.g. the Visual Analogue Scale).

Upon completion of the study you will be reimbursed for your time with AU$1,500.

To protect the confidentiality of the participants whose transcripts you will be reading you must agree to:

* Not discuss the content of transcripts outside of this research project
* Store the transcripts securely and delete all copies of the transcripts upon completion of the study.

Further details about the study can be found on the next page.

If you have any questions, please don't hesitate to contact the project officer (Mr Vijay Rawat) at v.rawat@cqu.edu.au

ADDITIONAL INFORMATION

How your confidentiality will be protected

We will have some personal details (such as your name and contact details) which we will only use to arrange and conduct an interview. We will de-identify your responses so that nobody can identify you. Your responses will be combined with those of other participants so no one will be able to tell what your individual answers were. The anonymous data will be stored securely and indefinitely by CQUniversity.

Participation will not prejudice you in any way

Your participation in this study is completely voluntary. Should you wish to withdraw at any stage you are free to do so without prejudice or penalty. If you withdraw prior to completing the study your data will be deleted.

How you will receive feedback

Information about the results of the research will be made available through CQUniversity's gambling research Facebook page - https://www.facebook.com/cquegrl/

Where you can get further information

If you want further information or have any questions, please contact Vijay Rawat: v.rawat@cqu.edu.au You can also contact the Ethics Coordinator for any complaints at CQUniversity's Office of Research: ethics@cqu.edu.au

If you experience discomfort at any point during the survey, you can contact the **Gambling Helpline on 1800 858 858** or **www.gamblinghelponline.org.au** or **Lifeline on 13 11 14**. These are free and confidential help services that operate 24 hours a day, 7 days a week. You may also seek support from your personal General Practitioner (GP).

Project team

The study is being conducted by:
CQUniversity: Professor Matthew Browne, Mr Vijay Rawat, Professor Matthew Rockloff, Professor Nerilee Hing, Dr Alex Russell, Dr En Li
La Trobe University: Associate Professor Steve Begg

Appendix 10. Comparison of direct and indirect methods for eliciting gambling-related harm

As discussed in the report, direct and indirect elicitation methods represent substantially different methodologies. Although both yield health utility decrements on a [0,1] scale, they are not directly comparable as a result. There are multiple reasons for these differences, the most salient being that (a) direct elicitation methods do not discount for comorbidities, (b) they implicitly compare the health state with one of ideal health functioning (i.e., 1), when the reality is that this is almost never the case, and (c) evaluators may be subject to an upward bias in their estimates of impact due to stigma and response framing effects. Expect for the last point, these do not necessarily reflect deficiencies in the direct elicitation approach; rather, that direct and indirect estimates are simply scaled differently.

It is informative to compare the health utility weights estimated in this study with other those estimated via similar methods in the broader health literature. Väätäinen et al. (2014) found a SF-6D decrement of .04 between those with diagnosed Type 2 diabetes and controls. Dan et al. (2016) found decrements of between .03 and .10 for a range of types of liver disease, although they did not perform propensity score weighting, controlled for only age and sex. Atroshi et al. (2006) found an improvement in patients' health utilities of 0.08 after operations to treat carpal tunnel syndrome. Using propensity score matching of 218 chronic migraine sufferers and matched controls, but without controlling for comorbidities, Vo et al. (2018) found a decrement of 0.09. DiBonaventura et al. (2010) calculated a decrement of 0.03 using propensity score weighting and the SF-6D as an outcome for 695 Hepatitis C sufferers and matched controls. Chavez et al. (2016) found no clinically meaningful differences in health functioning for different levels of alcohol use, as measured by the AUDIT-C, on either the EQ-5D or the SF-6D, in a sample of 17,440 persons. Health utility weights derived from direct elicitation tend to be much higher. For example, Salomon et al. report weights of .178 (liver cirrhosis), .133 (diabetic neuropathy), 0.441 (migraine) and 0.235 and 0.570 for mild and severe alcohol use disorder. These discrepancies are result of the very different methodologies used to arrive at the weights (Arnold et al., 2009). For example, direct elicitation measures implicitly assume a counterfactual of ideal health and wellbeing in the absence of the evaluated condition, do not factor-out comorbidities in determining the utility weight, and the global health instrument (e.g., SF-6D) may not be fully sensitive to impacts of the condition. A full discussion of the ways in which health utility weights can be interpreted and applied is beyond the scope of this chapter. However, we caution that the raw weights estimated in this study cannot be directly compared to those estimated in prior work (Browne et al., 2016, Browne et al., 2017). However, weights derived for gambling can be compared to those estimated via direct and indirect methods, respectively, in the broader public health literature. Further, the relative decrement conditional on PGSI status conditional on increasing PGSI or GHS scores are comparable within each study. As shown in Table A1, the relative impact of moderate-risk gambling problems was reasonably consistent between studies, but the impact of low-risk gambling problems differed markedly. Indirect elicitation yielded small and non-significant decrement for low-risk gamblers, as compared to the (2016) direct elicitation that yielded a small but clinically and statistically significant decrement. Table A2 compares direct and indirect elicited utility weights estimated in the present study for the three 'bands' of gambling harm considered. Direct elicitation from expert evaluations yielded proportionately similar decrements to those determined by the 2016 study. For example, those in the low-harm band were evaluated as experiencing about one-third of the impact of those in the highest band. This corresponds to the 2016 results, where low-risk gamblers were evaluated as experiencing about one-third as much impact as problem gamblers. As would be expected, the direct elicitation protocol employed in this study yielded decrements on a similar scale to those estimated in the 2016 study, which also used a direct elicitation framework. However, a directly comparison is not possible, since the decrements in the 2016 study were done with respect to the PGSI, since the SGHS (or GHS-10) had not been developed at that time.

Table A1. Health utility weights by PGSI category for gamblers derived via direct elicitation methods in prior (2016) study and indirect methods employed in the present study

PGSI Category	2016 (direct)		2022 (indirect)	
	Raw	Relative	Raw	Relative
Low risk	0.13	.29	.005	.05
Moderate risk	0.29	.66	.050	.51
Problem Gambler	0.44	1.00	.099	1.00

Note: Negative signs for decrements are omitted for clarity.

Table A2. Health utility weights by gambling harm band for gamblers and affected others derived via direct and indirect elicitation methods in in the present study

GHS-10 Band	Gamblers				Affected Others			
	Direct		Indirect		Direct		Indirect	
	Raw	Relative	Raw	Relative	Raw	Relative	Raw	Relative
Low (1-2)	0.068	.325	.020	.183	0.116	.418	.027	.267
Moderate (3-5)	0.194	.928	.062	.569	0.244	.881	.064	.634
High (6-10)	0.209	1.000	.109	1.000	0.277	1.000	.101	1.000

Note: Negative signs for decrements are omitted for clarity. For affected others, indirect decrements are taken as the average decrement within each band, as described in Appendix 4, so as to facilitate comparisons with the direct evaluations. Direct decrements for gamblers and affected others are sourced from Table 8.2 (column 3). The categorisation into low/moderate/high bands is for comparison purposes only, and the GHS scales are not intended for categorical scoring in normal use.

As advised in the Conclusion chapter of this report, indirect and direct elicitation approaches yield 'apples and oranges' estimates that are on a different scale. Both approaches have methodological strengths and weaknesses, and it is not possible to say definitively that one approach is better or worse than the other. The indirect estimation methods introduced in this report are arguably 'maximally conservative', but nevertheless find statistically significant health decrements for all non-zero GHS scores.

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Appendix 11. Comparison between 72-item harms checklist and GHS instruments

Domain	Abbrev.	Item	GHS 20	GHS 10	GHS-AO 20	GHS-AO 10
Emotional/ Psychological	Distress	Felt distressed about my (their) gambling	√	√	√	
	Shame	Felt ashamed of my (their) gambling	√	√		
	Fail.	Felt like a failure	√	√		
	Vulner.	Felt insecure or vulnerable	√			
	Anger	Felt angry about not controlling my (their) gambling			√	√
	Worthl.	Felt worthless	√			
	Hopeless.	Feelings of hopelessness about (their) gambling			√	√
	Ext. Distress	Feelings of extreme distress				
	Esc.	Thoughts of running away or escape			√	
	Regret	Had regrets that made me feel sorry about my (their) gambling	√	√		
Financial	Red. Savings	Reduction of my savings	√	√	√	
	Red. Spending	Reduction of my available spending money	√	√		
	Inc. CC debt	Increased credit card debt	√	√		
	Sold Items	Sold personal items	√	√		
	Add. Employ.	Took on additional employment				
	Late Bills	Late payments on bills (e.g. utilities, rates)			√	√
	Red. Rec. Exp.	Less spending on recreational expenses such as eating out, going to movies or other entertainment	√	√		
	Red. Ben. Exp.	Less spending on beneficial expenses such as insurances, education, car and home maintenance				
	Red. Ess. Exp.	Less spending on essential expenses such as medications, healthcare and food	√		√	
	Welfare	Needed assistance from welfare organisations (foodbanks or emergency bill payments)				
	Loss Util	Loss of supply of utilities (electricity, gas, etc.)				
	Loss Ass.	Loss of significant assets (e.g. car, home, business, superannuation)				
	Bankrup.	Bankruptcy				
	Emerg. Accom.	Needed emergency or temporary accommodation				
Health	Phys. Act.	Reduced physical activity due to my (their) gambling				
	Stress Prob.	Stress related health problems (e.g. high blood pressure, headaches)			√	√
	Red. Sleep Gamb.	Loss of sleep due to spending time (with the person) gambling				
	Red. Sleep Worry	Loss of sleep due to stress or worry about (their) gambling or gambling-related problems			√	√
	Hyg.	Neglected my hygiene and self-care				
	Med. Needs	Neglected my medical needs (including taking prescribed medications)				
	Malnutr.	Didn't eat as much or often as I should				
	Overeat.	Ate too much				
	Tobac.	Increased my use of tobacco				
	Alch.	Increased my consumption of alcohol				
	Dep.	Increased experience of depression	√		√	√
	Service	Increased use of health services due to health issues caused or exacerbated by my (their) gambling				
	S. Harm	Committed acts of self harm				

Category	Abbrev.	Description				
	Liv. Cond.	Unhygienic living conditions (living rough, neglected or unclean housing, etc)				
	Emerg. Treat.	Required emergency medical treatment for health issues caused or exacerbated by (their) gambling				
	Sui.	Attempted suicide				
Social deviance / Other	Chil. Unsup.	Left children unsupervised				
	Chil. Negle.	Didn't fully attend to needs of children			√	
	Took Mon.	Took money or items from friends or family without asking first			√	√
	Pay Mon.	Promised to pay back money without genuinely intending to do so	√			
	Arr. Driving	Arrested for unsafe driving				
	Red. Contrib. Cult.	Reduced my contribution to religious or cultural practices				
	Red. Connec. Cult	Felt less connected to my religious or cultural community				
	Shame. Cult.	Felt that I had shamed my family name (had been shamed) within my religious or cultural community				
	Theft Gov.	Petty theft or dishonesty in respect to government, businesses or other people (not family/friends)				
	Crime	Felt compelled or forced to commit a crime or steal to fund (their) gambling or pay debts				
	Outcast	Outcast from religious or cultural community due to (their) involvement with gambling				
	Viol.	Had experiences with violence (include family/domestic violence)			√	
Relationships	Red. Time	Spent less time with people I care about	√	√		
	Red. Enjoy	Got less enjoyment from time spent with people I care about			√	√
	Neglected Respon.	Neglected my relationship responsibilities				
	Red. Events	Spent less time attending social events (non-gambling related)				
	Inc. Tension	Experienced greater tension in my relationships (suspicion, lying, resentment, etc)			√	
	Inc. Conflict	Experienced greater conflict in my relationships (arguing, fighting, ultimatums)	√		√	
	Belittle	Felt belittled in my relationships			√	
	Threat End.	Threat of separation or ending a relationship/s			√	√
	Actual End.	Actual separation or ending a relationship/s				
	Isolation	Social isolation (felt excluded or shut-off from others)	√			
Work/Study	Red. Perf.	Reduced performance at work or study (i.e. due to tiredness or distraction)	√		√	√
	Late	Was late for work or study				
	Absent	Was absent from work or study	√			
	Hind. Job Seek.	Hindered my job-seeking efforts				
	Time	Used my work or study time to (attend to issues caused by their) gamble (gambling)	√	√		
	Resources	Used my work or study resources to (assist with matters arising from their) gamble (gambling)				
	Lack Prog.	Lack of progression in my job or study				
	Conflict	Conflict with my colleagues				
	Lost Job	Lost my job				
	Exc. Study	Excluded from study				

Note. Text in brackets indicates alternative phrasing for GHS-AO

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