Improving the Psychometric Properties of the Problem Gambling Severity Index

SHAWN R. CURRIE
DAVID M. CASEY
DAVID C. HODGINS

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Table of Contents

List of Tables

List of Figures

Acknowledgements

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Executive Summary

The Canadian Problem Gambling Index (CPGI) has become the gold standard in Canada for collecting information on gambling habits and problem gambling symptoms. Since its launch, the CPGI has been used in all ten Canadian provinces and the national mental health survey (Canadian Community Health Survey – Mental Health and Well-being; CCHS-1.2). It is also used in Australia, Norway, Great Britain, and Iceland. The CPGI includes nine items assessing gambling problems that form a quantitative index called the Problem Gambling Severity Index (PGSI). Four gambler subtypes have been identified based on the total PGSI score: non-problem, low-risk, moderate-risk, and problem gamblers.

In the 10 years since the CPGI was first introduced, criticism of the scale has surfaced. Much of this criticism centres on the PGSI. Specific issues identified include: the lack validation of for the low-risk and moderate-risk subtypes; the variable range of scores for each of the PGSI-defined subtypes; the limited number of items; choice of wording for the Likert response categories; absence of weights for items; low frequency of endorsement for many items, and; concerns of false positives and false negatives. While no measurement instrument is perfect and brief screening tools such as the PGSI inevitably attract criticism, proponents of the CPGI believe that many of the concerns could be addressed with a thorough investigation of the psychometric properties of the present version and exploration of alternate methods of scoring.

The present study employed advanced statistical techniques to identify the strengths and weaknesses of the PGSI scoring systems and the impact of alternative scoring. Three large population datasets were used:

- **CPGI integrated dataset.** Contains CPGI data pooled from the National CPGI validation study and prevalence surveys conducted in Alberta, British Columbia, Ontario (two cycles), Manitoba, Newfoundland between 2001 and 2005.
- **Canadian Community Health Survey – Mental Health Well-being (CCHS-1.2).** The 2002 national mental health survey that included the CPGI to assess gambling.
- **Leisure, Lifestyle, and Lifecycle Project (LLLP).** An ongoing (2006-present) longitudinal study of gambling involving adolescents and adults living in rural and urban Alberta.

Statistical methods used in this study included: exploratory and confirmatory factor analysis, Rasch modeling, differential item functioning analysis, test-retest reliability, validation of the four PGSI gambler subtypes, and regression modeling to explore the development of statistical weights. We also conducted an opinion survey of 142 experts in the field of gambling from Canada and other countries. The main findings are:

The CPGI is well-regarded by researchers and clinicians in Canada and elsewhere. Experts who participated in our survey felt the PGSI is useful in identifying both at risk and problem gamblers.

The PGSI in its present form demonstrates strong internal validity and reliability. The factor structure was confirmed with both exploratory and confirmatory methods. All items load on the one-factor model. The factor structure is valid for both the 4-point Likert scaled items and when the items are scored dichotomously. Internal reliability is better with the Likert scaled items. The factor structure is invariant across subgroups defined by gender, age, income level, and game types.

The Rasch analysis supports the PGSI as an internally reliable, continuous measure of problem gambling severity. No miss-fitting items were identified. There was evidence of clinically significant differential item functioning with only one item, borrowing money to gamble, which indicated a potential response bias in gamblers who play electronic gaming machines (EGM) or casino games versus other game types. Specifically, EGM/casino gamblers were less likely to report the need to borrow money for gambling than gamblers who played other games at equivalent levels of problem gambling severity. This could indicate a reduced sensitivity for the PGSI symptom of borrowing money to detect problem gambling in EGM/casino players.

The internal validity of the PGSI is superior to other comparable measures of problem gambling severity notably the SOGS and DSM-IV based scales. The factor structure and Rasch model fit were stronger for the PGSI compared to recent publications applying the same methods to the SOGS and DSM-IV based scales including the NODS. The relative order of PGSI symptoms when ranked by level of problem gambling severity being assessed is similar to the SOGS and DSM-IV based scales, at least for the items that are comparable across instruments.

Gaps in the coverage of problem gambling severity are evident in the PGSI. The Rasch model suggests a gap in symptom coverage exists in the severity of problem gambling reflected in the items betting more than one can afford to lose and recognition of gambling problem. This portion of the continuum corresponds to the low-risk and moderate-risk range of the PGSI scoring categories (i.e., gamblers who endorse between one and four symptoms). The addition of new PGSI items that reflect mid-range problem gambling severity would provide better coverage of symptoms that are characteristic of low to moderate-risk gamblers.

Among the four gambler subtypes defined by the PGSI, the non-problem gambler (PGSI = 0) and problem gambler subtype (PGSI > 7) are the most distinct and possess the greatest external validity. The non-problem subtype represents the typical, normative Canadian gambler. The problem gambler category is a distinct group of gamblers on all dimensions. The differences between this category and closest adjacent category, moderate-risk gamblers, were large enough to be considered clinically meaningful on most dimensions. Overall, there is sufficient evidence to retain these PGSI subtypes with minimal changes. Furthermore, combining the moderate-riskmoderate-risk and problem gambler subtypes and labelling the resultant group ‘problem gamblers’ is not recommended. Because of the low prevalence of individuals who score as problem gamblers researchers often merge the moderate-risk and problem gambling groups into a single category to increase statistical power. Our analyses indicate that individuals in the moderate-risk and problem gambler categories represent distinct subtypes of gamblers and combining these groups is not empirically supported.

There is insufficient evidence to consider the low-risk and moderate-risk PGSI subtypes as distinct groups of gamblers using the present scoring cut-offs. These PGSI subtypes were found to have poor external validity. There are two options for improving the classification of mid-level problem gambling severity (i.e., gamblers who score greater than zero but under 9 on the PGSI): (1) merge the low and moderate-risk categories into a single PGSI subtype of ‘at-risk gamblers,’ with the PGSI score used as a quantitative index of degree of risk that ranges from 1 to 7. (2) modify the PGSI scoring cut-off rules, creating two new mid-level categories consisting of low-risk gamblers (PGSI = 1 to 4) and moderate-risk gamblers (PGSI = 5 to 7). The latter option is recommended. The low and moderate-risk groupings are similar on many dimensions

and this is largely the result of the original scoring rules that established moderate-risk as having a score as low as 3. The modified scoring produces two categories of mid-level problem gambling severity that appears clinically distinct and better captures the gradient of problem gambling severity from the non-problem to problem levels.

The temporal reliability for the four PGSI subtypes, using both the original scoring rules and the novel scoring rules, is satisfactory for a retest interval of approximately 14 months. Using both the intraclass correlation coefficient and reliable change index to assess reliability, the majority of gamblers do not shift PGSI subtype over time. As predicted, a shift in PGSI subtype over time corresponded to a change in level of gambling intensity—i.e., an increase in PGSI score that resulted in a gambler being classified as a higher risk gambler could be explained by an increase in gambling expenditure.

There is no statistical evidence justifying item-level weights for the PGSI items. In regression models predicting both measures of gambling intensity and number of DSM-IV symptoms of pathological gambling the confidence intervals around the coefficients overlapped for the majority of PGSI symptoms. This suggests there is no statistical basis for weighting specific PGSI items as contributing more to the total score, although we acknowledge there are significant limitations in the data available that prevent the development of robust weights at this time. The development of item-level weights requires a valid, external criterion to assess the relative contribution of the individual PGSI items in predicting. The ideal criterion would be an another indicator of problem gambling severity that is distinct from the PGSI -e.g., collateral ratings of problem severity obtained from a family member or clinician--and not exclusively based on DSM-IV criteria. A future CPGI population survey could attempt to collect collateral ratings of problem gambling severity for a sample of participants for use in a weight development study.

Recommendations

The results from our analyses suggest that revisions to the existing scoring system would improve the assessment of mid-level problem gambling severity. The first recommendation could be implemented immediately. The remaining recommendations pertain to the development of new PGSI items and an overhaul of the Likert response scale. These recommendations would require a new validation study to collect normative data and establish new cut-offs for the PGSI subtypes. The specific recommendations are:

1) Modify the PGSI scoring cut-off rules, creating two new mid-level categories consisting of low-risk gamblers (PGSI = 1 to 4) and moderate-risk gamblers (PGSI = 5 to 7). Ideally, these subtypes would have the same range of scores (4) however defining moderate-risk gamblers as scoring from 5 to 8 would require validation of a new cut-off for problem gamblers (e.g., ≥ 9). Our findings suggest this is little difference in defining moderate-risk gamblers with the upper range being 7 rather than 8 so keeping the original cut-off for defining problem gamblers as PGSI ≥ 8 would allow for comparisons of previous and future prevalence studies.

2) Adopt a new Likert scale that replaces the ‘most of the time’ and ‘almost always’ choices. It has been noted that these response choices are very similar in wording and ‘almost always’ is rarely endorsed. Two options for improving the Likert scale include: removing the ‘almost always’ choice to create a shorter 3-point scale (never, sometimes or most of the time), or adopting the Australian revision of having five response choices

(never=0, rarely = 1, sometimes = 1, often = 2, always =3) for each item. In the Australian scoring system, rarely and sometimes receive the same score. Given that the PGSI performs similarly when the items are dichotomously scored or Likert scored, we recommend shortening the number of response choices per item in favour of adding more items to expand the range of symptoms in the low and moderate-risk categories.

3) Following from above, new items that specifically assess mid-level problem gambling severity should be added to increase the range of scores for gamblers classified as low-risk or moderate-risk. An increased score range could also enhance the distinctiveness of these subtypes and aid in the detection of gamblers who are approaching the clinical threshold for problem gambling.

4) Quantitative measures of gambling intensity (frequency of gambling, expenditure on gambling, duration of gambling sessions) could also be considered for new items.

5) Any future validation work on the PGSI should incorporate changes to the diagnostic criteria for pathological gambling being planned for the release of the DSM-5 [1]. We recommend waiting for the release of the DSM-5 before changing the cut-off for problem gamblers for clinical diagnostic purposes.

Finally, it should be noted that maintaining the status quo and leaving the PGSI as is would be a defendable option until the revised DSM criteria are released. Any revisions to the PGSI in its current form would not necessarily improve the identification of problem gamblers, which is one of the primary purposes of the instrument. In this capacity, the PGSI appears to do an adequate job and is psychometrically stronger than comparable gambling scales.

Section 1

Background

The gaming industry is one of the fastest growing industries in North America. In Canada, net revenue from gambling increased four-fold from $2.7 billion in 1992 to $14 billion in 2007. Canada has a broad range of gambling venues and opportunities including over 87,000 electronic gaming machines, 33,000 lottery outlets, 250 race tracks, 60 permanent casinos, and 25,000 licenses to run temporary bingos, casinos, and raffles [2]. Past year and lifetime rates of gambling among Canadians are 76% and 85%, respectively [3-6]. Rates of gambling participation in the general population have increased along with per capita expenditure [2]. It is estimated that about 23% of Canadian gaming revenue now derives from problem gamblers [7].

Problem Gambling Severity Index (PGSI)

The Canadian Problem Gambling Index (CPGI) has become the standard in Canada for collecting information on gambling habits and problem gambling symptoms. It is also used in Australia (Queensland, Victoria and Tasmania), Norway, Great Britain, and Iceland. Although predominately a survey instrument for research, it is also used clinically for screening problem gambling and program evaluation. The CPGI collects data on problem gambling symptoms and gambling habits for all major types of gambling including instant win/scratch tickets, lottery tickets, bingo, casino games, electronic gaming machines (EGMs), private card/board games, horse betting, sports betting, games of skill, internet, raffle tickets, and arcade games [8]. The CPGI includes nine items assessing gambling problems that form a quantitative index called the Problem Gambling Severity Index (PGSI). The PGSI items were chosen from a larger pool of symptoms based on superior test-retest reliability, ability to discriminate recreational gamblers from gamblers, and contributing to high internal consistency of the total score [8]. Scores on the PGSI correlate highly (r = .83) with DSM-based scales such as the NODS [8]. The response choices for each PGSI item are 'never,' 'sometimes,' 'most of the time,' or 'almost always,' with a total score ranging from 0 to 27. Cut-offs are used to assign gamblers to categories consisting of 'non-problem gamblers' (PGSI = 0), 'low-risk' (PGSI = 1 to 2), 'moderate-risk' (PGSI = 3 to 7), or 'problem-gambler' (PGSI >7)[9]. These PGSI categories are purported to represent distinct subtypes of gamblers within the continuum of problem gambling severity. Since its launch, the CPGI has been used in all ten Canadian provinces and the national mental health survey (Canadian Community Health Survey – Mental Health and Well-being; CCHS-1.2),

The initial enthusiasm for the CPGI as a tool for screening and quantifying problem gambling severity has started to fade and serious criticism of the scale is now emerging. For example, there was relatively little validation of the cut-offs for the low-risk and moderate-risk categories. The scale developers argued that issues of sensitivity and specificity do not apply because these groups do not represent problem gambling [8]. This raises important questions such as: what do these categories really represent? Is there any meaningful difference between low-risk and moderate-risk gamblers, or non-problem and low-risk gamblers? The present scoring system for the PGSI may also be problematic for the scale's reliability. The range of scores for each PGSI category varies considerably: low-risk (2-point range), moderate-risk (5-point), and problem gambling (19-point range). The variable score ranges could impact the temporal stability of the categories with more stability for categories with wider ranges. Recent reviews of the CPGI provide other critical insight on the scale:

Performance and enhancement of the Canadian Problem Gambling Index: Report and recommendations [10]. Investigators interviewed 20 researchers familiar with the CPGI including the scale developers. These key informants were asked their opinions of the PGSI as a measure of problem gambling severity and to recommend improvements or additional research. Key findings to emerge from this study were:

- Additional research is needed to validate the subtypes and cut-offs. The soundness of the labels, definitions and cut-points was questioned. Respondents questioned the variable range of scores for each of the severity categories.
- The PGSI may underestimate problem gambling given that some heavy gamblers (those investing time and money on gambling that greatly exceed the population norm) can score below the threshold for problem gambling.
- Suggestions for improving the PGSI included: adding new items (e.g., loss of control, family arguments over gambling), weighting the items, changing the wording of particular items and response choices, and developing additional items specifically to measure low-risk and moderate-risk.
- Suggestions for new research were: additional validation studies of the PGSI subtypes, using more advanced scaling methods such as latent trait modeling to understand how the individual items assess problem gambling severity at different levels, additional factor analysis studies, and longitudinal cohort studies to assess how PGSI scores predict future gambling or other indicators.

Using the SOGS vs CPGI in Problem Gambling Screening and Assessment [11]. This comprehensive literature review of the CPGI and related instruments identified similar concerns as the McCready and Adlaf (2006) report. They also concluded: 1) The CPGI lacks an underlying theoretical model of gambling; 2) Factor analytic studies of the PGSI have produced inconsistent results, although the latest results from the British Gambling Prevalence Survey indicate a one factor solution is the best fit for the PGSI; 3) Although the four point scale for each item is thought to be an improvement over the dichotomous scoring of related instruments, the reality is that most respondents use one or two response choices, suggesting the items could be simplified. Despite these concerns, the authors conclude the PGSI outperforms the SOGS and the Victorian Gambling Screen in terms of construct validity, item difficulty, and sensitivity in detecting symptoms within the general population [12]. Scores on the PGSI also correlate with mental health consequences of problem gambling including anxiety, depression, and suicide ideation.

Canadian Low-Risk Gambling Limits: New Evidence and Limitations [13]. This series of studies funded by the Ontario Problem Gambling Research Centre did not specifically focus on the psychometrics of the PGSI but did produce findings relevant to the current project. The work by this team used the population data collected in the provincial prevalence surveys and CCHS-1.2 to examine how well indicators of gambling intensity (expenditure, frequency of gambling, and time invested) predict harm as measured by the PGSI. Using CCHS-1.2 data we derived a set of low-risk gambling limits using a combination of risk curve analysis and logistic regression [14]. The empirically derived limits (gambling no more than two to three times per month, spending no more than $501-$1000CAN per year or no more than 1% income on gambling) accurately predicted risk of gambling-related harm after controlling for other known risk factors. The limits were replicated in a large integrated dataset of CPGI surveys from provincial prevalence studies.

We also demonstrated using longitudinal data that risk of harm changes over time in gamblers who increase or reduce their level of gambling in relation to the low-risk limits. Specifically, data from the Leisure, Lifestyle, and Lifecycle Project (dataset described in method below) shows that individuals who shift from being low-risk to high risk gamblers from Time 1 to Time 2 (~14 month interval) are more likely to report harm (defined as reporting at least 2 symptoms from the PGSI) compared to those who remain low-risk gamblers.[15].

This project also convened a panel of leading gambling researchers in Canada and the US to review the data and make recommendations. The panel concluded that limitations in the CPGI prevent additional development of low-risk gambling limits using existing population data. Specifically,

- The concept of harm has not been satisfactorily defined in the context of gambling. The present PGSI contains a narrow sample of potential harm, with most of the items being characteristic of problematic gambling levels.
- A limitation of the current scoring system is that the composite score (sum of ratings for all items) assumes qualitative equivalency among the items. The total score fails to account for the relative contribution of different items to the construct of problem gambling severity.
- The shortcoming of the present scoring system could be corrected by the application of item weights, or by varying the threshold on specific items that respondents need to endorse to be recognized as experiencing a harm.

Similar concerns have been voiced about other measures of problem gambling severity, including the DSM-IV [16] where each of the ten criteria receives equal weighting when scored, with five or more symptoms being the threshold for diagnosing pathological gambling. The relative importance of each symptom is not considered despite the fact that some represent more severe consequences of problem gambling (e.g., committing illegal acts) than others (e.g., feeling irritable when unable to gamble). Stinchfield and colleagues undertook a rigorous psychometric evaluation of the DSM-IV criteria for pathological gambling [17]. Using a sample of community-dwelling recreational gamblers and gamblers in treatment, they tested the validity of individual criteria and the cut-score of five for distinguishing problem from non-problem gamblers. The diagnostic accuracy of the DSM-IV criteria was improved when the cut-off was lowered to four. The accuracy was further improved by using weights derived from discriminant function analysis to adjust the scoring of each criterion. These weights placed more importance on the symptoms trying to cut back on gambling, preoccupation with gambling, using gambling to escape or avoid problems and chasing losses, as contributing to the determination of diagnosis.

PGSI and DSM-IV in the 2007 British Gambling Prevalence Survey. This study by Orford and colleagues [18] is the most recent psychometric evaluation of the PGSI to be published. The British Gambling Prevalence Survey was conducted in 2007 with a nationally representative random sample of community dwelling persons aged 16 years and older. The survey included both the PGSI and a DSM-IV-based scale thereby allowing for direct comparison of the two instruments. The DSM-IV scale employed a 4-point Likert scale similar to the PGSI. Focusing on the sample of 6161 past-year gamblers, the investigators examined internal reliability, item response patterns, factor structure, and inter-scale agreement. The PGSI was found to have better internal reliability than the DSM-IV scale and fewer problems with differential item endorsement along gender, age, and socioeconomic divisions. The factor structure of the PGSI was superior to the DSM scale in terms of clarity and parsimony. The DSM scale, despite

having only 10 items, produced two factors that could roughly be labeled as dependence and consequences. However, several items loaded equally on both scales suggesting the dimensionality of the DSM items is not clear. Furthermore, the DSM items had very low rates of positive endorsement compared to the PGSI items. The correlation between the PGSI and DSM scale was high, but the rate of agreement in identifying problem gamblers was only modest.

This study is important because it represents the most comprehensive psychometric evaluation of the PGSI that is published in a peer-reviewed journal. However, the study also has numerous limitations in the method that we take steps to improve upon in the present report. Foremost, the investigators employ a very superficial item response analysis based on descriptive statistics and visual inspection of the frequency of endorsement across the PGSI categories. The factor analytic approach in the study relied exclusively on exploratory methods. In the present report, we substantially improve on these methods, using Rasch modeling to conduct the item analysis and confirmatory factor analysis to examine the PGSI factor structure. Moreover, the datasets available to our team were by far the largest ever used in a population level analysis of the psychometric properties of the PGSI.

Present study objectives

The specific aims of the present study are to (1) assess the validity of the present PGSI severity classifications and cut-off scores for the non-problem gamblers, low-risk, moderate-risk and problem gamblers groups using cross-sectional and longitudinal population data; (2) assess the impact of re-calibrating the PGSI scoring rules on the reliability and external validity of PGSI severity categories; (3) assess the factor structure of the PGSI with newly acquired population data; (4) model the continuum of gambling problems as assessed by the PGSI total score with item response theory (IRT) and identify sources of differential responding across demographic and game type subgroups, and; (5) determine if weights are justified for the PGSI items to recalibrate the scoring and assignment to severity categories.

Section 2

Overall Approach

Data sources

CPGI integrated dataset. The CPGI integrated dataset was provided to the investigators for a previous project funded by the Ontario Problem Gambling Research Centre. [13] It includes data from prevalence surveys conducted in Alberta (AB; N = 1,461)[19], British Columbia (BC; N = 3086)[20], Ontario (ON; two cycles 2001; N = 3,764 [[21]] and 2005; N = 2,252 [22]), Manitoba (MB; N = 578)[23], Newfoundland (NF; N = 2,152)[24] and the National CPGI validation study [8] for a total sample size of 21,374. Each survey employed a similar methodology. Namely, the data were collected via a computer-assisted telephone interviewing system. Samples were stratified by regional boundaries, age, and gender. Random digit dialing was used to select cases at the household level and the adult resident (minimum age = 18 years) with the most recent birthday was selected to be interviewed. The prevalence of problem gambling (PGSI > 8) ranged from 0.4% in BC to 1.3% in AB. The Alberta survey, typical of most of the provincial CPGI surveys, is provided in Appendix A. Detailed comparisons of the provincial surveys in terms of demographic, gambling habit and ancillary questions are provided in Appendices B and C.

In addition to the CPGI, the integrated dataset contains information on participant characteristics, involvement in gambling activities, and, in some surveys, limited data on health and mental

health status. In terms of gambling involvement, information was collected on types of gambling, frequency of play, and amount spent on gambling activities in the last year. In previous research, percent of income spent on all gambling activities has shown the strongest relationship with level of risk as measured by the PGSI [13 25] and related instruments like the SOGS[26].

Canadian Community Health Survey – Mental Health Well-being (CCHS-1.2). Detailed descriptions of the CCHS-1.2 in terms of target population, sampling procedures, response rate and psychiatric assessment are in other sources [27;28]. Briefly, the CCHS-1.2 was a cross-sectional survey of a nationally representative sample of individuals aged 15 and older. The CCHS-1.2 data were collected by Statistics Canada between May and December 2002 (N=36,984). Valid PGSI data for past year gamblers is available for 18913 cases. Gambling was assessed using the CPGI (Ferris & Wynne, 2001). In addition, the CCHS-1.2 provided data on 12-month prevalence of mood disorders (major depression, bipolar disorder, and dysthymia, anxiety disorders (panic disorder, obsessive-compulsive disorder, social anxiety, phobias), and substance use disorders (alcohol and drug). All disorders were based on a Canadian adaptation of the World Mental Health version of the Composite International Diagnostic Interview (WMH-CIDI; 13). The CCHS-1.2 also collected information on self-reported health status (1=excellent to 5 = poor), self-reported stress (1= no stress to 5 = extreme stress), and psychological well-being (0 to 100 with higher values indicating better psychological well-being). The psychological well-being scale is a composite score based on the sum of participants' responses to 25 items [29]. Sample items include "During the past month, you felt self-confident" and "felt satisfied with accomplishments." Information on the CCHS-1.2 gambling module and mental health measures is provided in Appendix D.

Leisure, Lifestyle, and Lifecycle Project (LLLP). This longitudinal study is described in detail in another source [30]. Briefly, the LLLP is a prospective cohort study of 1808 adolescents and adults living in rural and urban Alberta. Individuals in five age cohorts range from 13 to 65 years are being followed for five years using a combination of telephone, web-based, and in-person data collection. The study began in 2006 and is ongoing. The data collected at each wave (separated by approximately 18 month intervals) include a rich set of psychological, behavioural, medical, and social variables used to examine the etiology and natural progression of both recreational and problematic gambling. Random digit dialing (RDD) was used to recruit participants from the general population sample (n=1284) with approximately equal numbers in each of the five age cohorts: (13-15, 18–20, 23–25, 43–45, and 63–65 year olds). A second wave of RDD sampling was used to recruit 'at-risk' gamblers (n=524) who were at or above the 70th percentile in either gambling expenditure or gambling frequency based on provincial normative data. The intent of the 'at-risk' sample was to increase the yield of individuals who may be experiencing or likely to develop gambling problems during the course of this longitudinal study. The present study uses data from time 1 and 2.

Inclusion and exclusion criteria used in all studies

All analyses were restricted to individuals who a) 18 years and older; b) reporting gambling at least once in the past year, and; c) were administered the PGSI items. Individuals who reported no gambling activity in the past year were excluded. Each substudy used data from one or more of these datasets. For the factor analysis and latent trait modeling, we merged the CPGI integrated and CCHS-1.2 datasets to maximize the sample size.

General analysis plan

Gambling variables common to all datasets and analyses are shown in Table 2.1. The CPGI Integrated dataset and CCHS-1.2 were merged into one file for many analyses. Both the CPGI integrated datasets contain sampling weights, to adjust for age and gender biases. However, the methods used to weight cases were different hence it was not possible to utilize the sampling weights in analyses of the merged data from these datasets. For some analyses, the use of the individual datasets was better justified because the results were clearer and more interpretable. The LLLP dataset was reserved for analyses involving longitudinal data. In consideration of the number of statistical tests performed we adopted a more conservative criteria for significance ($p < .01$) to guard against Type I error.

Table 2.1.
The main gambling variables that were common across the datasets used in this project.

Term	Definition
Dollars spent on gambling	Amount of money spent on games of chance in a typical month.
Percent income	Dollars spent on gambling per year divided by gross household income (range 0% to 100%). In cases where expenditure on gambling exceeded household income, the value for percent of income was winsorized to 100%.
Frequency of gambling	CPGI categories: Daily; 2 to 6 times a week; once a week; 2 to 3 times a month; once a month; 6 to 11 times year; 1 to 5 times a year.
Number of gambling activities	Total number of game types played at least once in the last 12 months to a maximum of 8.
Type of gambler	Two groups formed: (1) EGM/casino gambler were persons who reported playing electronic gaming machines (VLTs or slot machines) or casino games; (2) Other consisted of individuals who reported any other type of gambling other than EGMs or casino games. Research has shown that electronic gaming machines (video lottery terminals and slot machines) and casino gambling have a greater risk of harm and addiction compared to other forms of gambling [31;32]

Section 3

Assessing the Reliability and Validity of Current PGSI Severity Categories

Study 1 – PGSI Severity Categories Based on Original Scoring

Objectives

The intent of this set of analyses was to assess the external validity of the PGSI by determining if the four subtypes of gamblers that are defined based on current PGSI scoring rules (i.e., non problem, low-risk, moderate-risk, and problem gamblers) represent meaningful and distinct subpopulations of gamblers. Specifically, we compared the PGSI category groupings on the following key variables: (1) age, gender, marital status, and gross household income; (2) intensity of gambling involvement (frequency, total expenditures, percent of income spent on

gambling, total number of different games played); (3) types of games played at least 2-3 times per month, and: (4) frequency of other addictive behaviours and mental health concerns reported.

Method

Both the CPGI integrated and CCHS-1.2 datasets were used in this set of analyses. The merged data file was used to examine demographic variations across PGSI categories. The remaining analyses were conducted using the CPGI integrated or CCHS-1.2 datasets. The merged dataset could not be used in many analyses because of differences in the coding for key variables such as dollars spent on gambling, which was more precise in the CPGI integrated dataset (the CCHS-1.2 used broad categories to solicit amount spent on gambling), and frequency of playing different game types, which had large variations in the number response choices provided participants across the individual provincial surveys. The CCHS-1.2 also contained a rich set of mental health indicators not available in the CPGI integrated dataset.

As with all the studies in this report, the samples were restricted to individuals who reported gambling at least once in the past year. Each PGSI category was statistically compared with the other categories (Chi-square test for categorical variables, ANOVA for continuous variables followed up by Scheffe post hoc pairwise comparisons) to assess whether the four PGSI subtypes were, in fact, different from each other. Because the distributions for total monthly expenditures on gambling and percent of income spent on gambling were highly skewed, these variables were transformed using the natural log function. Statistical tests were conducted on the transformed data, however for ease of interpretation we report the untransformed means and medians in the tables. Given the number of statistical comparisons conducted, a conservative level of alpha, $p < .01$, was used for assessing significance. In addition, the magnitude of differences between categories (percent difference in means and median values) was examined to determine if a statistical difference was in fact meaningful. Sampling weights were used in all analyses.

Results

Demographics. Table 3.1 compares the four PGSI groups on demographic variables. The data presented are from the merged data using both the CCHS-1.2 and CPGI Integrated dataset (N = 25584). No differences in age across the PGSI categories were detected at the $p = .01$ level. In terms of gender, the low-risk and moderate-risk group contained a significantly higher proportion of males compared to the non-problem group (58% and 59% compared to 49%), but the difference between the low-risk and moderate-risk groups was not significant. As expected the proportion of males in the problem gambling group was significantly different from the proportion in the non-problem gambling group but not different from the remaining categories. The proportion of divorced or separated persons was highest in the problem gambling group. The proportion of low income gamblers (<$30,000 per year) was significantly higher in the low-risk, moderate-risk, and problem gambling groups compared to the non problem group. The proportion in the problem gambling group was not significantly different from the low-risk and moderate-risk groups.

Game type preferences. Table 3.2 shows the proportion of gamblers in each PGSI subtype who play various game types at least 2 to 3 times per month. The CCHS-1.2 was used in this analysis because it provided the largest sample using a uniform scale of response choices for frequency of gambling. The variability in response choices for frequency across the individual provincial CPGI surveys precluded the use of the CPGI Integrated dataset. We examined differences among the PGSI subtypes in high frequency game play (at least > 2-3 times per month) rather

than playing at any degree of frequency to minimize group differences due to one-time game experimentation. Furthermore, 2 to 3 times per month is the low-risk gambling limit for frequency that we have validated in previous research [33].

The results show large differences in high frequency playing of many game types across the four PGSI subtypes. These trends are depicted best in Figure 3.1. Non-problem gamblers are distinct from the other subtypes on all game types. For example, the proportion who played sport lotteries weekly jumped from 10% in the non-problem group to 27% in the low-risk group. The proportion who played instant win tickets also increased substantially from 19% in the non-problem group to 41% in the low-risk group. The low-risk, moderate-risk, and problem gambling groups showed minimal differences in the proportion of gamblers who engage in high frequency playing of games of skill, instant win or lottery tickets, and bingo.

Of particular interest was the difference between gambler subtypes in the frequent playing of higher risk games—EMGs and casino games. Research has shown that electronic gaming machines (video lottery terminals and slot machines) and casino gambling have a greater risk of harm and addiction compared to other forms of gambling [31;32]. Moreover, the general public ranks EGMs and casino games as having the most potential for harm [34]. To highlight these trends, we collapsed the game types into two broad categories: EGMs and casinos games versus all other games except EGMs and casino games. The proportion of gamblers who played EGMs or casino games at least weekly significantly increased in each successive PGSI subtype (see Figure 3.2). Problem gamblers were significantly more likely to play EGMs or casino games than non-problem, low-risk or moderate-risk gamblers. The difference between the low-risk and moderate-risk gambling groups was not significant. Overall, the category of EGM/casino games is effective in discriminating gambler subtype on the PGSI. It is noteworthy that, regardless of PGSI category, more gamblers play games other than EGMs and casino games. This finding is influenced by the larger number of other games included in this category. The other game type category does not distinguish between the PGSI subtypes of problem, low-risk and moderate-risk gamblers as well as the EGM/casino game category.

Gambling intensity measures. There were large and significant differences among the PGSI categories for total monthly expenditures on gambling and percent of gross household income spent on gambling. Results of the Scheffe test were significant for all pairwise comparisons. As shown in Table 3.3 both average expenditure on gambling and percent of income spent on gambling increase in a stepwise fashion from the non-problem to the problem gambling groups. The percent of income spent by low-risk gamblers is 266% higher than the percent of income spent by non-problem gamblers. Problem gamblers typically spend 367% more of their gross income on gambling than moderate-risk gamblers. The difference between moderate-risk and low-risk gamblers in percent of income spent on gambling and total monthly gambling expenditure was less pronounced (96% and 88% higher in the moderate-risk group, respectively) but still statistically significant.

In light of the large variability associated with the untransformed data, the median value for these indicators is a better representation of the midpoints for each PGSI grouping. The differences among the median values for each PGSI categories are less pronounced in comparison to the average values. Although each successive PGSI category is associated with an incrementally higher expenditure on gambling, the actual difference in median value between the low-risk and moderate-risk groups is relatively small for both total expenditures and percent of income spent on gambling. In contrast, the increase in values from moderate-risk to problem gambling group

is very large. Figure 3.3 shows this trend graphically. This figure suggests a large gap exists between gamblers labelled as moderate-risk and gamblers labelling as problem gamblers.

Table 3.1
Comparison of non-problem, low-risk, moderate-risk and problem gamblers on demographic variables using original PGSI scoring

	PGSI Category				
Variable	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-2)	Moderate-Risk (MR) (PGSI = 3-7)	Problem Gambling (PG) (PGSI = 8-27)	Significant differences
N	21,597	2,513	1,106	368	
Age					
15-19 years	2.4	7.4	7.0	3.7	
20-29 years	17.0	27.6	28.4	28.4	
30-44 years	33.1	33.0	32.3	36.4	No Differences
45-64 years	33.9	23.4	23.2	28.2	
65+ years	13.6	8.7	9.2	3.4	
Gender, % male	49.0	58.3	59.0	63.8	LR>NP [a] MR>NP [a] PG>NP [a]
Household income					
< $30K	19.8	25.6	31.5	30.6	LR>NP [a] MR>NP [a] PG>NP [a]
$30K – 49999	24.8	25.2	21.9	22.7	No Differences
$50K+	55.4	49.1	46.6	46.7	LR>NP [a] MR>NP [a]
Marital status					
Married/common-law	64.4	50.1	47.2	50.3	LR>NP [a] MR>NP [a] PG>NP [a]
Single	15.2	14.5	16.1	16.0	No Differences
Divorced/separated/widow	20.4	35.5	36.7	33.7	LR>NP [a] MR>NP [a] PG>NP [a]

Note: Data source – CPGI and CCHS-1.2 merged datafile; [a] $p < .01$.

Table 3.2
Proportion of non-problem, low-risk, moderate-risk and problem gamblers that gamble at least 2-3 times/month using original PGSI scoring

	PGSI Category				
Type of gambling	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-2)	Moderate-Risk (MR) (PGSI = 3-7)	Problem Gambling (PG) (PGSI = 8-27)	Significant differences
N	12,160	1,496	564	168	
Sports lotteries	10%	27%	37%	28%	NP < LR [a] NP < MR [a]
VLT inside of casino	2%	8%	9%	16%	NP < LR [a] NP < MR [a] NP < PG [a]
VLT outside of casino	6%	14%	25%	61%	NP < MR [a] NP < PG [a] LR < PG [a] MR < PG [a]
Other casino games	1%	8%	9%	45%	NP < MR [a] NP < PG [a] LR < PG [a] MR < PG [a]
Instant Win Tickets	19%	41%	47%	49%	NP < LR [a] NP < MR [a] NP < PG [a]
Lottery Tickets	30%	54%	53%	53%	NP < LR [a] NP < MR [a] NP < PG [a]
Card Games	9%	14%	24%	20%	NP < MR [a]
Horse Racing	3%	12%	10%	14%	No differences
Games of Skill	10%	23%	26%	12%	No differences
Bingo	19%	36%	30%	32%	NP < LR [a]
Other forms of gambling	9%	14%	19%	27%	No differences
EGM or any casino games	2%	13%	21%	47%	NP < LR [a] NP < MR [a] NP < PG [a] MR < PG [a]
All other types of gambling	30%	63%	75%	72%	NP < LR [a] NP < MR [a] NP < PG [a]

Note: Data source – CCHS-1.2; coding for frequency of gambling - 0 = < 2-3 times/month; 1 = > 2-3 times/month.
[a] $p < .01$.

These findings are also reflected in the percentile ranks for the median values. The percentile ranks provide an indication of how the typical percent of income, monthly expenditures and number of games played in the past year within each group compares to the full distribution of values in the population of Canadian gamblers. For example, the median monthly expenditure for non-problem gamblers, which represents about 85% of Canadian population, corresponds roughly to the 50th percentile for total expenditure and percent of income spent on gambling. The percentile ranks for the median expenditure within the low risk and moderate-risk gambling groups were relatively close, 73th and 79th percentiles, respectively. The typical expenditure for problem gamblers was at the 96th percentile for all Canadian gamblers. Expressed in other terms, the median total expenditures and percent of income for low-risk and moderate-risk gamblers are less than 1½ standard deviations of the population norm. The spending patterns of problem gamblers exceed 2½ standard deviations of the population norm. There appears to be a large gap in gambler subtype that fails to capture gamblers who are 1½ standard deviations above the norm (i.e., gamble more than 80% of Canadians) but not quite at the level of problem gamblers.

Table 3.3
Comparison of non-problem, low-risk, moderate-risk and problem gamblers on amount spent on gambling, percent of income spent on gambling, and number of games played in last year using original scoring

	PGSI Category					
Variable	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-2)	Moderate-Risk (MR) (PGSI = 3-7)	Problem Gambling (PG) (PGSI = 8-27)	ANOVA *F* value [a]	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Weighted mean (SE)	46.3 (4.2)	134.3 (22.9)	313.0 (63.0)	1140.3 (231.6)	299.42	All comparisons [c]
Median	8.3	30.0	41.6	250		
Percentile rank of median [b]	49	73	79	96		
Percent of gross income spent on gambling						
Mean (SD)	1.2 (.06)	3.2 (.30)	7.6 (1.0)	18.3 (2.6)	289.04 [c]	All comparisons [c]
Median	0.21	0.77	1.51	7.05		
Percentile rank of median [b]	46	70	82	95		
Number of games played in last year (0-8)						
Mean (SD)	3.3 (.02)	4.4 (.08)	4.6 (.14)	4.8 (.24)	206.16 [c]	NP < LR [c] NP < MR [c]
Median	3	4	4	5		
Percentile rank of median [b]	60	75	75	75		

Note: Data source – CPGI Integrated dataset. [a] Conducted on natural log transformed amount spent per month and percent income spent. [b] Within ungrouped full sample. [c] $p < .01$.

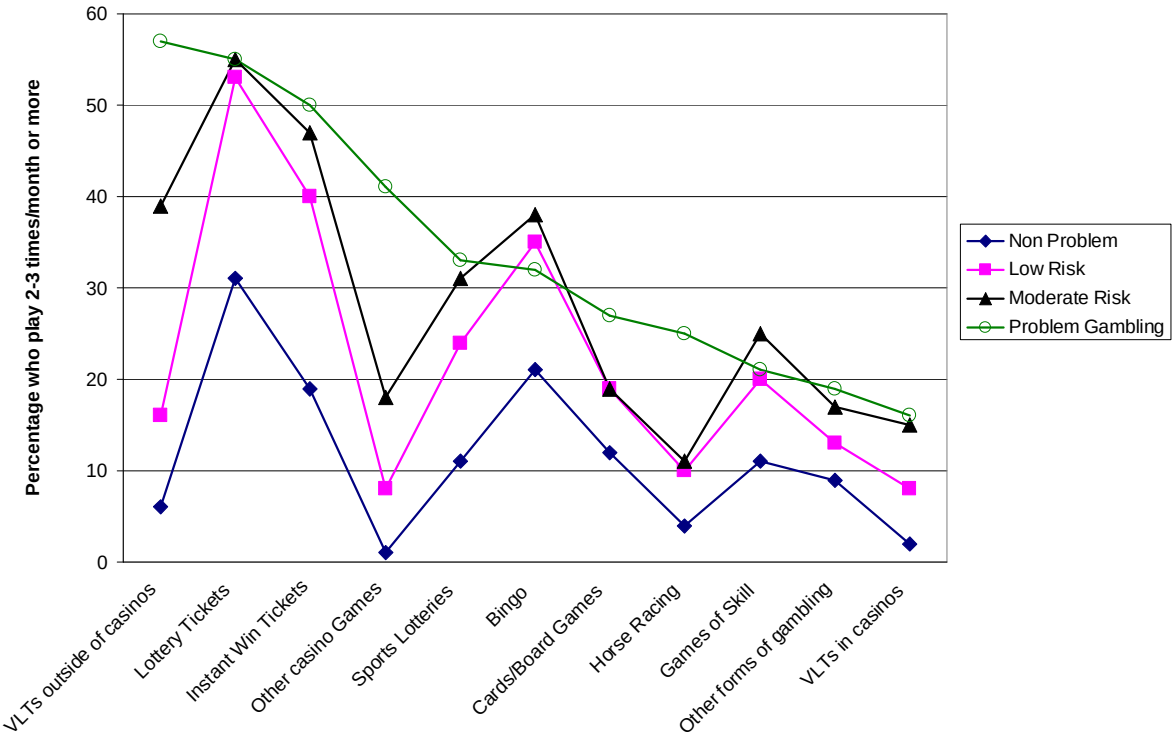


Figure 3.1. Proportion of non-problem, low-risk, moderate-risk, and problem gamblers who play different game types 2-3 times per month or more.

For number of games played in the last year, the difference among the four PGSI subtypes was also highly significant. With this indicator, the source of variability was the difference between the non-problem group and the low-risk and moderate-risk subtypes ($p < .01$ for Scheffe pairwise comparisons). There was little difference in number of games played in the last year among the low-risk, moderate-risk, and problem gambling groups. For example, low-risk and problem gamblers only differed by 0.4 games. As a quantitative indicator of gambling intensity, number of games played does not appear to discriminate among PGSI categories to the same degree as total expenditures and percent of income.

Differences in mental health indicators

The four PGSI sub-groups were compared on indices of health and mental health. The data source was CCHS-1.2 dataset due to the richness of information on mental health and mental disorders gathered in this survey. Table 3.4 shows the results of statistical comparisons of self-reported health status (1=excellent to 5 = poor), self-reported stress (1= no stress to 5 = extreme stress), and psychological well-being (0 to 100 with higher values indicating better psychological well-being). The non-problem gambling group reported significantly better physical health and less stress than the remaining PGSI groups. The low-risk group also reported less stress than the problem gambling group. The differences in stress levels between the low-risk, moderate-risk and problem gambling groups were non-significant. Psychological well-being was highest in the non-problem gambling group and lowest in the problem gambling group.

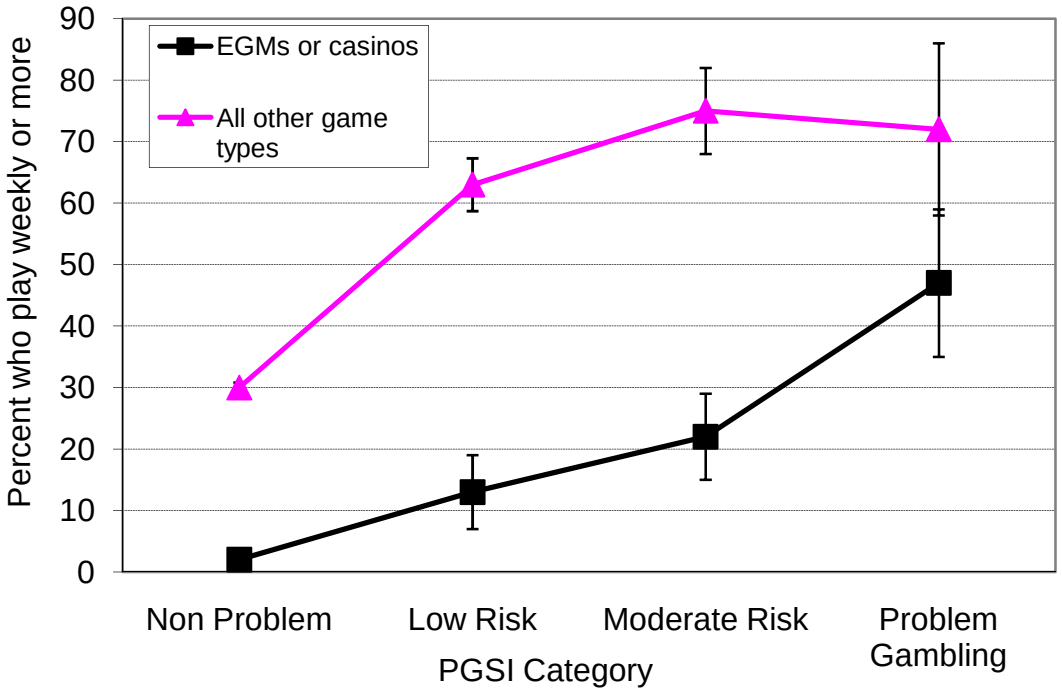


Figure 3.2. Proportion (with 99% confidence intervals) of non-problem, low-risk, moderate-risk, and problem gamblers who play EGMs or casino games versus all other game types (except EGM and casino games) 2-3 times per month or more.

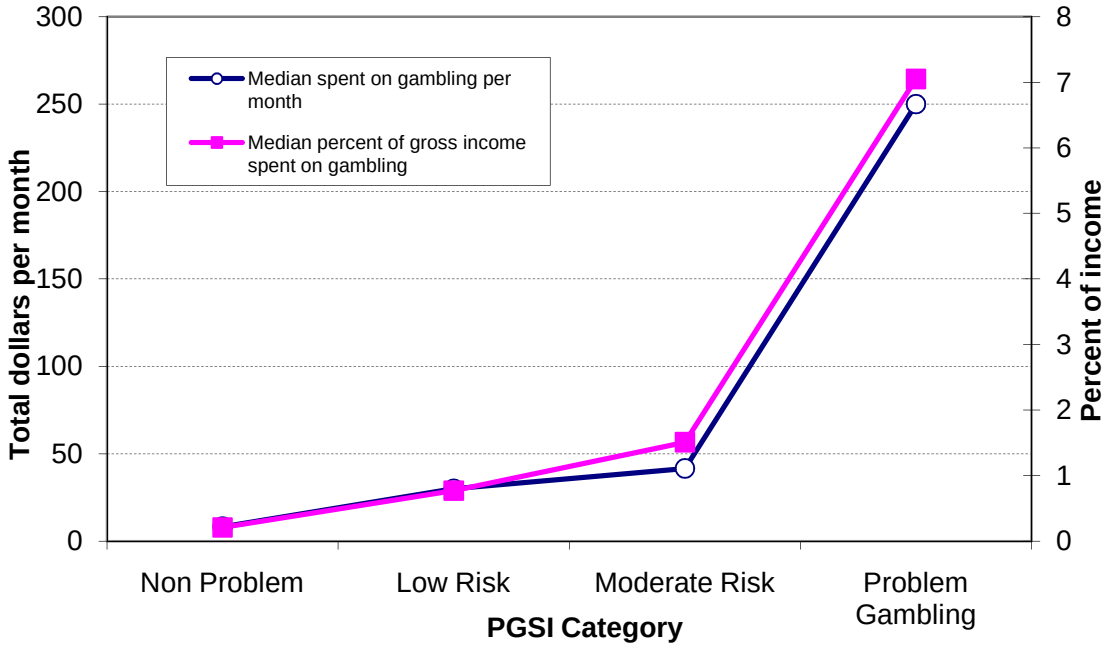


Figure 3.3. Indicators of gambling intensity by PGSI category using original scoring

The difference between low-risk and moderate-risk gamblers' psychological well-being was not significant but problem gamblers reported significantly lower psychological well-being compared to non-problem, low-risk and moderate-risk gamblers.

In terms of diagnosed mental disorders, mood and anxiety disorders were more prevalent in the problem gambling group compared to the other PGSI groups. The differences in prevalence for these disorders among the non-problem, low-risk and moderate-risk gambling groups were not significant. Substance use disorders were significantly more common in the low-risk, moderate-risk and problem gambling groups compared to the non-problem gambling group. The prevalence of substance use disorders among the low-risk, moderate-risk and problem gambling groups was not significant.

Table 3.4
Comparison of non-problem, low-risk, moderate-risk and problem gamblers on health and mental health status using original PGSI scoring

	PGSI Category				
Variable	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-2)	Moderate-Risk (MR) (PGSI = 3-7)	Problem Gambling (PG) (PGSI = 8-27)	Significant differences[1]
Overall health ratings					
Self-perceived health[a]	2.3	2.4	2.5	2.6	NP<LR NP < MR NP < PG
Self-perceived stress[b]	2.8	3.0	2.9	3.3	NP<LR NP<PG LR <PG MR<PG
Psychological well-being	81.5	77.7	76.6	69.6	NP>LR NP > MR MP>PG LR >PG
Mental disorders (Past 12 Months)					
Any mood disorder [c]	4.8%	6.6%	7.5%	18.2%	NP<PG LR <PG
Any anxiety disorder [c]	4.6%	8.2%	6.9%	15.9%	NP<PG
Substance Use Disorder [c]	3.0%	8.3%	14.9%	17.3%	NP<LR NP < MR NP<PG

Note: Data source – CPGI Integrated dataset. [a] Coding : 1=excellent; 2=very good; 3=good; 4=fair; 5=poor. [b] Coding: 1=not at all; 2=not very; 3=a bit; 4=quite a bit; 5=extremely. [c] Coding: 0=not present; 1=present. [1] p<.01.

Discussion

Our analysis of the PGSI-defined gambler subtypes can be summarized with the following conclusions:

1) The problem gambler category (PGSI > 7) appears to be a distinct group of gamblers on all dimensions. Differences between this category and the remaining PGSI subtypes were statistically significant at the p = .01 level on nearly every dimension examined including demographics, game type preferences, indicators of gambling intensity and prevalence of other mental health concerns. Moreover, the differences between this category and closest adjacent category, moderate-risk gamblers, were large enough to be considered clinically meaningful on many key dimensions. This is not surprising given the extensive validation work completed by the PGSI development team to establish this category.

2) The non-problem category (PGSI = 0) also appears to be a distinct group of gamblers on most dimensions. Differences between this category and the low-risk, moderate-risk, and problem gambler subtypes were statistically significant. Differences between non-problem gamblers and the remaining categories were clinically meaningful for measures of gambling intensity and game preferences. It is fitting that expenditures for gamblers in this category were at the 50^{th} percentile for the population. Non-problem gamblers, according to current PGSI scoring rules, comprise about 85% of the Canadian population of past-year gamblers. Hence, this group represents the typical, normative Canadian gambler.

3) Differences between the low-risk and moderate-risk PGSI subtypes were not statistically significant for most of the dimensions analyzed. For example, these groups are demographically similar and play many game types at the same level of frequency. There was no difference in the proportion who play EGMs or casino games at least 2 -3 times per week. There was no difference between these groups in measures of stress, well-being, or prevalence of mental health problems. The groups did show statistically significant differences in gambling expenditures. For example, the median proportion of income spent on gambling by moderate-risk gamblers is double the median amount spent by low-risk gamblers. The median percent of income spent by moderate-risk gamblers exceeds 82% of the Canadian population while low-risk gamblers exceed 70% of the population. However, the relative difference between low and moderate-risk gamblers was not as large as other adjacent PGSI categories. One option is to merge these categories into a single PGSI subtype of 'low-risk gamblers.' The PGSI score could be used as a quantitative index of degree of risk that ranges from 1 to 7.

4) The difference between moderate-risk gamblers and problem gamblers is very large on nearly all dimensions, most notably in gambling expenditures. This calls into question research studies that merge these categories under the single subtype of problem gamblers. Our data suggest these are distinct subtypes of gamblers and merging is not justified. Figure 3.1 suggests rescoring of the PGSI is needed to create a subtype just below the problem gambling category that better captures the continuum of risk that the total PGSI score is intended to represent. In essence, rescoring could change the inverted L-shape of the curve in Figure 3.1 to a linear trend. On the other hand, researchers and clinicians may value the distinctive nature of the present problem gambling category. Given one of the main purposes of the PGSI is to screen for problem gamblers, there are advantages to maintaining the large gap between this and the adjacent category of moderate-risk.

Study 2 – Temporal Stability of the original PGSI Classifications in Adults

Objectives

The objective here was to use the LLLP dataset to examine the temporal stability of the original PGSI classifications in a sample of adults who were at least 18 years of age at wave 1. In particular, we wanted to examine if comparable levels of gambling among a sample of adults would lead to stability of their PGSI score and category over time. We hypothesized that the reliability of the PGSI categories would directly correspond to the range of possible scores, with the non-problem and low-risk gamblers showing the most instability over time. Finally, this section also provided the opportunity to complete a preliminary validity check of the PGSI severity classifications and the cut-off scores for each category (non-gamblers, non-problem gamblers, low-risk, moderate-risk and problem gamblers) using a longitudinal population data.

Method

A summary of the LLLP was presented earlier and a more detailed description of the LLLP is available elsewhere [30]. The analysis that was completed here was limited to those adults that had participated in a least one gambling activity at both wave 1 and wave 2 of the LLLP (N=809). This facilitated an analysis on individuals where we had complete information regarding their gambling behavior during the first two data collections. Table 3.5 shows the demographic characteristics at wave 1 for these 809 participants included in this analysis.

Survey weights and bootstrap weights were developed for the LLLP to compensate both for the complex sampling design, and for the differences between the sampling plan and the collected sample. It was felt that these weights would allow for more accurate estimates of population prevalence of relevant aspects of gambling behavior. It is important to note however, that these weights were not used in the present analysis. It was deemed unreliable to use these weights on the subsample of 809 individuals, since the weights were calculated based on the total sample of 1808 adults and adolescents.

In this section, there were a number of statistical analyses that were completed. First, an intraclass correlation coefficient (ICC) was calculated to examine the temporal reliability of the original PGSI measured at wave 1 and 2 in the LLLP. The ICC is an effective measure of the reliability of measurements or ratings over time. Second, partial correlations were completed to try and identify the role that the change in proportion of income spent on gambling played in changes in the relationship between the PGSI scores over time. Partial correlations allowed for the examination of the relationship between two variables while controlling for percentage of income spent on all gambling activities. Finally, a reliable change index was calculated [35] as a way of capturing the natural change in PGSI scores over time. Using the PGSI's published test-retest reliability coefficient of 0.78, the reliable change index provided a statistical method of determining if the observed change is beyond the limits of chance variation, given the reliability of the assessment instrument. The original scoring system for the PGSI would be seen to have flaws if more than 25% of the LLLP participants shift PGSI categories between wave 1 and 2 without a corresponding increase in their gambling involvement. The reliable change index was calculated using the Jacobson et al technique [35] as a way to measure this change over time. The data analysis was completed using PSAW 17.0.

Table 3.5
Demographics for the LLLP

	Wave 1 and 2 longitudinal sample (N=809)	
	N	%
Age		
18-20	146	18.0
23-25	182	22.5
43-45	283	35.0
63-65	198	24.5
Gender		
Male	348	43.0
Female	461	57.0
Location		
Calgary	345	42.6
Edmonton	252	31.1
Grande Prairie	98	12.1
Lethbridge	114	14.1
Marital Status (Adults Only)		
Single, Divorce, Widowed	399	49.4
Married, Common-law	408	50.6
Level of Education		
Less than High School	57	7.0
Completed High School	142	17.6
Some Technical/College	121	15.0
Completed Tech/College	157	19.4
Some University	129	15.9
Bachelor's Degree	150	18.5
Master's or Professional Degree	53	6.5
Current Employment Status		
Not Currently Employed	222	27.4
Employed Part-Time	182	22.5
Employed Full-Time	405	50.1
Household Income		
$0 to $19,999	42	5.5
$20,00 to $39,999	95	12.5
$40,000 to $59,999	139	18.4
$60,000 to $79,999	120	15.9
$80,000 +	360	47.6

Note: Data source – LLLP

Results

The test-retest reliability for each of the four PGSI categories was computed. The results found an intraclass correlation coefficient of $r = .75$ ($F = 9.1878$, $p < .001$). A partial correlation was also completed that allowed for the statistical control of any change in gambling involvement (i.e., percent of income spent on all gambling activities) between waves. Without controlling for the change in gambling involvement, the correlation between the PGSI score at wave 1 and 2

was r = .641, p < .001, whereas when the change in gambling involvement was controlled, the correlation only dropped slightly to r =. 622, p < .001.

The reliable change index was not calculated for participants that scored 0 on the PGSI score at both wave 1 and 2. Consequently, the results of the analysis on the remaining 303 individuals showed that 62 individuals (7.7% of original 808) had a reliable change in their score from wave 1 to 2. Specifically, 15 individuals had a reliable change index score that was below -1.96 and another 47 individuals had a reliable change index score that was above +1.96. The remaining 241 individuals did not show a statistically significant change in their score, with values between -1.96 and +1.96.

Discussion

The intraclass correlation coefficient (r = .75) indicates there is a reasonably strong test-retest reliability associated with original PGSI scoring system. The partial correlation (r = .62) that is calculated when controlling for percent of income spent on gambling is lower than one might expect. This may be indicative of change in gambling behaviour over time from wave 1 to 2. The results of the reliability change index analysis indicate that there was not a significant statistical change in the score overtime. Only 7.7% of the sample shifted PGSI categories between wave 1 and 2, which was well below the 25% cut-off that was set at the outset. Consequently, the original PGSI gambler subtypes appear to be reliable over time. Based on these results, the PGSI score is an effective measure to examine change in problem gambling risk severity in a longitudinal study.

Study 3 – Reasons for Shifting PGSI Categories over Time

Objectives

Using the LLLP dataset, we explored potential reasons for shifting PGSI categories between wave 1 and 2 in adults. We hypothesized that, in addition to increasing gambling activity, an increase in PGSI category could be accounted for by other variables such as increase in number of friends who gamble, age, income, etc. The identification of factors other than PGSI measurement error that can explain the shift in PGSI category over time could provide evidence of the validity of the original PGSI scoring system.

Method

It was theorized that adults gambling at the same level should have comparable PGSI scores at each wave. We hypothesized that reliability of PGSI category would directly correspond to the range of possible scores (i.e., the non-problem and low-risk gambler categories will show the most instability over time). A series of ANOVAs were completed to examine two issues. First, how did individuals vary on variables like amount spent gambling, percent of gross income spent on gambling, and number of games played as a function of the PGSI categories at wave 1 and 2. Second, how did these same variables vary when the category at wave 1 is held constant, which allowed us to examine the shifting pattern of categories between wave 1 and 2. As well, an ANOVA was completed to examine the role that percentage of friends who gamble, age, and income play in explaining the shift in PGSI categories over time.

Results

The results for the ANOVA for the PGSI categories at wave 1 can be found in Table 3.6. A one-way ANOVA was completed for the amount spent on gambling, percent of gross income spent on gambling, and the number of games played in the past year. Each of the following varied significantly as a function of the PGSI categories: the amount spent on gambling per month, F (3, 805) = 87.10, $p < .001$, the percent of gross income spent on gambling, F (3, 805) = 6.26, $p < .001$, and the total number of games played in last year, F (3, 805) = 50.73, $p < .001$. The Scheffe post-hoc results are also indicated in Table 3.6, with the non-problem and low-risk gamblers being significantly different than the moderate-risk and problem gamblers for amount spent and percent of income, and the amount spent by moderate-risk gamblers being significantly different than the amount spent by problem gamblers. The comparisons of the overall means are shown in Figure 3.4. The only significant difference between non-problem and low-risk gamblers was for the number of games played in the last year.

The results for the ANOVA for the PGSI categories at wave 2 can be found in Table 3.7, with each of the following varying significantly as a function of the PGSI categories: the amount spent on gambling per month, F (3, 805) = 20.20, $p < .001$, the percent of gross income spent on gambling, F (3, 805) = 14.07, $p < .001$, and the total number of games played in last year, F (3, 805) = 38.24, $p < .001$. The Scheffe post-hoc results are also indicated in Table 3.7, with the non-problem and low-risk gamblers being significantly different than the moderate-risk and problem gamblers for amount spent and percent of income, and the amount spent by moderate-risk gamblers being significantly different than the amount spent by problem gamblers. The comparisons of the overall means are shown in Figure 3.5. Similar to Time 1, the only significant difference between non-problem and low-risk gamblers was for the number of games played in the last year.

Tables 3.8, 3.9, and 3.10 show the results for a series of ANOVAs for the stability of the PGSI categories from wave 1 to 2. For example, Table 3.8 shows the results for only those individuals that were non-problem gamblers at wave 1. At total of 454 individuals continued to be non-problem gamblers at wave 2, 95 met the criteria for low-risk gambling by wave 2, and 19 met the criteria for moderate-risk gambling by wave 2. Each of the following varied significantly as a function of the PGSI categories: the amount spent on gambling per month, F (3, 565) = 10.72, $p < .001$ and the percent of gross income spent on gambling, F (3, 565) = 20.71, $p < .001$. The Scheffe post-hoc results are also indicated in Table 3.8, with the non-problem being significantly different than the low-risk and moderate-risk gamblers for amount spent on gambling. There was a consistent increase in the amount spent on gambling through the progression from non-problem, to low-risk, to ultimately, moderate-risk gambling. For the percent of income and the number of games played, there was not a consistent increase through the progression in the gambling. This lack of consistency might be due in part to the small sample size for moderate-risk gamblers. Tables 3.9 and 3.10 show the results for low-risk and moderate-risk separately. The results for problem gamblers in Table 3.9 are not shown due to the small sample size (N=2). As well, the overall results for problem gamblers are not shown due to small sample sizes in each of the four categories.

The other ANOVA examined the role percentage of friends who gamble, age, and income play in explaining the shift in PGSI categories over time. The results showed that the percentage of friends who gamble, F (3, 781) = 7.40, $p < .001$ varied significantly as a function of the PGSI categories. The Scheffe post-hoc results also indicated that non-problem gamblers were

significantly different than the low-risk gamblers for percentage of friends who gamble. Age also varied significantly as a function of the PGSI categories, F (3, 805) = 7.83, p < .001, with the Scheffe post-hoc results indicating that non-problem gamblers were significantly different than the low-risk gamblers in terms of age.

Table 3.6
Wave 1 of LLLP: Original PGSI Scoring System
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	PGSI Category at Wave 1					
Variables Wave 1	Non-Problem (NP) (PGSI = 0) (N=568)	Low-Risk (LR) (PGSI = 1-2) (N=174)	Moderate-Risk (MR) (PGSI = 3-7) (N=55)	Problem Gambling (PG) (PGSI = 8-27) (N=12)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	18.8 (1.52)	40.93 (5.4)	150.0 (35.6)	401.7 (131.0)	87.10 [a]	NP < MR [a] LR < MR [a] NP < PG [a] LR < PG [a] MR < PG [a]
Median	8.0	20.0	60.0	250.0		
Percentile rank of median	42.5	65.5	87.0	97.5		
Percent of gross income spent on gambling						
Mean (SD)	1.91 (.50)	1.76 (.67)	7.36 (2.71)	12.5 (4.82)	6.26 [a]	NP < MR [b] LR < MR [b] NP < PG [b] LR < PG [b]
Median	0.12	0.36	1.44	2.59		
Percentile rank of median	43.5	66.0	85.5	92.0		
Number of games played in last year						
Mean (SD)	2.35 (.06)	3.38 (.13)	4.49 (.23)	4.17 (.58)	50.73 [a]	NP < LR [a] NP < MR [a] LR < MR [a] NP < PG [a]
Median	2.0	3.0	4.0	4.0		
Percentile rank of median	40.0	62.0	78.0	78.0		

Note: Data source – LLLP

[a] p < .001; [b] p < .01

Table 3.7
Wave 2 of LLLP: Original PGSI Scoring System
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=517)	Low-Risk (LR) (PGSI = 1-2) (N=192)	Moderate-Risk (MR) (PGSI = 3-7) (N=83)	Problem Gambling (PG) (PGSI = 8-27) (N=17)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	62.86 (10.7)	162.3 (32.6)	374.4 (101.2)	739.7 (401.6)	20.20 [a]	NP < MR [a] LR < MR [a] NP < PG [a] LR < PG [a] MR < PG [b]
Median	15.0	22.0	60.0	250.0		
Percentile rank of median	43.0	56.5	72.5	91.0		
Percent of gross income spent on gambling						
Mean (SD)	2.55 (.53)	5.93 (1.37)	9.2 (2.41)	23.9 (8.31)	14.07 [a]	NP < MR [b] NP < PG [a] LR < PG [a]
Median	0.24	0.48	1.30	4.50		
Percentile rank of median	43.0	56.0	72.5	88.0		
Number of games played in last year						
Mean (SD)	3.30 (.07)	4.43 (.13)	4.92 (.22)	4.88 (.32)	38.24 [a]	NP < LR [a] NP < MR [a] NP < PG [b]
Median	3.0	4.5	5.0	5.0		
Percentile rank of median	38.5	66.5	75.0	75.0		

Note: Data source – LLLP

[a] $p < .001$; [b] $p < .01$

Figure 3.4. Mean amount spent on all gambling in each category at wave 1 (1=non-problem; 2=low-risk gambler; 3=moderate-risk gambler; and 4=problem gambler).

Figure 3.5. Mean amount spent on all gambling in each category at wave 2 (1=non-problem; 2=low-risk gambler; 3=moderate-risk gambler; and 4=problem gambler).

Table 3.8
Wave 1 & 2 of LLLP: Original PGSI Scoring System
Only for Wave 1 Non-Problem Gamblers & PGSI Category at Wave 2
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=454)	Low-Risk (LR) (PGSI = 1-2) (N=95)	Moderate-Risk (MR) (PGSI = 3-7) (N=19)	Problem Gambling (PG) (PGSI = 8-27) (N=0)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	52.0 (7.04)	117.8 (33.4)	266.7 (160.6)	--- (---)	10.72 [a]	NP < LR [b] NP < MR [a] LR < MR [b]
Median	12.0	20.0	50.0	---		
Percentile rank of median	47.0	58.0	75.5	---		
Percent of gross income spent on gambling						
Mean (SD)	2.56 (.59)	6.37 (2.14)	3.70 (1.70)	--- (---)	20.71 [a]	NP < MR [b] LR < MR [b] NP < PG [b] LR < PG [b]
Median	0.20	0.45	1.15	---		
Percentile rank of median	44.5	61.0	78.0	---		
Number of games played in last year						
Mean (SD)	3.23 (.07)	4.36 (.19)	4.00 (.42)	--- (---)	2.87	ns
Median	3.0	4.0	4.0	---		
Percentile rank of median	45.0	65.5	65.5	---		

Note: Data source – LLLP

[a] $p < .001$; [b] $p < .01$

Table 3.9
Wave 1 & 2 of LLLP: Original PGSI Scoring System
Only for Wave 1 Low-Risk Gamblers & PGSI Category at Wave 2
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=59)	Low-Risk (LR) (PGSI = 1-2) (N=79)	Moderate-Risk (MR) (PGSI = 3-7) (N=34)	Problem Gambling (PG) (PGSI = 8-27) (N=2)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	148.5 (76.5)	219.5 (67.3)	245.1 (119.0)	--- (---)	0.23	ns
Median	25.0	30.0	60.0	---		
Percentile rank of median	45.0	49.0	62.0	---		
Percent of gross income spent on gambling						
Mean (SD)	2.59 (1.22)	4.86 (1.72)	7.73 (3.67)	--- (---)	6.25 [a]	NA
Median	0.48	0.42	1.05	---		
Percentile rank of median	47.5	45.0	57.5	---		
Number of games played in last year						
Mean (SD)	3.75 (.24)	4.51 (.21)	5.00 (.37)	--- (---)	3.40 [b]	NP < MR [b]
Median	3.0	4.0	5.0	---		
Percentile rank of median	28.5	46.0	63.5	---		

Note: Data source – LLLP

[a] $p < .001$; [b] $p < .01$

Table 3.10
Wave 1 & 2 of LLLP: Original PGSI Scoring System
Only for Wave 1 Moderate-Risk Gamblers & PGSI Category at Wave 2
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=4)	Low-Risk (LR) (PGSI = 1-2) (N=17)	Moderate-Risk (MR) (PGSI = 3-7) (N=28)	Problem Gambling (PG) (PGSI = 8-27) (N=6)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	32.50 (29.26)	146.04 (52.98)	595.54 (236.44)	290.83 (150.94)	1.07	ns
Median	5.0	30.0	125.0	200.0		
Percentile rank of median	7.5	34.5	58.0	65.5		
Percent of gross income spent on gambling						
Mean (SD)	1.91 (.50)	1.76 (.67)	7.36 (2.71)	12.5 (4.82)	0.53	ns
Median	0.16	0.69	1.86	4.65		
Percentile rank of median	15.0	35.5	53.5	68.5		
Number of games played in last year						
Mean (SD)	4.50 (1.19)	4.41 (.42)	5.57 (.32)	4.83 (.65)	1.78	ns
Median	3.5	5.0	5.0	5.5		
Percentile rank of median	21.0	49.5	49.5	62.0		

Note: Data source – LLLP

[a] $p < .001$; [b] $p < .01$

Discussion

We theorized that adults gambling at the similar levels would have comparable PGSI scores at each wave in longitudinal study. The ANOVAs that were completed on the data from wave 1 and 2 indicated that the amount spent on gambling per month, the percent of gross income spent on gambling, and the total number of games played in last year all varied significantly as a function of the PGSI categories. A closer look at these results, however, indicates that the amount spent on gambling per month provides the clearest separation between the four categories. As individuals progress in the PGSI categories, there is a clear and significant increase in the amount of money spent on gambling. Percent of gross income is the second best predictor that differentiates between the four categories. The number of games played in the last year is the least effective factor that differentiates between the four categories. Often, there are

fewer games played among problem gamblers than for moderate-risk gamblers, even though the amount spent and percent of income is often significantly higher among problem gamblers. This might be indicative of the types of gambling activities that problem gamblers participate in compared to other gamblers. That is fewer types, but more risky gambling activities like EGMs and casino games.

We also examined how the amount spent gambling, percent of gross income spent on gambling, and number of games played varied when the PGSI category at wave 1 was held constant. It provided an opportunity to examine the shifting pattern of PGSI categories between wave 1 and 2 of the LLLP. Unfortunately, the somewhat small sample sizes (e.g., problem gamblers) for some of these analyses limited the overall conclusions that could be drawn. Based on the analyses that were completed, the amount spent on gambling per month is the best predictor of the shifting PGSI categories that occur overtime in a longitudinal study. Finally we examined the role that factors like percentage of friends who gamble, age, and income play would play in explaining the shift in PGSI categories over time. The results showed, as compared to low-risk gamblers, non-problems gamblers had significantly fewer friends who gambled and they tended be older. Overall, there appears to a variety of factors that help differentiate between the PGSI categories over time. At lower levels of gambling (i.e., non-problem vs. low-risk), factors such as percentage of friends gambling, age, and amount spent on gambling appear to better predict which PGSI category one might separate, whereas, amount spent on gambling provides more specificity in identifying differences between the four PGSI categories.

Section 4
Validity and Reliability of Novel PGSI Scoring System

Study 1 – Creation and Reliability of Novel PGSI Scoring System

Objectives

Using the original 0 to 27 scoring range (each item scored on a 4-point scale), four novel categories were created that corresponded to scores of 0, 1 to 4, 5 to 8, and 9+). This scoring maintained the non-problem (zero-symptom) gambler and high severity categories as largely unchanged from the original scoring, while having equal intervals (4 points each) for the two middle categories. It was hypothesized that the original categories for the PGSI might need to be adjusted to facilitate a more refined separation between the four categories. We hypothesized this scoring system would demonstrate greater stability over time. The goal was to assess the impact of re-calibrating the PGSI scoring rules on the reliability and validity of the PGSI severity categories.

Method

An intraclass correlation coefficient (ICC) was calculated to examine the temporal reliability of the novel PGSI scoring system measured at wave 1 and 2 in the LLLP. Partial correlations were completed to try and identify the role that the change in proportion of income spent had in changes in the relationship between the novel PGSI scores over time. A series of ANOVAs were completed to examine the role that amount spent, the proportion of income spent on gambling, and the frequency of gambling play in identifying variation in the new categories for the PGSI. In order to complete this analysis, the LLLP dataset was used on these four categories to compare differences in the amount spent on gambling, the percent of gross income spent on gambling, and the number of games played in the last year. Of particular interest was the

distinction, if any, between non-problem (zero symptom) and low-risk (scores 1 to 4) gamblers or whether these groups should be combined.

If the new categories show improved reliability over time, the next step was to validate the four categories as representing conceptually and statistically different groups of gamblers that show a logical progression of risk from lower to higher scores. Using the CPGI integrated dataset, the four categories were compared on intensity of gambling involvement (frequency, total expenditures, percent of income spent on gambling, total number of different games played), type of gambler, and frequency of other addictive behaviours and mental health concerns reported. Borrowing from terminology used to define risk of alcohol problems [36;37], we proposed alternate names for the new categories to be non-problem gamblers, low-risk gamblers, moderate-risk gamblers, and problem gamblers.

Results

The comparison between the original PGSI scoring and the novel scoring system proposed here can be found in Table 4.1. There is no difference in the non-problem/non-problem groups at either wave 1 or 2 of the LLLP. With the modified scoring system there were more individuals in the second group, low-risk gamblers, and fewer individuals in the third group, moderate-risk gamblers. Finally, the problem or problem groups were virtually identical in the original and novel scoring system for the PGSI.

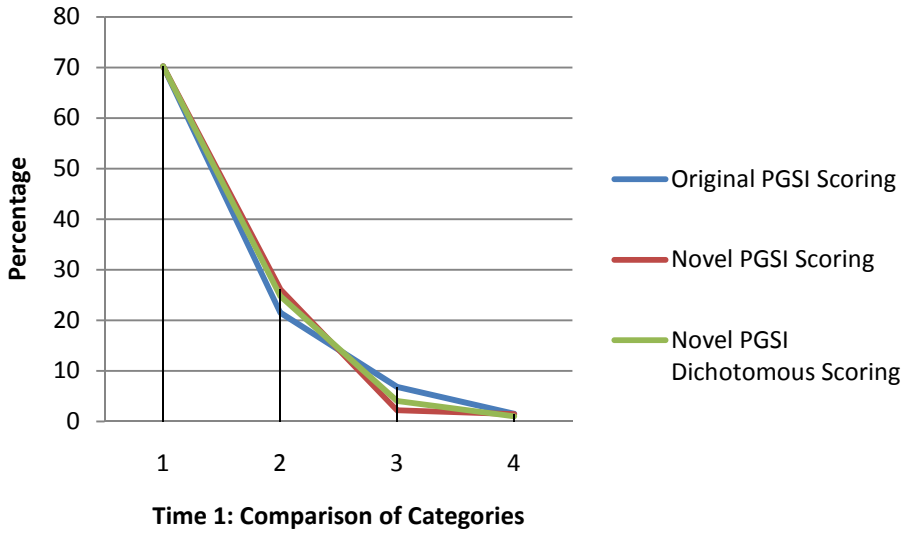


Figure 4.1 Percentage of gamblers in each category at wave 1 (1=non-problem; 2=low-risk gambler; 3=moderate-risk gambler; and 4=problem gambler).

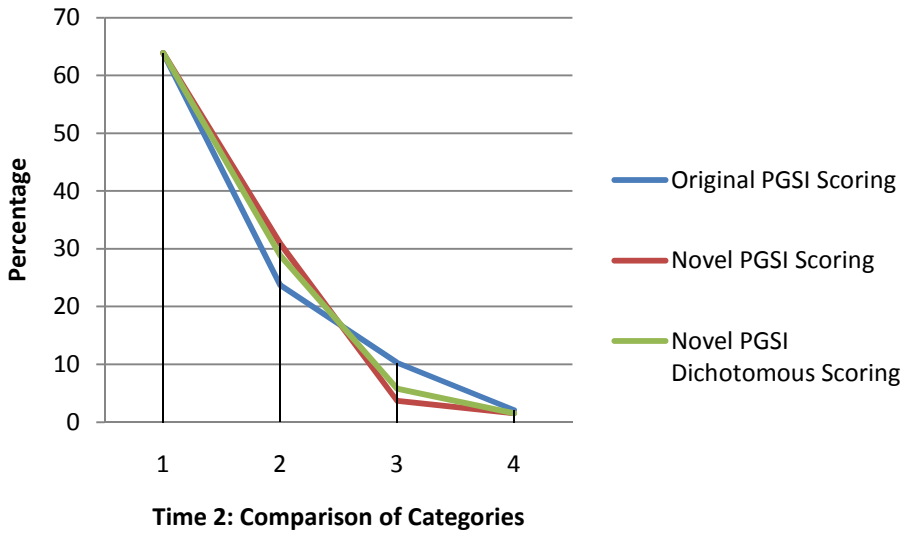


Figure 4.2 Percentage of gamblers in each category at wave 2 (1=non-problem; 2=low-risk gambler; 3=moderate-risk gambler; and 4=problem gambler).

The test-retest reliability for each of the revised PGSI categories was computed. The results found an intraclass correlation coefficient of r = .64 (F = 4.55, p < .001). A partial correlation was also completed that allowed for the statistical control of any change in gambling involvement (i.e., percent of income spent on all gambling activities) between waves. Without controlling for the change in gambling involvement, the correlation between the revised PGSI scores at wave 1 and 2 was r = .641, p < .001, whereas when the change in gambling involvement was controlled, the correlation only dropped slightly to r =. 620, p < .001.

The results for the ANOVA for the novel PGSI categories at wave 1 can be found in Table 4.2. Each of the following varied significantly as a function of the novel PGSI categories: the amount spent on gambling per month, F (3, 805) = 66.16, p < .001, and the total number of games played in last year, F (3, 805) = 46.80, p < .001. The Scheffe post-hoc results are also indicated in Table 4.2, with all comparisons between the four categories being significant for the amount spent. Only non-problem and problem gambling categories were significantly different for the number of games.

The results for the ANOVA for the novel PGSI categories at wave 2 indicates that each of the following varied significantly as a function of the novel PGSI categories: the amount spent on gambling per month, F (3, 805) = 33.03, p < .001, the percent of gross income spent on gambling, F (3, 805) = 18.77, p < .001, and the total number of games played in last year, F (3, 805) = 38.84, p < .001 (Table 4.3). The Scheffe post-hoc results are also indicated in Table 4.3, with the non-problem and low-risk gamblers being significantly different than the moderate-risk and problem gamblers for amount spent on gambling. In terms of percent of income, non-problem was significantly different than the other three groups on the percentage of income spent on gambling.

Table 4.1
Comparison of Original PGSI Scoring with Novel PGSI Scoring Systems
Participants that gambled at both Wave 1 and 2 of LLLP

	Wave 1		Wave 2	
Categories	Freq	%	Freq	%
Original PGSI Categories				
Non-Problem (0)	568	70.2%	517	63.9%
Low-Risk (1-2)	174	21.5%	192	23.7%
Moderate-Risk (3-7)	55	6.8%	83	10.3%
Problem (≥8)	12	1.5%	17	2.1%
Mean Tot Score	0.77		0.98	
Novel PGSI Categories				
Non-problem (0)	568	70.2%	517	63.9%
Low-Risk (1-4)	212	26.2%	250	30.9%
Moderate-risk (5-8)	18	2.2%	30	3.7%
Problem (≥9)	11	1.4%	12	1.5%
Mean Tot Score	0.77		0.98	
Novel PGSI Categories based on Dichotomous Scoring				
Non-problem (0)	568	70.2%	517	63.9%
Low-Risk (1-4)	201	24.8%	233	28.8%
Moderate-risk (5-8)	32	4.0%	47	5.8%
Problem (≥9)	8	1.0%	12	1.5%
Mean Tot Score	0.63		0.88	

Note: Data source – LLLP

Table 4.2

Wave 1 of LLLP: Novel PGSI Scoring System
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	Modified PGSI Category at Wave 1					
Variables Wave 1	Non-Problem (NP) (PGSI = 0) (N=568)	Low-Risk (LR) (PGSI = 1-4) (N=212)	Moderate-Risk (MR) (PGSI = 5-8) (N=18)	Problem Gambler (PG) (PGSI = 9-27) (N=11)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	18.8 (1.52)	60.55 (9.6)	168.4 (58.4)	392.7 (143.1)	66.16 [a]	All comparisons significant [a]
Median	8.0	20.0	80.0	200.0		
Percentile rank of median	42.50	65.5	89.0	96.0		
Percent of gross income spent on gambling						
Mean (SD)	1.91 (.50)	2.88 (.86)	6.04 (3.26)	13.0 (5.25)	3.69 [b]	NP < LR [a] NP < MR [a] LR < MR [b]
Median	0.12	0.38	1.60	2.40		
Percentile rank of median	43.5	66.5	88.0	91.0		
Number of games played in last year						
Mean (SD)	2.35 (.06)	3.57 (.12)	4.94 (.50)	3.64 (.24)	46.80 [a]	NP < PG [b]
Median	2.0	4.0	4.5	4.0		
Percentile rank of median	40.0	78.0	85.5	78.0		

Note: Data source – LLLP

[a] $p < .001$; [b] $p < .01$

Table 4.4, 4.5, and 4.6 show the results for a series of ANOVAs for the stability of the novel PGSI categories from wave 1 to 2. For example, Table 4.3 shows the results for only those individuals who were non-problem gamblers at Time 1. At total of 454 individuals continued to be non-problem gamblers at wave 2, while 112 met the criteria for low-risk gambling by wave 2, and only 2 (results not shown to small n) met the criteria for moderate-risk gambler by wave 2. The results of the one-way ANOVA indicated that each of the following varied significantly as a function of the PGSI categories: the amount spent on gambling per month, $F(3, 565) = 51.48$, $p < .001$ and the number of games played in last year, $F(3, 565) = 20.30$, $p < .001$. The Scheffe post-hoc results are also included in Table 4.3, with the non-problem and low-risk being significantly different than the moderate-risk gambler on the amount spent. There was a consistent increase in the amount spent on gambling through the progression from non-problem, to low-risk, to ultimately, moderate-risk gamblers. Table 4.4 and 4.5 show the results for low-risk, moderate-risk, and problem gamblers separately. Some of the results (e.g., moderate-risk

and problem) in these tables are not shown due to the small sample size (n<5). The sample sizes for many of these categories are small enough that it is difficult to draw general conclusions.

Table 4.3
Wave 2 of LLLP: Novel PGSI Scoring System
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	Modified PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=517)	Low-Risk (LR) (PGSI = 1-4) (N=250)	Moderate-Risk (MR) (PGSI = 5-8) (N=30)	Problem Gambler (PG) (PGSI = 9-27) (N=12)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	62.86 (10.7)	165.4 (27.1)	744.67 (256.6)	927.5 (562.4)	33.03 [a]	NP < LR [b] NP < MR [a] LR < MR [a] NP < PG [a] LR < PG [a]
Median	15.0	30.0	100.0	275.0		
Percentile rank of median	43.0	61.0	78.5	91.5		
Percent of gross income spent on gambling						
Mean (SD)	2.55 (.53)	5.99 (1.16)	14.8 (5.18)	30.7 (11.12)	18.77 [a]	NP < LR [b] NP < MR [a] NP < PG [a] LR < MR [b] MR < PG [b]
Median	0.24	0.52	1.47	4.65		
Percentile rank of median	43.0	57.0	75.0	88.5		
Number of games played in last year						
Mean (SD)	3.30 (.07)	4.50 (.12)	5.33 (.29)	4.83 (.39)	38.84 [a]	NP < LR [a] NP < MR [a]
Median	3.0	4.5	5.0	5.0		
Percentile rank of median	38.5	66.5	75.0	75.0		

Note: Data source – LLLP. [a] $p < .001$; [b] $p < .01$

The validation of the four categories as representing conceptually and statistically different groups of gamblers, with a logical progression of risk from lower to higher scores was examined using the CPGI integrated dataset. The results examining the comparison of the type of gambler is shown in Table 4.7 and Figures 4.3 and 4.4. There are significant differences between the non-problem category and many of the other categories for each of the various types of gambling. In particular, those in the non-problem are significantly less involved in EGMs and other casino games than individuals in the higher three categories. Those in the low-risk category are also significantly less involved in EGMs and casino games than are moderate-risk and problem gamblers.

The examination of the amount spent on gambling per month, percentage of gross income spent on gambling, total number of different games played for the CPGI integrated dataset are included in Table 4.8. The results of the one-way ANOVA indicated that each of the following varied significantly as a function of the PGSI categories: the amount spent on gambling per month, F (3, 14,385) = 181.87, $p < .001$, the percentage of gross income spent on gambling F (3, 14,385) = 323.07, $p < .001$, and the number of games played in last year, F (3, 14,385) = 206.08, $p < .001$. The Scheffe post-hoc results are also included in Table 4.8, with all comparisons for amount spent and percentage of income being significantly different. Finally, the results looking at the frequency of other addictive behaviours and mental health concerns for each category are presented in Table 4.9. In general, those individuals in the non-problem group show fewer symptoms of health problems, self-perceived stress, increased psychological well-being, fewer mood and anxiety disorders, and lower levels of substance use disorders.

Table 4.4

Wave 2 of LLLP: Novel PGSI Scoring System

Only for Wave 1 Non-problem Gamblers & Novel PGSI Category at Wave 2

Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	Modified PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=454)	Low-Risk (LR) (PGSI = 1-4) (N=112)	Moderate-Risk (MR) (PGSI = 5-8) (N=2)	Problem Gambler (PG) (PGSI = 9-27) (N=0)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	51.99 (7.04)	117.97 (29.6)	--- (---)	--- (---)	51.48 [a]	NP < MR [a] LR < MR [a]
Median	12.0	20.0	---	---		
Percentile rank of median	47.0	58.0	---	XX		
Percent of gross income spent on gambling						
Mean (SD)	2.56 (.59)	5.74 (1.82)	--- (---)	--- (---)	3.13	NP < LR [a]
Median	0.20	0.47	---	---		
Percentile rank of median	44.5	61.5	---	XX		
Number of games played in last year						
Mean (SD)	3.23 (.07)	4.30 (.18)	--- (---)	--- (---)	20.30 [a]	ns
Median	3.0	4.5	---	---		
Percentile rank of median	45.0	65.5	---	XX		

Note: Data source – LLLP. [a] $p < .001$; [b] $p < .01$

Table 4.5

Wave 2 of LLLP: Novel PGSI Scoring System
Only for Wave 1 Low-Risk Gamblers & Novel PGSI Category at Wave 2
Comparison of non-problem, low-risk, moderate-risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	Modified PGSI Category at Wave 2					
Variables Wave 2	Non-Problem (NP) (PGSI = 0) (N=62)	Low-Risk (LR) (PGSI = 1-4) (N=128)	Moderate Risk (MR) (PGSI = 5-8) (N=21)	Problem Gambler (PG) (PGSI = 9-27) (N=1)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	143.45 (72.79)	193.01 (43.59)	675.24 (334.39)	--- (---)	3.40	NA
Median	22.5	35.0	100.0	---		
Percentile rank of median	42.5	49.5	69.0	---		
Percent of gross income spent on gambling						
Mean (SD)	2.49 (1.16)	6.08 (1.59)	16.61 (7.20)	--- (---)	12.17 [b]	NA
Median	0.48	0.54	1.38	---		
Percentile rank of median	46.0	47.0	64.0	---		
Number of games played in last year						
Mean (SD)	3.81 (.24)	4.58 (.17)	5.52 (.35)	--- (---)	4.89 [b]	NA
Median	3.0	5.0	5.0	---		
Percentile rank of median	26.0	61.5	61.5	---		

Note: Data source – LLLP. [a] $p < .001$; [b] $p < .01$

Table 4.6

Wave 2 of LLLP: Novel PGSI Scoring System
Only for Wave 1 Moderate-risk Gamblers & Novel PGSI Category at Wave 2
Comparison of non-problem, low-risk, moderate risk, and problem gamblers on amount spent on gambling, frequency, and percent of income spent on gambling

	Modified PGSI Category at Wave 2					
Variables Wave 2	Non- Problem (NP) (PGSI = 0) (N=1)	Low-Risk (LR) (PGSI = 1-4) (N=9)	Moderate-Risk (MR) (PGSI = 5-8) (N=6)	Problem (PP) (PGSI = 9-27) (N=2)	ANOVA *F* value	Significant differences (Scheffe post hoc tests)
Amount spent on gambling per month						
Mean (SE)	0.0 (---)	380.85 (211.2)	685.0 (390.1)	--- (---)	0.42	NA
Median	0.0	15.0	250.0	---		
Percentile rank of median	XX	48.0	60.5	---		
Percent of gross income spent on gambling						
Mean (SD)	0.0 (---)	8.44 (4.60)	7.16 (4.62)	--- (---)	1.64	NA
Median	0.0	0.36	2.20	---		
Percentile rank of median	XX	11.0	44.5	---		
Number of games played in last year						
Mean (SD)	3.00 (---)	5.89 (.63)	5.50 (.56)	--- (.---)	0.17	NA
Median	3.0	5.0	5.0	---		
Percentile rank of median	14.0	45.0	45.0	---		

Note: Data source – LLLP. [a] $p < .001$; [b] $p < .01$

Table 4.7

Proportion of non-problem, low-risk, moderate-risk and problem gamblers that gamble at least 2-3 times/month using modified scoring of the PGSI

	PGSI Category				
Type of gambling	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-4)	Moderate-Risk (MR) (PGSI = 5-8)	Problem Gambler (PG) (PGSI = 9-27)	Significant differences [a]
N	5,843	1,110	1,019	227	
Sports lotteries	10%	31%	26%	34%	NP < LR
VLT inside of casino	2%	8%	15%	16%	NP < LR NP < MR NP < PG
VLT outside of casino	6%	16%	39%	57%	NP < LR NP < MR NP < PG LR < PG
Other casino games	1%	8%	18%	41%	NP < LR NP < PG MR < PG
Instant Win Tickets	19%	43%	42%	55%	NP < LR NP < MR
Lottery Tickets	30%	54%	53%	53%	NP < LR NP < MR NP < PG
Card Games	9%	17%	28%	11%	No differences
Bingo	19%	34%	32%	31%	NP < LR
Other forms of gambling	9%	17%	12%	30%	No differences
EGMs or any casino games	2.3%	14%	32%	46%	NP < LR NP < MR NP < PG LR < MR LR < PG
All other types of gambling	30%	66%	77%	66%	NP < LR NP < MR NP < PG

Note: Data source – CCHS-1.2; coding freq of gambling - 0 = < 2-3 times/month; 1 = > 2-3 times/month. [a] $p < .01$.

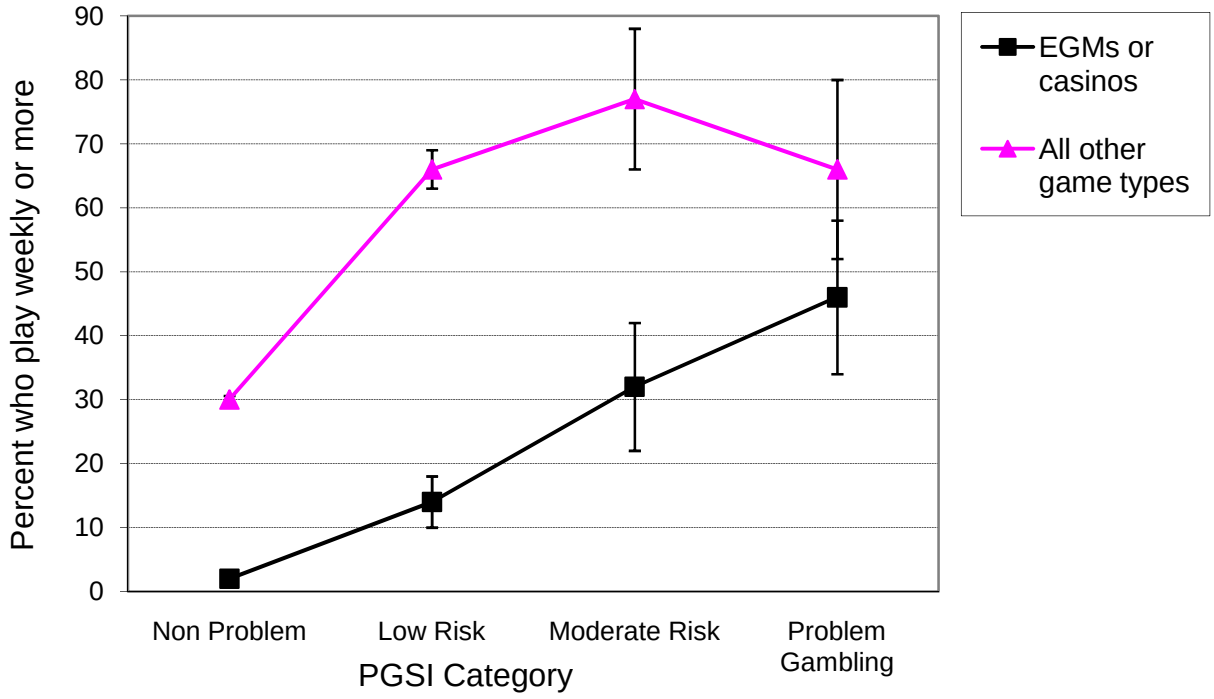


Figure 4.3 Proportion (with 99% confidence intervals) of non-problem (0), low-risk (1-4), moderate-risk (5-8), and problem gamblers (>8) who play EGMs or casino games versus all other game types (except EGM and casino games) 2-3 times per month or more using novel scoring.

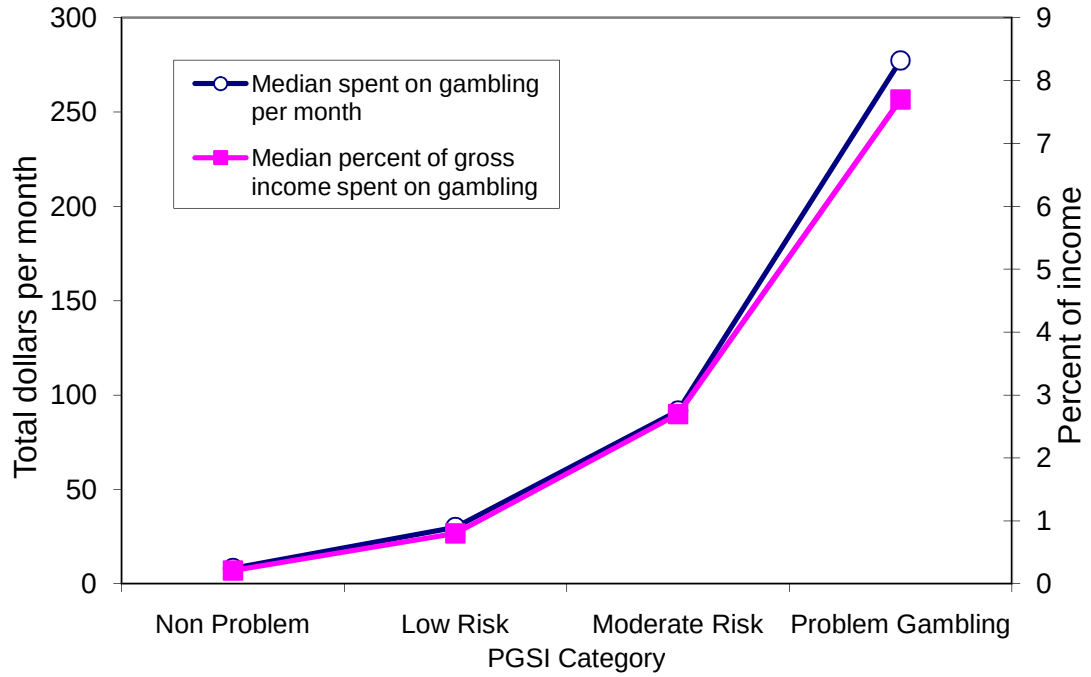


Figure 4.4. Indicators of gambling intensity by PGSI category using modified scoring.

Table 4.8

Comparison of gambling intensity indicators for PGSI categories based on novel scoring

Variable	PGSI Category: Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-4)	Moderate-Risk (MR) (PGSI = 5-8)	Problem (PG) (PGSI = 9-27)	ANOVA *F* value [a]	Significant differences (Scheffe post hoc tests) [a]
N	12,160	1,873	220	135		
Amount spent on gambling per month						
Weighted mean (SE)	46.3 (4.2)	149.8 (19.6)	513.1 (152.0)	1316.4 (285.9)	181.87	All comparisons [c]
Median	8.3	30	91.7	277.3		
Percentile rank of median [b]	49	74	88	96		
% of gross income spent on gambling						
Mean (SD)	1.2 (.06)	3.8 (0.3)	10.8 (2.0)	19.5 (2.9)	323.07	All comparisons [c]
Median	0.21	0.8	2.7	7.7		
Percentile rank of median [b]	46	72	88	96		
Number of games played in last yr (0-8)						
Mean (SD)	3.3 (.02)	4.2 (0.5)	4.7 (0.2)	4.7 (0.2)	206.08	NP < LR [c] NP < MR [c]
Median	3	4	4	4		
Percentile rank of median [b]	60	75	75	75		

[a] Conducted on natural log transformed amount spent per month and percent income spent.
[b] Within the ungrouped full sample. [c] $p < .01$.

Table 4.9
Comparison of non-problem, low-risk, moderate-risk and problem gamblers on health and mental health status using novel scoring of the PGSI

	PGSI Category				
Variable	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-4)	Moderate-Risk (MR) (PGSI = 5-8)	Problem (PG) (PGSI = 9-27)	Significant differences[1]
N	5,843	1,110	1,019	227	
Overall health ratings					
Self-perceived health[a]	2.3	2.4	2.6	2.6	NP<LR NP<MR NP<PG
Self-perceived stress[b]	2.8	2.9	3.1	3.2	NP<LR NP<MR NP<PG
Psychological well-being	81.5	78.0	74.5	69.3	NP>LR NP>MR NP>PG LR>MR LR>PG
Mental disorders (Past 12 Months)					
Any mood disorder [c]	4.8%	6.7%	9.8%	19.5%	NP<PG
Any anxiety disorder [c]	4.6%	8.0%	6.4%	19.8%	NP<PG
Substance Use Disorder [c]	3.0%	10.7%	9.9%	20.3%	NP<LR NP<MR NP<PG

Note: Data source – CCHS-1.2. [a] Coding : 1=excellent; 2=very good; 3=good; 4=fair; 5=poor. [b] Coding: 1=not at all; 2=not very; 3=a bit; 4=quite a bit; 5=extremely. [c] Coding: 0=not present; 1=present. [1] p<.01.

Recognizing that changing the cut-off for the problem gambler subtype from 8 to 9 would make comparisons with previous research using the old cut-off very difficult, we examined the impact of defining moderate-risk gamblers as a PGSI score of 5 to 7 and problem gamblers as a PGSI score of 8 or higher on measures of gambling intensity, game preference and mental health. These results are displayed in Table 4.10 (for ease of interpretation only select measures of mental health are shown). Retaining the old cut-off for problem gambling has relatively little impact on the distinctiveness of the moderate-risk gambler and problem gambler subtypes. The median amount spent of gambling per month and percent of gross annual income spent on gambling are impacted only modestly—this indicators decrease when the cut-off for problem gamblers is lowered to the original value of 8. Importantly, the relative change in intensity of gambling and proportion who play high risk games from the non-problem gambler to problem gambler subtype is maintained. The most significant impact of modifying the PGSI cut-offs is raising the definition of moderate-risk gambling from 3 to 5. This improves the external validity of mid-level problem gambling severity.

Discussion

Original versus novel PGSI scoring. The comparison between the original PGSI scoring system and the novel scoring system showed no differences in the non-problem/non-problem group or the problem gambler group at either wave 1 or 2 of the LLLP. Using the novel scoring system there were more individuals in the second group, low-risk gamblers, and fewer individuals in the third group, moderate-risk gamblers. The analysis completed on the data from wave 1 and 2 indicated that the amount spent on gambling per month, the percent of gross income spent on gambling, and the total number of games played in last year all varied significantly as a function of the novel PGSI categories. Similar to the results with the original PGSI scoring system, the amount spent on gambling per month provide the clearest separation between the four categories. In the case of this new novel PGSI scoring system, the percentage of gross income spent on gambling also provides a clear separation between the categories, particularly at wave 2. The re-distribution of individuals into these new novel categories appears to have provided clearer differences between low-risk, moderate-risk, and problem gamblers in relation to the percentage of income spent on gambling.

Given the somewhat promising initial findings related to the new novel PGSI categories, we then attempted to validate the four categories as representing conceptually and statistically different groups of gamblers that show a logical progression of risk from lower to higher scores in relation to intensity of gambling involvement, type of gambler, and frequency of other addictive behaviours and mental health concerns. Using the CPGI integrated dataset, we found those in the non-problem category were significantly less involved in EGMs and other casino games than individuals in the higher three categories. Those in the low-risk category were also significantly less involved in EGMs and casino games than are moderate-risk and problem gamblers. These findings are consistent with other research that has found that higher risk gamblers tend to be more likely to participate in risky types of gambling like EGMs and casino table games.

The examination of the amount spent on gambling per month, percentage of gross income spent on gambling, total number of different games played for the CPGI integrated dataset also found that amount spent on gambling per month and percentage of gross income spent on gambling provide clear separation between the four categories. Finally, the results looking at the frequency of other addictive behaviours and mental health concerns indicate that individuals in the non-problem group show fewer symptoms of health problems, self-perceived stress, increased psychological well-being, fewer mood and anxiety disorders, and lower levels of substance use disorders. Consequently, the non-problem category does appear to represent conceptually and statistically a different group that than the other three categories in terms of psychological well-being, metal health, and addiction. The distinction between the other three categories using the novel PGSI scoring system is less clear.

LLLP data limitations. There are a number of issues that need to be considered in the LLLP. First, the methodology was different at Wave 1 as compared to wave 2 and 3. At wave 1, the gambling questions were asked as part of the initial telephone survey. At wave 2 and 3, the gambling questions were asked as part of a web-based survey. This change in methodology was made to make it more convenient for participants to complete the survey at wave 2 and 3. This might have lead to variations in some of the gambling data that was collected at the three different waves. For example, the average amount spent by non problem gamblers was $18.8/month at wave 1 and then increased to $62.8/month by wave 2. The participants may have been more comfortable disclosing the amount they spent on gambling anonymously in wave 2

and 3 as compared to wave 1 where they had to disclose this information to a stranger on the telephone.

Second, wave 1 of the LLLP occurred at the beginning of a period that involved a booming economy in the province of Alberta. Wave 2 occurred near the height of this booming economy, while wave 3 was near the tail end of the boom or even the start of the drop in the economy. As such, one would expect there to be fluctuations in factors like the amount spent on gambling in a typical month. This was one of the perceived strengths of longitudinal nature of the LLLP, the ability to identify changing patterns in gambling behaviours during fluctuations in the economy. Finally, participants were maturing during the course of this longitudinal study. Therefore, it was expected that there would be changes in gambling behaviour over the life of the study as participants matured. This is particular true for the young adults (18-25 years), since their disposable income would increase during the longitudinal study. The fact that gambling expenditure increased for all PGSI subtypes from wave 1 to wave 2 would argue against the influence of a systematic bias with one group.

Table 4.10

Comparison of gambling intensity indicators for PGSI categories based on novel scoring that retains the PGSI = 8 as cut-off for problem gambling

Variable	PGSI Category: Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-4)	Moderate-Risk (MR) (PGSI = 5-8)	Problem Gambler (PG) (PGSI = 9-27)	ANOVA *F* value [a]	Significant differences (Scheffe post hoc tests) [a]
N	12,160	1,873	187	168		
Amount spent on gambling per month						
Weighted mean (SE)	46.3 (4.2)	149.8 (19.6)	547.5 (208.7)	1101.5 (222.5)	168.01	All comparisons [c]
Median	8.3	30	100	250		
Percentile rank of median [b]	49	74	88	96		
% of gross income spent on gambling						
Mean (SD)	1.2 (.06)	3.8 (0.3)	9.9 (1.8)	17.9 (2.5)	318.89	All comparisons [c]
Median	0.21	0.8	2.7	7.1		
Percentile rank of median [b]	46	72	88	96		
Game preference						
EGMs or any casino games	2.3%	14%	27%	47%		NP < LR NP < MR NP < PG LR < MR LR < PG
All other types of gambling	30%	66%	75%	72%		NP < LR NP < MR NP < PG
Mental disorders (Past 12 Months)						
Any mood disorder [c]	4.8%	6.7%	8.4%	18.2%		NP<PG LR>PG
Any anxiety disorder [c]	4.6%	8.0%	6.3%	15.9%		NP<PG LR>PG
Substance Use Disorder [c]	3.0%	10.7%	9.8%	17.3%		NP<LR NP<MR NP<PG

[a] Conducted on natural log transformed amount spent per month and percent income spent.
[b] Within the ungrouped full sample. [c] $p < .01$.

Study 2 – Validity of a Percentile-based PGSI Scoring System

Objectives

The purpose of this study was to determine if more meaningful categories of risk could be developed using the population distribution of a key indicator of gambling intensity—percent of income spent on gambling— as the basis for gambler subtypes. After creating the novel categories, we compared the new groups on measures of gambling intensity, types of games played, and frequency of other mental health concerns to determine if the four new groupings better separate subpopulations of gamblers than the categories based on the original scoring.

Method

The four categories of risk for problem gambling were defined based on deviation from population norms for gambling involvement. Using the CPGI integrated dataset, these four groups were defined as follows:

> *Non-problem gamblers* - individuals with a percent of income spent on gambling being no greater than ½ standard deviation of the population norm (0^{th} to 70^{th} percentile);
>
> *Low-risk gamblers* - individuals who stay below 1½ standard deviation of the population norm (71^{st} to 84^{th} percentile);
>
> *Moderate-risk gamblers* – individuals who gamble 1½ standard deviation above the population norm but below 2½ standard deviations (85^{th} to 98^{th} percentile);
>
> *Problem gamblers* – individuals gambling more than 2½ standard deviations above the population norm (ie., exceeding the 98^{th} percentile).

The median PGSI score within each risk group was used to define the cut-offs and range of scores.

Results

Table 4.11 compares the indices of gambling intensity among the PGSI categories based on the novel scoring using percentile rank. The novel scoring does not improve the distribution of gambling intensity values or separation between the PGSI categories. There remains a large increase in median percent of income and total gambling expenditures between the moderate-risk gambling and problem gambling groups (see Figure 4.5). The difference between low-risk and moderate-risk gamblers on these indices was relatively small. The change in scoring had little impact on the non-problem grouping which is not surprising given that the typical non-problem gambler under the original scoring represented gambling expenditures at the 50^{th} percentile for the Canadian population. The proportion of gamblers that play different game types 2-3 times per week or more also did not show much change with the novel scoring categories (Table 4.21). Of note, the average PGSI score for problem gamblers was 4.0 suggesting a lower cut-off may be justified to identify individuals who gambler more than 98% of the population.

Discussion

Overall, these findings suggest there is little value added by classifying individuals as non-problem, low-risk, moderate-risk, or problem gamblers according to percentile ranks rather than cut-off scores of the PGSI total index. The resulting categories are very similar to the original PGSI subtypes.

Table 4.11
Comparison of gambling intensity indicators for PGSI categories based on percentile ranking of percent of income spent on gambling per year

Variable	PGSI Category			
	Non-Problem	Low-Risk	Moderate-Risk	Problem Gamblers
N	5,843	1,110	1,019	227
Percentile range for percent of income spent on gambling	0 – 70th	71st to 84th	84th to 97th	98th to 100th
Gambling intensity, mean (95%CI)				
Percent of income spent on gambling	0.2 (.22– .24)	1.3 (1.28– 1.32)	4.6 (4.4– 4.8)	35.2 (31.6 – 38.8)
Dollars spent per month	11.1 (10.0– 1.5)	56.0 (53.3– 58.6)	177.3 (166.6– 188.1)	1801.4 (1307.8 – 2295.0)
Number of games played in last year (0-8)	3.0 (3.0–3.1)	4.1 (4.0 – 4.2)	4.8 (4.7– 4.9)	5.3 (5.0 –5.6)
PGSI, mean (95%CI)	0.22 (.19 – .24)	0.57 (.47 – .67)	1.23 (1.06 – 1.41)	4.00 (3.21 – 4.77)

[a] Conducted on natural log transformed amount spent per month and percent income spent. [b] Within the ungrouped full sample.

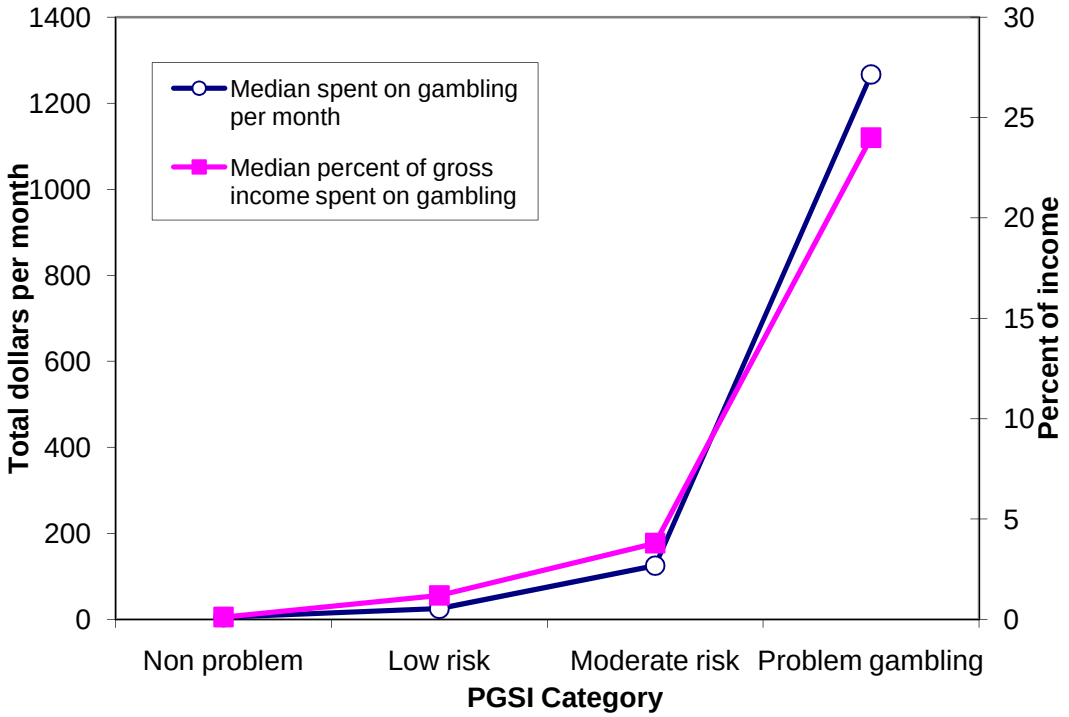


Figure 4.5 Indicators of gambling intensity by PGSI category using novel percentile rank scoring.

Study 3 – Reliability of the Dichotomous PGSI Scoring System

Objectives

The second alternate scoring system to recalibrate the PGSI categories uses dichotomous scores for original 9 items that make up the PGSI. Although the PGSI has a range of 0 to 27, less than one percent of the population has scores exceeding 9 or 10. Furthermore, the range of responses to individual items suggest most individuals use only the 'never' and 'sometimes' categories. The reliability of dichotomous scoring of the PGSI items (range 0 to 9) was assessed with the LLLP data. Four categories of scores were created (0, 1-3, 4-7, and 8-9) that correspond to: non-problem gamblers, low-risk gamblers, moderate-risk gamblers, and problem gamblers.

Method

An intraclass correlation coefficient (ICC) was calculated to examine the temporal reliability of the new dichotomous PGSI scoring system at wave 1 and 2 in the LLLP. A reliable change index [35] was calculated as a way of capturing the natural change in novel dichotomous PGSI scoring system over time. Here we used the PGSI's published test-retest reliability coefficient of 0.78. The original scoring system for the PGSI would be seen to have flaws if more than 25% of the LLLP participants shift PGSI categories between wave 1 and 2 without a corresponding increase in their gambling involvement.

Results

The comparison between the original PGSI scoring and the novel dichotomous scoring system proposed here can be found in Table 4.11 (or Figure 4.1 and 4.2). The test-retest reliability for the novel dichotomous PGSI was computed. The results found an intraclass correlation coefficient of $r = .71$ ($F = 5.881$, $p < .001$). Again for the dichotomous scoring method, the reliable change index was not calculated for participants that scored 0 on the PGSI score at both wave 1 and 2. Consequently, the results of the analysis on the remaining 297 individuals showed that 116 individuals (14.3% of original 808) had a reliable change in their score from wave 1 to 2. Specifically, 35 individuals had a reliable change index score that was below -1.96 and another 81 individuals had a reliable change index score that was above +1.96. The remaining 181 individuals did not show a statistically significant change in their score, with values between -1.96 and +1.96.

Discussion

There is no difference in the non-problem group at either wave 1 or 2 of the LLLP. With the novel dichotomous scoring system there were more individuals in the second group, low-risk gamblers, and fewer individuals in the third group, moderate-risk gamblers. Finally, the problem or problem groups were virtually identical in the original and novel dichotomous scoring system for the PGSI. When comparing the novel scoring system and the novel dichotomous scoring system for the PGSI, it is evident that the non-problem group is identical and the problem group is virtually identical. The difference occurs in the two middle groups, with novel scoring system having more individuals in the low-risk gambling group and fewer in the moderate-risk gambling group, while the novel dichotomous scoring system has fewer in the low-risk gambling group and more in the moderate-risk gambling group.

One important issue to consider going forward is which way of categorizing the PGSI should be used: the original scoring system, the novel scoring system, or the novel dichotomous scoring system? As mentioned early, very few individuals score above 9 on the PGSI and most only use

the two lowest options in the Likert scale for the 9-items. Based on the reliable change index, the original scoring system appears to be superior to the new novel dichotomous scoring system in terms of assessing gambling behaviour over time. There is still the issue of very few individuals scoring above 9 on the PGSI. What impact does this somewhat restricted range (0-9) have on the specificity of the measure? It would be useful to examine the change over time in PGSI scores in another longitudinal study to see if similar findings are reached in relation to the reliability change index.

Section 5

Factor Analysis and Latent Trait Modeling

Study 1 - Factor Structure Analysis

Objective

The purpose of this set of analyses was to explore and confirm the factor structure of the PGSI items scored using Likert response categories (0 = never, 1 = sometimes, 2 = most of the time, 3 = almost always) and dichotomously (0 = never, 1 = sometimes, most of the time, almost always). Based upon the scale development and previous research [18;38] a one factor structure was hypothesized. We also hypothesized a high level of internal reliability. However, Orford at al. [18] and Young et al. [39] found differential item endorsement for a number of PGSI items, which may indicate that the items are measuring different constructs for men and women. Therefore, the factor invariance across gender was also examined. In addition, factor invariance across age, income, and type of game was explored as these are additional factors that are associated with prevalence of gambling problems.

Method

The data file of 25,584 cases was randomly split into two databases. Exploratory factor analyses were conducted on the first half and confirmatory analysis of the structure was performed on the second half. Both analyses were conducted with items scored using the Likert scale and repeated with items scored dichotomously. Principal components analysis was used for the exploratory factor analysis using SPSS V 17 for the Likert data and Stata V.11 for the dichotomous data. Confirmatory factor analyses were conducted using AMOS V17. Internal reliability of the summed total score was estimated using coefficient alpha (SPSS. V. 17). Factor invariance across gender, age, type of game and income was assessed using confirmatory factor analysis of the total data file.

Results

Exploratory Factor Analysis

Principal components analysis (PCA) was used to explore the factor structure of the nine PGSI items. Two analysis were conducted, one with items using the four Likert response categories and the other with the dichotomously scored items. Because of the very small amount of missing item data (from 9 to 22 cases, M = 11.8), mean substitution was used to replace the missing values.

For the four response items, a Pearson correlation matrix was used in the PCA. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .925, indicating good factorability of the

matrix. PCA revealed a clear one component solution, accounting for 49.8% of the variance (Eigenvalue = 4.48). The Eigenvalue for the second unrotated component was comparably small, 0.76. Item communalities ranged from .36 to .60 and all items loaded strongly on the first component as shown in Table 5.1.

For the dichotomous items, a tetrachoric correlation matrix was used in the PCA. Again, PCA revealed a clear one component solution, accounting for 77.6% of the variance (Eigenvalue = 6.99). The Eigenvalue for the second unrotated component was comparably small, 0.39. Item communalities ranged from .70 to .87 and all items loaded strongly on the first component as shown in Table 5.1. The ordering of the items based upon the strength of their loadings was generally similar between the dichotomous items and the Likert response option items (e.g., the strongest and weakest three items were the same in both analyses) although the strength of the loadings was generally higher for the dichotomous items. This finding may reflect that the items are mostly measuring the presence versus absence of an impact versus degree of impact.

Confirmatory Factor Analysis

A one-factor structural equation model of the PGSI Likert response category items showed good fit to the data, despite a significant χ^2 (27) = 2393.6 (CFI = .972; RMSEA = .059 [90%CI .057 - .061]). Hu and Bentler [40] suggest that CFI > .95 and RMSEA < .06 represent good fit. Because item data were positively skewed, bootstrapping was used to estimate parameter confidence intervals. As shown in figure 5.1, all model parameters were significant.

For the dichotomous items, the Bayesian estimation approach was used to estimate the structural equation model [41]. The parameters estimates were almost identical to those produced by the maximum likelihood approach. The dichotomous items also showed good fit for a one factor model, χ^2 (27) = 1026.2; CFI = .969; RMSEA = .054 (90% CI .051, .056. Figure 5.2 displays the standardized parameter estimates.

Reliability Analysis

Corrected item-total correlations for the summed total score ranged from .49 to .70 for the Likert response items (M r = .61) and .41 to .64 for the dichotomous items (M r = .54). Coefficient alphas were .86 and .82 respectively. Neither coefficient alpha increased with the deletion of any item.

Subgroup Factor Structure Invariance

Gender. Because men and women differ in terms of their gambling involvements and the prevalence of gambling problems, structural equation modeling was used to examine the invariance of the PGSI items loadings across gender. The entire data set was used for these analyses using Likert response items. The first step examined the invariance of the configural (overall) model. Fit indices showed that the overall model is similar for men and women, χ^2 (81) = 3947; CFI = .970; RMSEA = .035. The second step tested whether the parameter loadings differ by comparing the change in χ^2 and CFI indices when the parameters are constrained to be identical for men and women. The change in Chi square was χ^2 (161) = 366, which is statistically significant, but the change CFI = .007 was less than the suggested cut off of .01 for a meaningful difference [41]. Figure 5.3 shows that there are some minor differences in the loadings for most items but no major differences.

Age. Because the prevalence of gambling and gambling problems vary according to age, a similar analysis was conducted to examine the invariance of PGSI item loadings in different age

groups. The age categories used in the different samples were not consistent but we were able to construct three meaningful age groups that could be coded in all databases, age 18 to 24 years (young adults), 25 to 64 years (adults), and age 65 and order (older adults). The first step showed that the overall model is similar for the three age groups, χ^2 (81) = 3028; CFI = .964; RMSEA = .035. In the second step the change in Chi square was χ^2 (16) = 1162, which is statistically significant, and the change CFI = .014 was slightly greater than the suggested cut off of .01 for a meaningful difference [41]. Figure 5.4 displays the item loadings for the three age groups. Follow-up analyses using the methods proposed by Byrne (2010) indicated that loadings for the tolerance, chasing and criticizing items do not differ significantly among the three groups. Inspection of the loadings for the remaining items did not reveal any strong differences although the older group has generally lower loadings across the items and the middle group the strongest loadings overall. None of the differences are sufficiently large to indicate that differential item selection or weighting is warranted in scoring the PGSI scale for different age groups.

Type of Game. Because electronic gaming machines and casinos games have been identified as particularly problematic types of gambling (most treatment seekers in Canada report problems with these games) we examined the invariance of the PGSI items loadings across individuals who play these games and those who do not. The entire data set was used for these analyses. The first step examined the invariance of the configural (overall) model. Fit indices showed that the overall model is similar for both groups, χ^2 (54) = 2833; CFI = .958; RMSEA = .045. The second step tested whether the parameter loadings differ by comparing the change in χ^2 and CFI indices when the parameters are constrained to be identical for both groups. The change in Chi square was χ^2 (8) = 552, which is statistically significant, but the change CFI = .009 was less than the suggested cut off of .01 for a meaningful difference. [41] Figure 5.4 shows that the loadings for most items are higher for electronic gaming machine or casino players versus players of other games.

Income. The final analysis examined the invariance of the PGSI items loadings across three income groups (less than $30000, $30000 – $50000, more than $50000). The first step examined the invariance of the configural (overall) model. Fit indices showed that the overall model is similar for the three subgroups, χ^2 (81) = 2747; CFI = .962; RMSEA = .039. The second step tested whether the parameter loadings differ by comparing the change in χ^2 and CFI indices when the parameters are constrained to be identical for the three subgroups. The change in Chi square was χ^2 (16) = 373, which is statistically significant, but the change CFI = .005 was less than the suggested cut off of .01 for a meaningful difference ([41],. Figure 5.6 shows that there are some minor differences in the loadings for most items but no major differences.

Discussion

The exploratory and confirmatory factor analyses revealed a one factor structure for the nine PGSI items. The item factor loadings for the dichotomous scoring were slightly higher than the loadings for the Likert scored items in the exploratory analysis but they were equivalent in the confirmatory analysis. The confirmatory model fit was good for both the Likert scoring and the dichotomous scoring. The internal reliability was slightly higher for the Likert scoring (.86 vs. .82) and was comparable to the value reported in the development sample (.84)[8]. Holtgrave [38] also reported α = .86 for a subset of these Canadian data and Orford at al [18] reported α = .90 for the British population survey.

These analyses did not identify any "weak" item in terms of factor loading and deletion of any item did not decrease the internal reliability. The lowest loading overall and across the various subgroups (gender, age, income, type of game) was the "borrowing" item which likely reflects its relatively low endorsement. Generally, the factor structure was invariant across subgroups with only minor differences in item loadings. There was no evidence of meaningful differences between men and women. There were some statistical differences among the three age groups, with slightly lower loadings for older participants. However, these differences were too small to warrant a different scoring or weighting scheme for these individuals.

Table 5.1
PGSI Item Loadings on First Unrotated Principal Component for Likert Response and Dichotomously Scored Items

	Likert Response		Dichotomous	
Item	Communality	Loading	Communality	Loading
Bet more than could afford to lose	.476	.690	.798	.893
Borrowed money to gamble	.359	.599	.695	.834
Felt had a problem with gambling	.619	.786	.874	.935
People were critical of gambling	.484	.695	.754	.868
Felt guilty about gambling	.527	.726	.784	.885
Had health problems due to gambling	.507	.712	.785	.886
Had financial problems due to gambling	.597	.773	.880	.938
Went back to win	.440	.663	.720	.848
Had to bet more for the same amount of excitement	.474	.688	.696	.834

Figure 5.1. Confirmatory Factor Analysis – PGSI Likert Items with Standarized Loadings

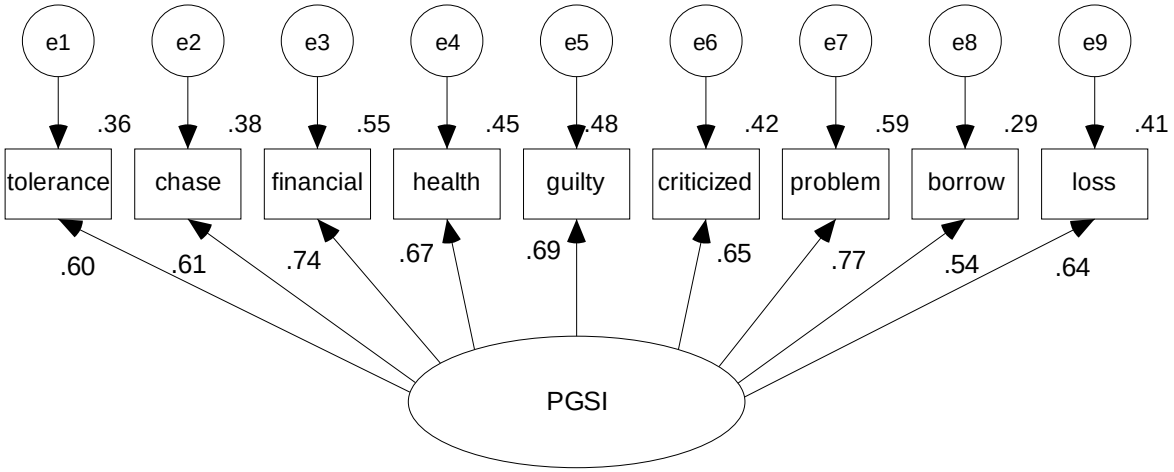


Figure 5.2. Confirmatory Factorr Analysis – PGSI Dichotomously Scored Items with Standarized Loadings

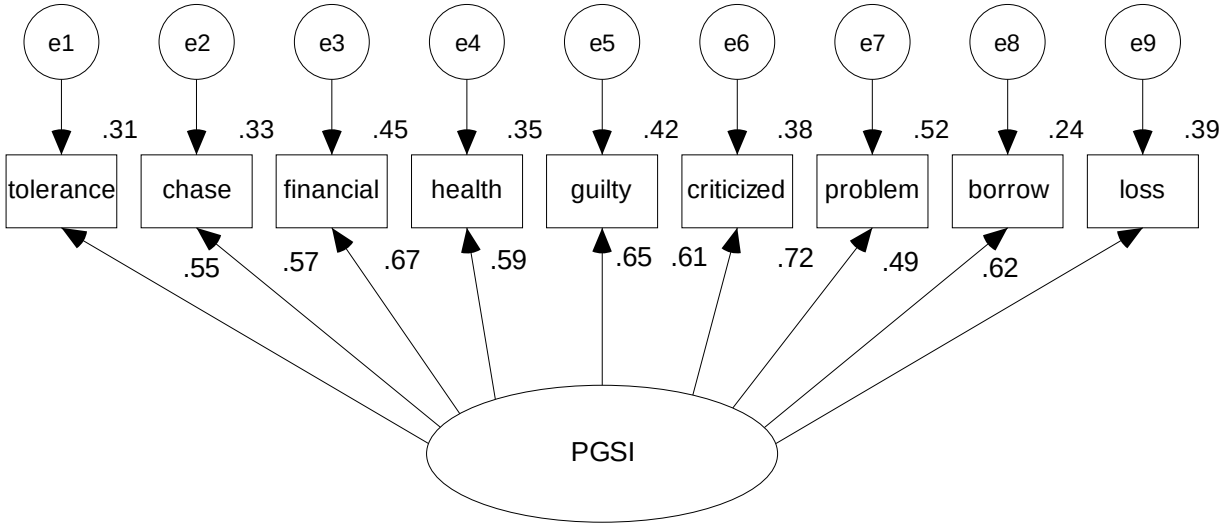
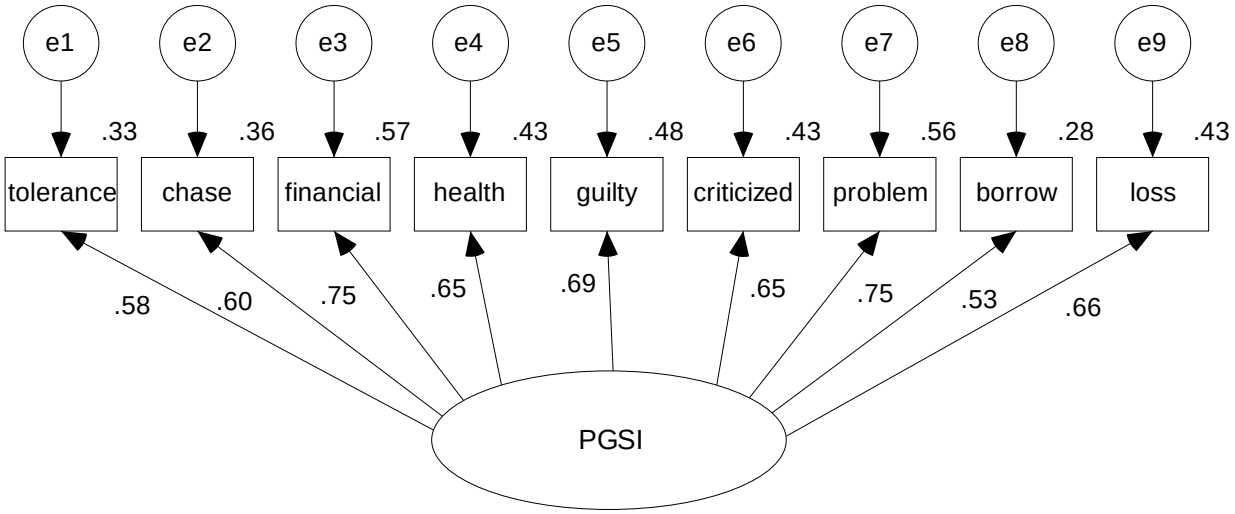


Figure 5.3. PGSI Item Loadings for Men and Women

Males



Females

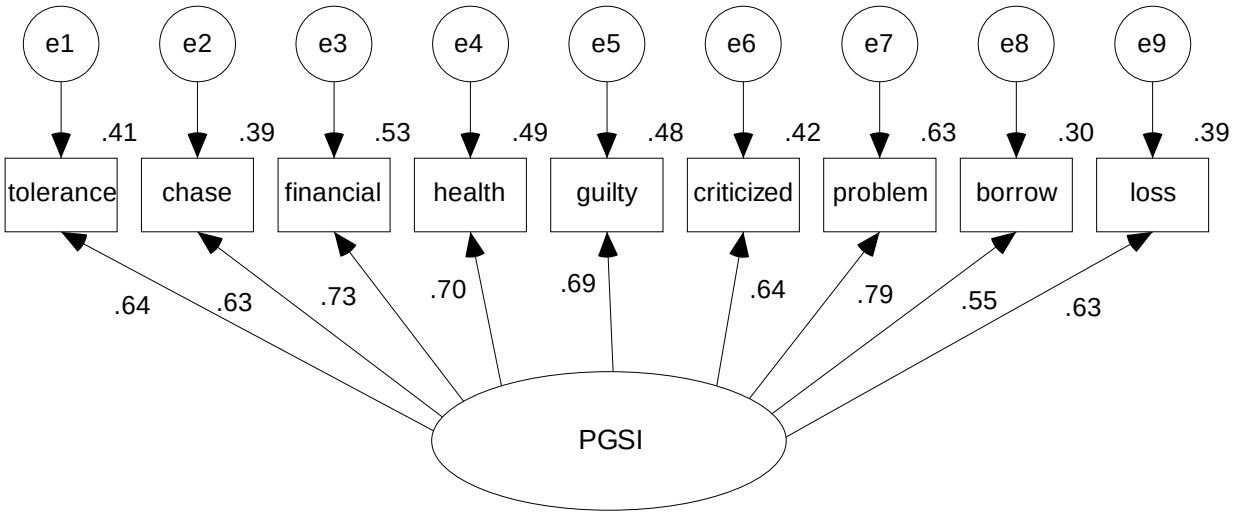
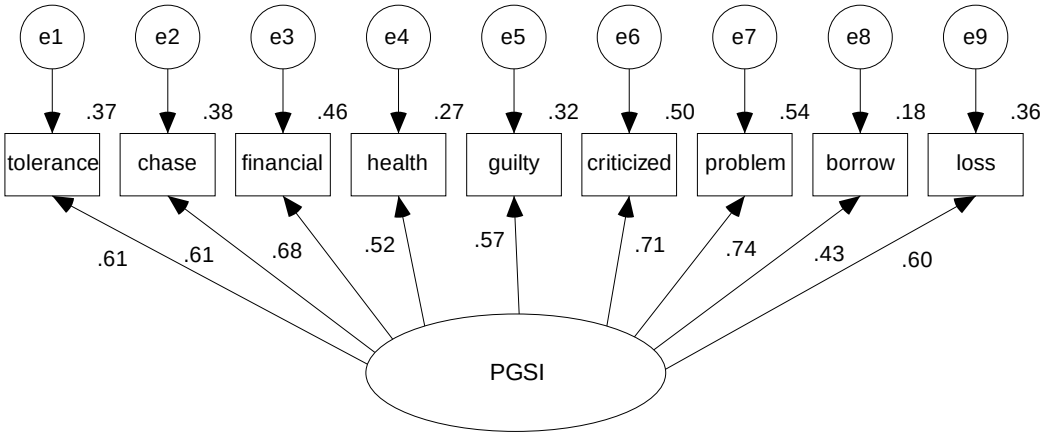
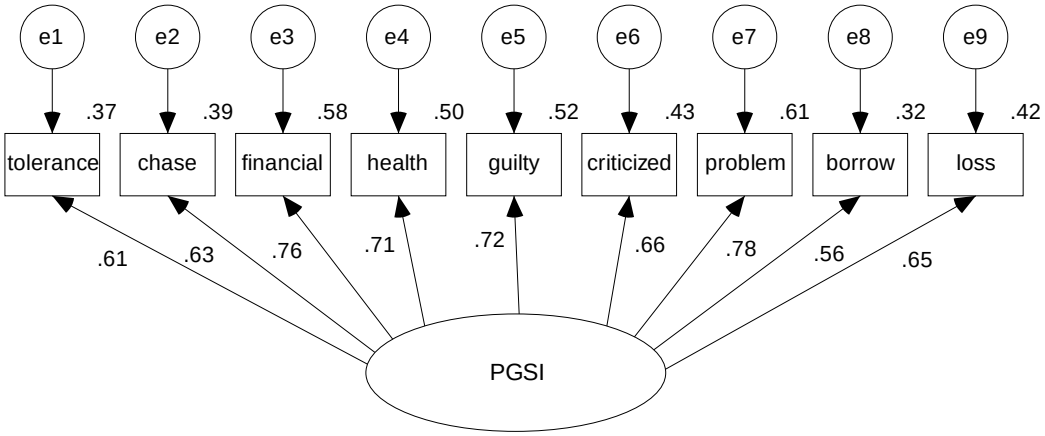


Figure 5.4. PGSI Item Loadings for Three Age Groups

Ages 18 to 24



Ages 25 to 64



Ages 65 plus

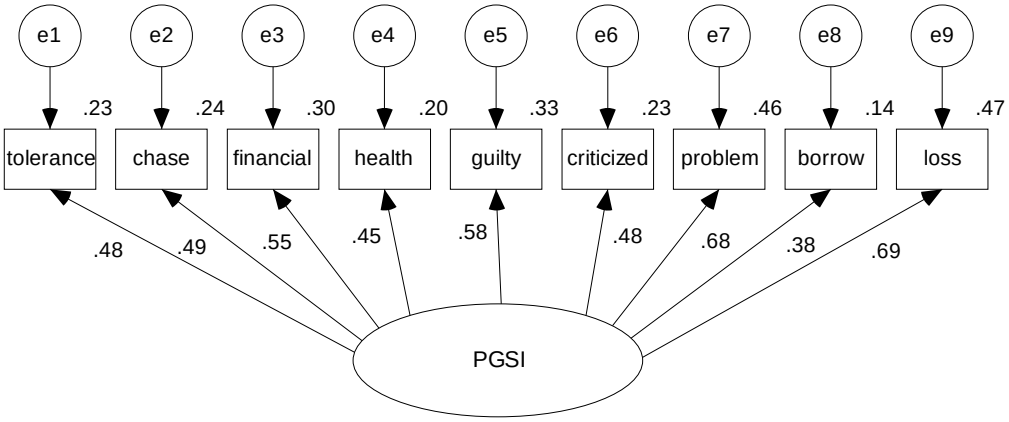
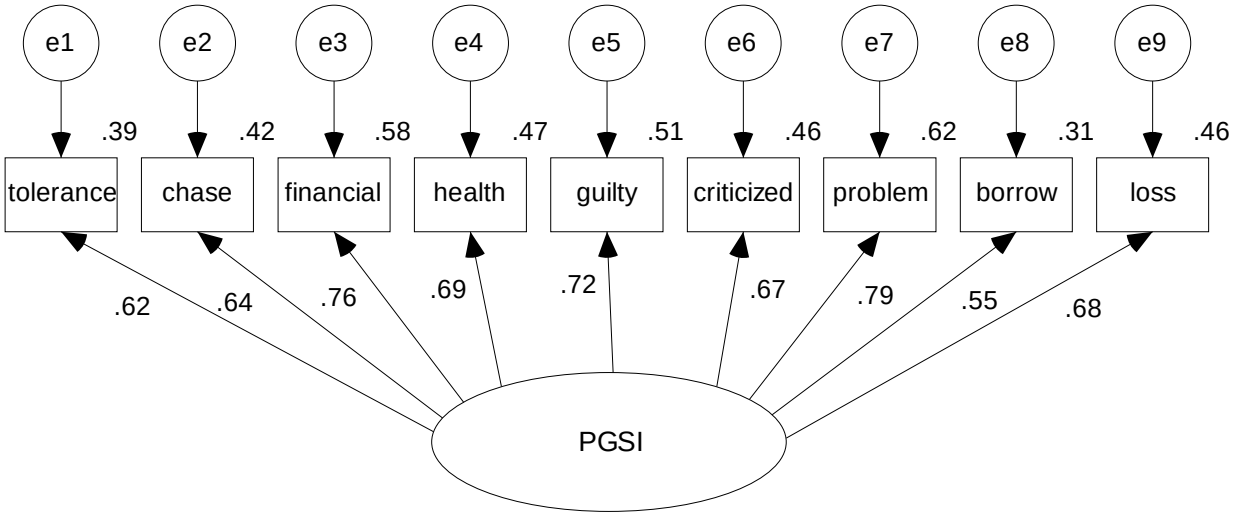


Figure 5.5 PGSI Item Loading for Indivduals who Play Electronic Gambing Machines or Casino Games versus Individuals Playing Other Games Only

Electronic Gaming Machines or Casino Game Players



Other Games Only

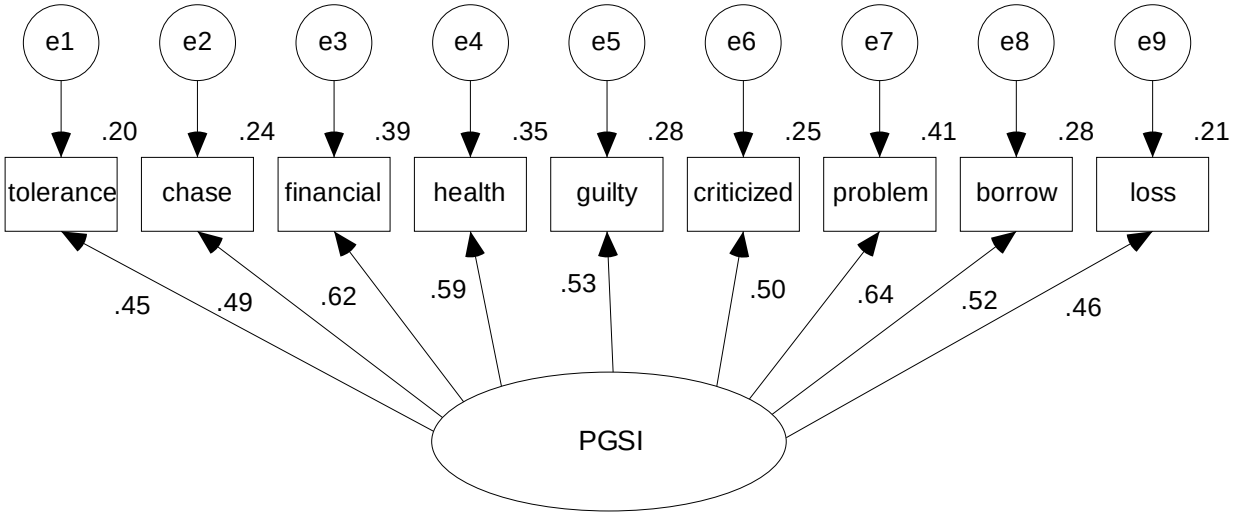
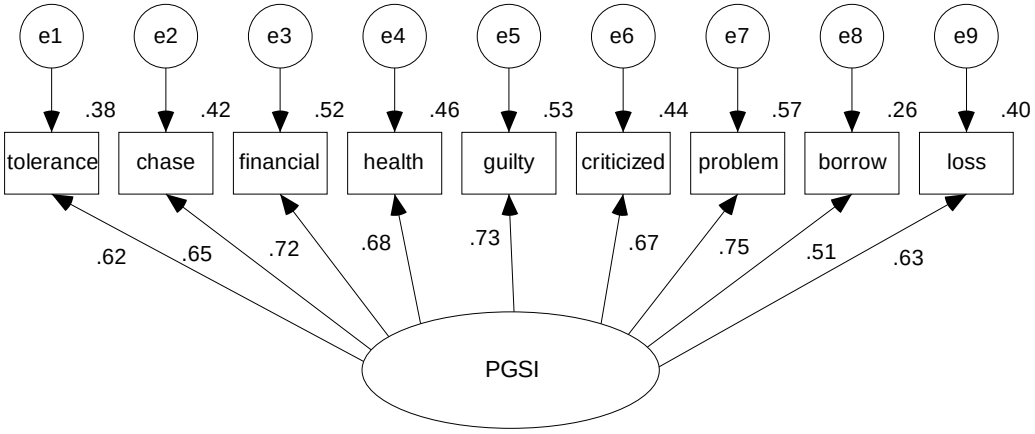
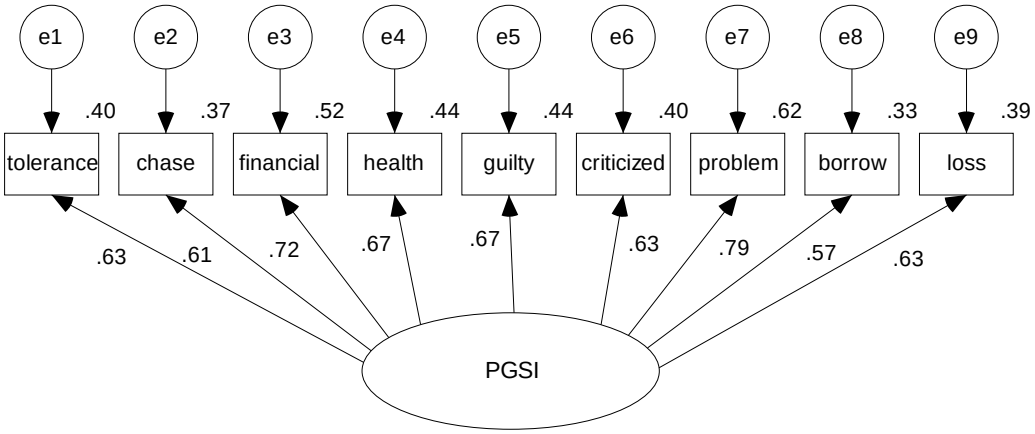


Figure 5.6. PGSI Item Loadings for Three Income Groups

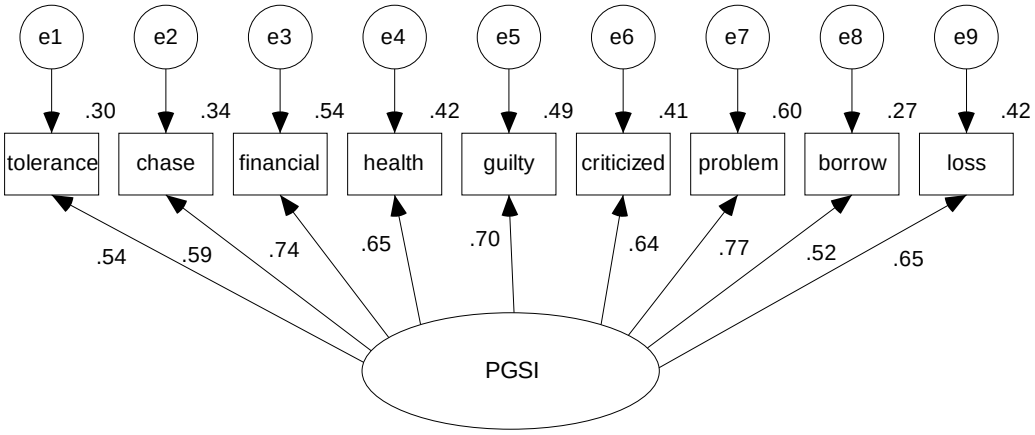
Lower Income (less than $30000)



Middle Income ($30000 to $50000)



Higher Income (more than $50000)



Study 2 - Evaluating Item Fit to the Rasch Rating-scale Model

Objectives

The purpose of this study was to assess how well the PGSI in its present form assesses the continuum of problem gambling severity in the general population. The Rasch model is a type of polytomous item response theory (IRT) model that is appropriate for Likert scaled items. The Rasch method analyzes item response patterns to characterize the performance of individual items in measuring the underlying construct of problem gambling severity. In this model items and people are scaled on the same metric. For the present study, we used the Rasch model to: (1) estimate the relative severity of problem gambling being assessed by each item; (2) assess the order in which symptoms covered by the PGSI are likely to be endorsed as severity increases; (3) assess the standard error of measurement associated with each item and the full range of PGSI scores, and; (4) determine whether applying dichotomous scoring to the PGSI items improves the assessment of problem gambling severity.

Method

A Rasch model was fitted to the merged CPGI integrated and CCHS-1.2 dataset (N=25,584). The same dataset and inclusion criteria used in the factor structure analysis were applied to the Rasch analysis except we employed the full sample from the merged datafile rather than splitting the file. The WINSTEPS program was used in this analysis. Because all the PGSI items have the same ordinal scale with the assumption that item response steps were comparable for all items (i.e., going from one step to the next is constant across items), we examined the fit of rating-scale model rather than the partial credit model [42].

Results

Testing the assumption of unidimensionality

Unidimensionality of the latent construct is an assumption of item response theory [43]. The principal components analysis and confirmatory factor analysis reported earlier in this report confirmed the presence of a single factor underlying the PGSI when the full Likert response scale is used. The eigenvalue for the first factor was 4.48, significantly larger than the value for the second factor (0.76). The first factor accounted for 50% of the total variance.

Item-level Estimates of Problem Severity

Table 5.2 presents the item parameters for all nine PGSI items. The first column (%) indicates the prevalence of a positive endorsement of each item (i.e., a non-zero score) within the sample of past-year gamblers. The most commonly reported symptoms were 'feeling guilty about gambling', 'chasing losses', and 'betting more than one could afford to lose'. The next column shows each item's severity index. The *severity* index (also known as item difficulty) conveys the point along the continuum where there is a 50% chance of the symptom being present [44]. Each item's severity in a Rasch model is standardized so that the average of all items is 0. Severity estimates greater than 0 reflect items that assess symptoms of problem gambling that are more severe than the mean level of severity for the PGSI scale. The rank order of symptoms by severity index provides an indication of the specific types of problems that are more likely to appear as problem gambling severity increases. Symptoms that are typical at low levels of problem gambling severity include feeling guilty about gambling, chasing losses, and betting more than one can afford to lose. These symptoms may provide the most useful information about individuals with relatively low levels of problem gambling severity. Symptoms that are typical at

high levels of severity are financial problems and borrowing money to support gambling. These items are more useful in separating people at high levels of problem gambling.

The severity estimates suggest some items may be providing redundant psychometric information about severity of problem gambling. Feeling guilty and chasing losses have the same severity index. Hence, the inclusion of both items on the PGSI does not increase the amount of information on problem gambling severity reflected in the total score. This also applies to the PGSI items assessing tolerance and self-perception of having a gambling problem. These findings were reflected in the response patterns for these item pairs: 43% of gamblers who endorsed the feeling guilty item also endorsed chasing losses, and 41% of gamblers who acknowledged the development of tolerance also felt they may have a gambling problem. The severity estimates also suggest there are gaps in the PGSI's coverage of problem gambling severity. There is a large gap after the item 'betting more than one can afford to lose' and the next item, acknowledgement that gambling may be a problem. After the gambler acknowledge they are betting more than they can really afford, a large increase in problem gambling severity is required before gamblers recognize they have a problem. Additional PGSI items are needed to assess severity in this low to middle range of the problem gambling continuum. Another gap is evident at the upper end of the continuum. More severe symptoms are needed to the fill the gap between acknowledging financial problems and admitting the need to borrow money to continue gambling.

Fit of Rasch model to PGSI data

With the exception of the mean outfit value for financial problems (M = 0.58), all of the infit and outfit statistics for individual PGSI items fell within the acceptable range of 0.6 to 1.4 [45]. This indicates there are no poorly fitting items in the PGSI. Furthermore, the standard errors (SE) for the severity estimates were small and consistent across all items (the mean SE for all 9 items was 0.03). The standard errors fell within a narrow range of 0.03 to 0.05 for all PGSI items including those that were endorsed infrequently by gamblers (e.g., borrowing money). The reliability estimate for item severity indicated perfect reliability (1.00), suggesting that the item rankings for severity would likely replicate in other similar population samples [42].

The Rasch model provides the standard error of measurement—that is, the estimated precision of measurement—for the complete of range of scores on the PGSI (0 to 27). Lower standard errors (< 1.0) are desirable because they indicate greater reliability of PGSI measurement [46]. The standard errors for the PGSI ranged from 0.37 to 1.86 across the full range of scores. The PGSI is most reliable (SE < 1.0) for individuals with PGSI scores ranging from 2 to 26, and is least reliable for individuals with scores in the extreme ends of the distribution. For example, the standard errors for PGSI scores of 0 or 1 were 1.9 and 1.1, respectively, while the standard error for a PGSI score of 27 was 1.7.

Differential item functioning

We examined possible response differences among subgroups of the sample using differential item functioning (DIF). Ideally, scores on a continuous index of severity should be free of bias from respondent characteristics. Items demonstrating differential item functioning (DIF) are measuring the latent construct differently for one subgroup of the population compared to another at the same level of severity. The detection of DIF could indicate problems in the instrument's validity across key subgroups.

Subgroup comparisons were identical to those used in the investigation of factor structure invariance: gender (males vs. females), age (18-24 years, 25-64 years, and 65+ years), household income (< $30K, $30K to $50K, >$50K), and game type (EGM/casino vs. other). The WINSTEPS program statistically compares the individual item severity estimates for the various subgroup comparisons. The statistical method used by the program is based on earlier work by Wright [42] and Linacre [45]. We also considered the magnitude of the difference to determine which results could be considered clinically meaningful. Hence, significant DIF findings were identified on the basis of exceeding two criteria: (1) the result of the t-test comparing severity estimates was significant at the $p < .01$ level, and (2) the difference in estimates was 0.5 logit units or greater, which represents a half standard deviation difference and considered large for most purposes [45;47].

Table 5.3 displays all the statistically significant ($p < .01$) DIF results. Four items had a statistically significant difference ($p < .01$) in severity estimates between male and female gamblers, three items showed a significant DIF for age, three items showed a significant DIF for game type and two items showed a significant DIF for income. However, only one of these differences was deemed to be both statistically and clinically meaningful. The item borrowing money had a significantly higher severity estimate for EGM or casino gamblers compared to gamblers who played other games. This item requires a more severe level of gambling problems to be endorsed by EGM or casino players.

Rasch model on dichotomously scored PGSI items

Similar to our factor analysis, we also examined the fit of the Rasch model to the PGSI if the items are scoring dichotomously (0 = never; 1 = sometimes, most of the time, or almost always). The survey response patterns indicate that the most of the time and almost always response choices are used infrequently by gamblers (only about 1% of the sample responded most of the time or almost always to the PGSI items). Furthermore, the exploratory factor analysis showed a slightly better fitting model when the items are scored dichotomously.

The Rasch model conducted on the dichotomously scored PGSI indicate a comparable fit to the data. The infit and outfit statistics were within the desired range of 0.6 and 1.4, and the ordering of items by severity index was identical to the model using the full Likert scaled scores. The standard errors for the Rasch severity estimates were marginally higher on the dichotomous items ($M = 0.05$) compared to the Likert scaled items ($M = 0.03$) but still considered acceptable. The severity estimates from the dichotomously scored PGSI provided slightly better coverage across the continuum of problem gambling severity. Nonetheless, the items feeling guilty and chasing losses had severity estimates close in value (-1.21 and -1.28), as did the items being criticized by others and self-perception of having a gambling problem (0.12 and 0.11), suggesting these item pairs may be redundant. The measurement precision across the range of PGSI scores was superior for the Likert scaled PGSI. Only 11% of the standard errors were above 1.0 when the total PGSI score is allowed to range from 0 to 27 compared to 44% of the standard errors being above 1.0 the PGSI ranges from only 0 to 9.

Comparison of Rasch model results and opinions of gambling experts

We compared the rank order of symptoms by level of severity produced by the Rasch model to the opinions of gambling experts collected from the online survey reported in section 6 of this report. Gambling experts were asked to rate the severity of each PGSI item level in terms of providing information on overall severity of problem gambling being exhibited by gamblers who

endorse the symptom. The rank order of these ratings indicates which PGSI items were viewed by experts as providing information on severe levels of problem gambling and which items provide information on less severe levels of problem gambling. The ranking of item severity from the Rasch model provides the same basic information. Table 5.4 compares the Rasch model and gambling experts' ranking of severity. The intraclass correlation coefficient, which assesses the overall level of agreement, was .79 suggesting good agreement in these rankings. Agreement of rankings was best at the upper and lower extremes of problem gambling severity. For example, borrowing money and financial problems were the PGSI items found to provide the most information on severe problem gambling while feelings of guilt provided the least information on severe problem gambling. Acknowledgement of health problems from gambling was found to be a mid-level symptom of problem gambling severity by both the Rasch model and gambling experts. There was a large disagreement between experts and the Rasch analysis for the chasing losses item. According to the Rasch model this symptom is typical of low levels of severity but experts rated this item as being indicative of more severe problem gambling. A similar disagreement occurred with the item being criticized by others. In this case, experts ranked the item as indicating low severity whereas the Rasch model placed the item in the middle range of problem gambling severity.

Table 5.2

Symptom severity estimates for the Problem Gambling Severity Index (PGSI) from a sample of 25,584 gamblers who reported gambling at least once in the previous 12 month period.

		Problem Gambling Severity		Infit statistic		Outfit statistic		
Item	% endorsed [a]	δ	*SE*	*M*	*Z*	*M*	*Z*	r_t
Guilt feelings	6.8	-.85	.03	.99	-.4	1.03	.9	.73
Chasing losses	7.0	-.85	.03	1.13	4.4	1.18	5.5	.71
Betting more than can afford	6.0	-.70	.03	1.12	3.8	1.15	4.5	.69
Recognizes one has a problem	3.6	.00	.03	.92	-2.3	.72	-7.7	.65
Tolerance	3.9	.00	.03	1.20	5.3	1.12	3.0	.59
Criticized by others	3.6	.05	.03	1.15	3.9	1.05	1.3	.59
Health Problems	2.7	.48	.04	1.07	1.7	.93	-1.3	.55
Financial Problems	2.2	.70	.04	.93	-1.7	.58	-9.1	.56
Borrowing money	1.7	1.17	.05	1.16	3.0	.99	-.1	.45

[a] Proportion with non-zero score.

Discussion

The Rasch model item-response analysis applied to the PGSI reveals a well-fitting, unidimensional model overall. No miss-fitting items were identified. The estimated internal reliability of the PGSI was very high (1.00), suggesting that the item rankings for severity would likely replicate in other future population samples. The standard errors associated with the severity estimates were much lower reported in comparable Rasch analyses of the NODS and other DSM-IV derived scales [46;48]. Furthermore, the range of standard errors was narrow across all items (0.03 – 0.06), an improvement over the DSM-IV based scales. Hence, the PGSI in its current form appears to be an internally reliable measure of a single dimension of problem gambling severity. Like all IRT models, a Rasch model assumes that less severe gambling problems exist on the same continuum as more severe problems. The appearance of symptoms along the continuum is not considered to be random, with some symptoms being characteristic of lower severity levels and some of higher severity levels. Furthermore, the presence of more severe gambling problems presumes the likely presence of less severe problems in the same individual [49].

Using this theoretical framework, we can interpret the appearance of the individual PGSI symptoms along the continuum in the context of current knowledge about the characteristics and progression of problem gambling at varying levels of severity. Notably, the item response patterns provide an indication of the specific types of problems that are more likely to appear as problem gambling severity increases. Note, because of the cross-sectional nature of the data, we cannot make conclusions about the emergence of symptoms within an individual over time. Our conclusions are limited to the appearance of symptoms at different levels of problem gambling severity in the population. The PGSI symptom with the lowest severity estimate was feeling guilty about gambling. Experiencing guilt or remorse about gambling or the consequences of gambling may be a useful indicator of low severity levels of problem gambling. Gambling experts also ranked this item as indicating low severity of problems. Chasing losses was also characteristic of low severity gambling problems. Three other Rasch studies [48-50] also found chasing loses (as assessed by the SOGS and DSM-IV) to being indicative of low severity levels of problem gambling. Gambling experts, however, ranked this item as characterized a moderate level of problem gambling severity.

Severe problem gambling was associated with the appearance of PGSI items assessing financial problems and borrowing money to gamble. There was agreement between the Rasch model and gambling experts on placement of these items along the problem gambling continuum. Furthermore, Strong and colleagues reported that a similar DSM-IV symptom, relies on others' money to relieve a financial situation, was useful in separating people at high levels of problem gambling severity. [46] Borrowing money was the only PGSI item to display both a statistically and clinically meaningful DIF between game type subgroups, suggesting a bias exists in the item that may result in measurement errors. Specifically, the severity estimate for EGM or casino gamblers was significantly higher than gamblers who play other games. Expressed another way, at equivalent levels of problem gambling severity EGM/casino gamblers were less likely to borrow money to gamble than gamblers who played other games. Although this finding may seem counter-intuitive, it is consistent with the spending habits of EGM/casino players compared to other gamblers. EGM and casino gamblers, in general, spend more money on gambling than individuals who don't play these games [25]. The winnings from EGMs and casino games are also higher than most other games [51]. This scaling up of wins and losses on the

monetary dimension may suggest there is a higher threshold of severity that EGM/casino gamblers must reach to before resorting to borrowing money. Moreover, the borrowing money item did not differ in severity for the three income groups, suggesting that this difference is not related to EGM/casino players having different financial resources. This result could indicate a reduced sensitivity for the PGSI symptom of borrowing money to detect problem gambling severity in EGM/casino players. However, this sole DIF finding should be put into context. The emergence of only one clinically significant DIF for the PGSI is a rather remarkable finding considering that other established scales including SOGS and DSM-IV gambling scales have been shown to have several items with DIF concerns [48 50;52].

The rank ordering of symptoms by severity was identical in the Likert scaled and dichotomously scored PGSI Rasch model. The model fit was marginally better when the PGSI is scored with the full Likert scale as indicated by the lower standard errors around the severity estimates and greater precision of measurement across the range of PGSI scores (0 to 27 vs. 0 to 9). Although the extent of miss-fitting or biased items on the PGSI is minimal, the instrument has limitations in the coverage of symptoms along the continuum. There is redundant psychometric information on severity being provided by two symptoms at the lower portion of the severity continuum. Coverage improves when the PGSI items are scored dichotomously, but the same gaps between items in this range of severity still persists.

Table 5.3
Results of differential item functioning tests of statistical and clinical significance

	Differential Item Functioning			
PGSI Item	Gender	Age	Income	Game type
Guilt feelings	F-M = 0.28			
Chasing losses	F-M = 0.20	18-24 yrs – Overall = -0.24		Other – EGM/Casino = 0..28
Betting more than can afford	F-M = 0.21		>$50K – Overall = 0.20	
Recognizes one has a problem		18-24 yrs – Overall = 0.44		Other – EGM/Casino = 0.34
Tolerance			$30K-$50K – Overall = -0.15	
			>$50K – Overall = 0.22	
Criticized by others				
Health Problems		18-24 yrs – Overall = -0.10		
Financial Problems	F-M = 0.23			
Borrowing money				**Other – EGM/Casino = 0.65**

Note: Cells with problem gambling severity parameters reported indicate the difference between groups (p <.01). The difference between the subgroups is shown for cells with significant results. Gender and Game Type were two-group comparison. For Age and Income the entire sample was the reference group and the specified category was the focal group. Bolded items indicate a severity parameter difference of .50 or greater.

Table 5.4
Severity rankings of the nine PGSI Items: Results from Rasch analysis and expert survey

Symptom assessed by PGSI	Rasch model ranking of severity	Gambling experts' ranking of severity	Percent of experts rating symptom as severe or moderate
Borrowing money	1	1	83
Financial problems	2	2	82
Health problems	3	4	75
Criticized by others	4	8	70
Tolerance	5	7	71
Recognizes one has a problem	6	6	73
Betting more than can afford	7	3	74
Chasing losses	8	5	71
Feelings of guilt	9	9	60

Note: Rasch model and expert rankings that agree within two scale points shown in grey.

Section 6

Weighting the PGSI Items

Objectives

The validity of the PGSI scoring system could potentially be improved by weighting the individual items, giving certain items more influence on the total score. The present scoring system assumes equivalency in the relative contribution of each PGSI item toward assessing problem gambling severity. The relative importance of each symptom is not considered despite the fact that some represent more severe consequences of problem gambling (e.g., financial problems) than others (e.g., feeling guilty). There are statistical and conceptual approaches to developing item weights.[53 54] Our study examined both methods.

Study 1 - Development of Weights for PGSI Items

Method

Following in Stinchfield et al.'s (2005) work, we first defined an external criterion for the individual PGSI items to assess relative contribution of each symptom. We examined two classes of external criteria: indices of gambling intensity and symptoms of pathological gambling. Given that the PGSI is intended to provide a continuous index of severity—from non problematic levels and to full-blown problem gambling—we reasoned that weights could be derived based on how well each PGSI symptom predicted examined total gambling expenditures and percent of income spent on gambling. Our previous research demonstrated that these specific quantitative indices of gambling intensity have the strongest relationship with problem gambling severity.[14]

Total gambling expenditures and percent of income spent on gambling were first examined as continuous dependent variables. The CPGI integrated dataset was used in this analysis. These

variables were highly skewed and hence were transformed using the natural log function. Regression diagnostics performed on the transformed total expenditure and percent of income variables indicated a good fit of the model to the data (residuals were normally distributed and displayed homescedasticity). In separate linear regression analysis, the nine PGSI items were regressed onto total expenditures and percent of income. For each model, we converted the Likert item scale for each PGSI item to a dichotomous score (0 = never; 1 = sometimes, most of the time, or almost always). This allowed us to examine the relevant contribution of a positive endorsement of each symptom toward predicting the indices of gambling intensity.

Using the same independent variables, we also ran a logistic regression model with percent of income as a dichotomous variable: 0 = low-risk gambling and 1 = high risk gambling. The latter group was defined as exceeding the 90^{th} percentile for percent of income invested on gambling in the general Canadian population. In both the linear and logistic regression models our interest was the size and significance of the unstandardized regression coefficients for each PGSI item. The PGSI items with the largest regression coefficients are those that contribute the most information to predicting percent of income or total expenditure on gambling while controlling for the influence of the remaining PGSI items. The regression coefficients could serve as weights in scoring the PGSI.

In a separate analysis, we examined how well each PGSI item predicted the total number of DSM-IV symptoms of pathological gambling. This criterion is similar to the one employed by Stinchfield et al. (2005). The LLLP dataset was used in this analysis. The sample consisted of adults ($\geq$ 18 years old) who at time 1 reported gambling at least once in the past year (N = 1059). Symptoms of pathological gambling were assessed in the LLLP using the same structured diagnostic interview employed in the Canadian Community Health Survey [55]. Each of the ten DSM-IV criteria for pathological gambling was scored as present or absent, yielding a continuous score that ranged from 0 to 10. Because over 90% of the sample reported zero symptoms of pathological gambling, the continuous DSM-IV index was highly skewed. However, transformations were unable to correct the distribution. A linear regression was conducted with the total number of DSM-IV symptoms as the dependent variable and the nine PGSI symptoms (dichotomously scored as 0 = never and 1 = sometimes, most of the time, or almost always) as the independent variables. Despite the skewed nature of the dependent variable, regression diagnostics performed indicated a good fit of the model to the data with no serious violations to the assumptions of normality and homescedasticity in the residuals.

Results

Weights derived using quantitative indices of gambling as the criterion. Table 6.1 displays the results of the linear regression models predicting percent of income and total expenditures. Both models were highly significant. The results were similar in both models although, the model with percent of income accounted for a larger percentage of variance (11% vs. 7%). Using $p <$ .01 as the criterion for significance, only four of the nine PGSI symptoms made significant, independent contributions to predicting percent of income spent on gambling. Ranking the significant PGSI symptoms by size of regression coefficient produced nearly identical orders for the two models (see Figure 6.1). There was also significant overlap of the confidence intervals surrounding each coefficient for the significant PGSI symptoms. The only pair displaying a difference in coefficient size was betting more than one can afford to lose and the tolerance symptom. Apart from this pair, the difference in coefficient size among the top four PGSI items was not significant.

Similar results were found using percent of income spent on gambling as a dichotomous dependent variable (see Table 6.2). The order of coefficients for the PGSI items that make a significant contribution to this outcome was slightly different compared to the linear regression results. Based on the 99% confidence intervals surrounding each predictor there was no difference in the relative contributions of these PGSI items to predicting low versus high risk gambling.

Weights derived using DSM-IV symptoms of pathological gambling as the criterion. As expected, the model predicting the continuous DSM-IV index of pathological gambling from the nine PGSI symptoms was highly significant ($p < .0001$). The nine PGSI symptoms accounted for a large proportion of the variation in the DSM-IV index ($R^2 = 0.48$) which is not surprising given that some of the PGSI symptoms can be directly mapped onto the DSM-IV criteria. Despite the overall strength of the model, only four PGSI symptoms were significant predictors of the DSM-IV index (shown in Table 6.3). Three of these symptoms were directly related to the DSM-IV criteria (evidence of tolerance to gambling excitement, financial problems and borrowing money to gamble). Like the models using the quantitative indicators of gambling as the criteria, the confidence intervals around the regression coefficients overlapped for all four significant PGSI predictors. This suggests no significant variation exists among the coefficient values hence using the coefficients as weights for the individual PGSI items is not supported.

Table 6.1

Statistical generation of PGSI weights: Linear regression results predicting percent income, total dollars and number of gambling activities from individual PGSI items

	Dependent variable			
	Log percent income		Log total dollars spent	
PGSI item	Coefficient (99% CI)	Ranking	Coefficient (99% CI)	Ranking
Betting more than one can afford	.88 [a] (.72 – 1.04)	1	.97 [a] (.79 – 1.15)	2
Chasing losses	.73 [a] (.57 – .89)	2	1.01 [a] (.84 – 1.18)	1
Criticized by others	.63 [a] (.40 – .58)	3	.72 [a] (.44 – 1.01)	3
Tolerance	.37 [a] (.14 – .60)	4	.47 [a] (.22 – .71)	4
Recognizes one has a problem	.32 (.06 – .58)	5	.40 [a] (.11 – .69)	5
Borrowing money	.45 (.07 – .82)	6	.37 (-.05 – .79)	6
Feeling guilty	.08 (-.07 – .24)	7	.12 (-.07 – .31)	9
Financial problems	.16 (-.15 – .48)	8	.15 (-.18 – .47)	8
Health problems	-.01 (-.26 – .26)	9	.20 (-.10 – .50)	7
R^2	.13		.07	

Note: significant predictors shown in grey. [a] $p < .01$.

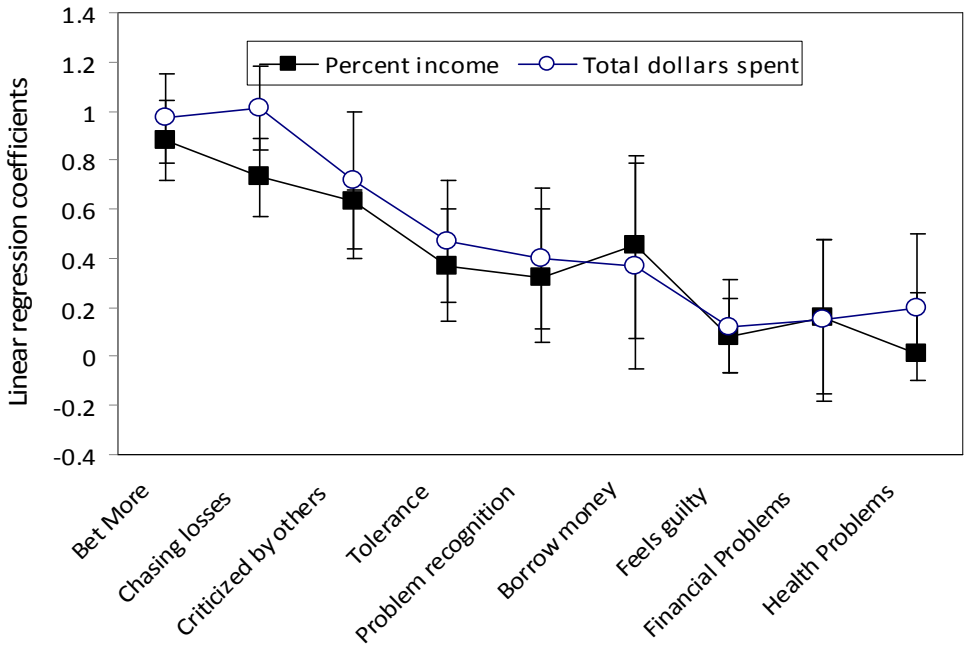


Figure 6.1 Regression coefficients (with 99% confidence intervals) associated with each PGSI item predicting percent of income spent on gambling and total expenditures.

Table 6.2
Statistical generation of PGSI weights: Results of logistic regression with dependent variable as exceeding the 90th percentile for percent of income spent on gambling.

PGSI item	Odds ratio	95% CI	Coefficient
Betting more than one can afford	2.68 [a]	2.04 – 3.52	.99
Criticized by others	2.32 [a]	1.59 – 3.38	.84
Chasing losses	2.28 [a]	1.71 – 3.01	.82
Borrowing money	2.27 [a]	1.26 – 4.07	.82
Tolerance	1.77 [a]	1.20 – 2.62	.57
Recognizes one has a problem	1.64	1.05 – 2.56	.49
Financial problems	1.19	0.69 – 2.06	.17
Feeling guilty	1.05	0.73 – 1.49	.05
Health problems	0.91	0.56 – 1.46	-.09
R^2		.10	

Note: Dependent variable percent income spent on gambling coded as 0 = below 90th percentile (n = 815), 1 = 90th percentile or higher (n = 7384). Significant predictors shown in grey. [a] $p < .01$.

Table 6.3
Statistical generation of PGSI weights: Results of linear regression using LLLP time 1 data on adult gamblers (N = 1059)

PGSI item	Coefficient	95% CI
Recognizes one has a problem	1.78 [a]	.95 – 2.62
Financial problems	1.55 [a]	.49 – 2.61
Tolerance	.94 [a]	.37 – 1.51
Borrowing money	.77 [a]	.03 – 1.51
Health problems	.48	-.05 – 1.00
Criticized by others	.38	-.13 – .89
Betting more than one can afford	.18	-.13 – .49
Feeling guilty	.15	-.10 – .40
Chasing losses	.07	-.17 – .31
R^2	0.48	

Note: Dependent variable is total number of DSM-IV symptoms for pathological gambling (0-10). Significant predictors shown in grey. [a] $p < .01$.

Discussion

The development of new item-level weights for PGSI item scoring using quantitative indices of problem gambling intensity as the external criterion cannot be justified based on these results. The two main problems are: (1) the amount of variance accounted for in each model is very low (11% for the model predicting percent of income as a dichotomous variable), and (2) the lack of statistical differentiation in the size of the coefficients for the individual PGSI items. Although the model using the DSM-IV symptom index as the external criterion produced stronger results (accounting for 48% of the variation), the results for the individual PGSI items still cannot be used to produce weights because of the substantial overlap of confidence intervals surrounding the coefficients. Furthermore, we are not confident that the total number of DSM-IV symptoms is the optimal external criterion to derive weights. Foremost, there is substantial overlap in content between the PGSI and DSM-IV symptoms leading to a conceptual confound that the external criterion is nearly identical to the predictor variables. Moreover, weights derived from a model predicting DSM-IV symptoms would be biased in favour of the items that directly map onto the DSM-IV criteria for pathological gambling. The PGSI is intended to be a broad measure of problem gambling that provides a continuous index of risk at all levels of severity not just the extreme pathological level.

In essence, quantitative indices of gambling involvement are too indirect a measure of problem gambling severity level and the DSM-IV symptom index is confounded by the presence of PGSI items that directly map onto specific DSM-IV symptoms. At this time, there is no alternative external criterion available in our dataset that would be appropriate to use in statistically developing weights. The ideal criterion would be an alternative indicator of problem gambling severity that is distinct from the PGSI--e.g., collateral ratings of problem severity obtained from

a family member or clinician. A future CPGI population survey could attempt to collect collateral ratings of problem gambling severity for a sample of participants for use in a weight development study.

The absence of statistical differentiation in the magnitude of regression coefficient is unlikely to be caused of the absence of power given the large sample sizes used in each analysis. One plausible conclusion from these results is that weighting of the PGSI at the item level is not necessary. It is possible that the status quo is most justified—that is, that each item should be equally weighted as contributing to the total score. Weights for the PGSI may instead be applied to the Likert scale response choices for each item. This was the conclusion stemming from the expert survey. By adjusting the weights for the response choices for specific items (e.g., assigning a higher score for acknowledging financial problems that occur 'sometimes' compared to experiencing guilty feelings), it is possible to ensure that items judged by gambling experts as being indicative of more severe problems would contribute more to the total score when the appropriate threshold is reached. These results are reviewed below.

Study 2 - Obtaining Expert Opinion on the Importance of PGSI Items

Method

We solicited the opinions of experts in the gambling field to assess the relative importance of individual PGSI items as contributing information to the severity of problem gambling. A web-based survey (provided in Appendix F) was developed and posted on Survey Monkey, a popular and cost-effective web resource for researchers conducting brief surveys. The survey was first piloted with 10 individuals before broad dissemination. Based on the feedback from the 10 pilot participants, the survey was modified slightly to improve wording and the comprehension of the instructions. The final version contained the following sections:

1) Respondent characteristics including knowledge of PGSI, use of PGSI clinically and in research, and demographics.
2) Personal opinions on the PGSI scale including its usefulness as a continuous measure of severity, the usefulness of the four PGSI subtypes, issues with false positives or false negatives, the effectiveness in identifying low-risk and problem gamblers, and whether the scoring system could be improved.
3) Rankings on PGSI item scoring weights. Respondents were presented with the nine PGSI items and asked to rate the severity of each response choice (sometimes, most of the time, almost always) in terms of providing information on the gambler's overall severity of gambling problems. Pilot participants found this question the most difficult to comprehend. A detailed example in the instructions enhanced clarity greatly. The example provided to participants is shown below.

Example item:
In the past 12 months, have you borrowed money or sold anything to get money to gamble?

Based on your experience, you believe that a gambler who endorses this symptom as occurring 'sometimes' could have a moderate gambling problem, whereas a gambler who endorses this symptom as occurring 'most of the time' or 'almost always' could have a severe gambling problem. You would therefore respond as follows:

1. Have you borrowed money or sold anything to get money to gamble?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	✓	4
"Most of the time"	1	2	3	✓
"Almost always"	1	2	3	✓

4) Classify each PGSI item as being a core aspect of problem gambling (i.e., a defining symptom one would expect to see in all problem gamblers), an indicator of problem gambling (i.e., a symptom that may indicate a gambling disorder is present but may not be observed in all gamblers), or neither (i.e., would be see infrequently in problem gamblers).

5) Identifying symptoms that characterize recreational gamblers, persons 'at risk' for developing a gambling disorder, and problem gamblers.

Sample recruitment

A list of experts in the field of gambling was compiled from several sources: the mailing list used in a prior gambling expert survey [56], lists of attendees at major gambling conferences in the past 5 years, researchers who received funding for gambling from provincial, Canadian and American granting agencies, and members of the Gambling Issues International Listserv. We attempted to recruit from three main professional groups: gambling researchers, clinicians who work with gamblers in treatment, government and industry persons involved in the administration and oversight of gambling venues. The email invitation was sent to 485 individuals. The text of the email is below:

Dear Colleague,

We are working on a project to evaluate the psychometric properties and utility of the Canadian Problem Gambling Index (CPGI). The CPGI has become the most widely used measurement tool in Canada for assessing risk of problem gambling. It has been used in numerous population surveys, research studies, and in some cases in clinical settings. The CPGI is also used in other countries including Australia, Iceland, and Norway. The main quantitative scale in the CPGI is the Problem Gambling Severity Index (PSGI), which is scored by summing the item totals for nine consequences and behavioural symptoms of problem gambling.

As one component of a larger study, we are seeking the opinions of researchers, clinicians, and policy makers on the PGSI and its scoring system. The purpose of the study is to determine if

the PGSI, in its present form, provides a valid and reliable index of problem gambling severity or whether improvements are needed to the scale. You do not need to be familiar with the CPGI to complete this survey. Our main interest is your opinion on how well the consequences and symptoms of problem gambling being assessed by the PGSI reflect problem gambling severity at different levels. The results should provide some insight on the relative weighting of each item toward the total score.

The online survey should take you less than 10 minutes to complete. It can be found at

http://www.surveymonkey.com/s/RG9TGRZ. If you would prefer to complete the survey by hand, a paper copy is attached.

A draw for a $100 Amazon gift certificate was offered as an incentive to complete the survey. The first notice for the survey was sent on May 20, 2010. Reminder notices were sent two and four weeks later. The survey was live on the web site until July 15, 2010.

Results

Response rate and respondent characteristics

Of the 485 email invitations sent out, 63 were returned because the email address was not valid and an alternative address could not be located. Among the remaining 422 valid invitations, surveys were completed by 142 individuals, making the response rate 34%. The characteristics of the responders are listed in Table 6.4. The primary position reported by respondents suggested we achieved our goal of recruiting approximately equal numbers of researchers, clinicians, and administrators.

Opinions on the PGSI scale

Three quarters of respondents rated their knowledge of the PGSI as good to excellent. These experts were invited to give their opinions of the PGSI using a 5-point Likert scale: Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree. Respondents were specifically asked to rate their feelings on eight questions related to the current scoring system of the PGSI, as well as characteristics of the questions. Only one response could be selected per question, and respondents had the option to skip these questions. 59% of respondents rated their opinion of the question “The PGSI is an effective tool for identifying problem gamblers” as either strongly agree or agree. As to whether “False positives are a concern with the PGSI”, 38% of experts indicated they were neutral on this issue and similarly, 35% indicated they were neutral on whether “False negatives are a concern on the PGSI”. 27% were neutral, and 31% of respondents strongly agreed or agreed with the statement “The PGSI is an effective tool for assessing low-risk gambling”. The question “The PGSI is an effective tool for identifying persons at risk for problem gambling” garnered a 52% strongly agree/agree response. 48% of experts indicated a strongly agree/agree response to both “The total score on the PGSI is a useful way of assessing severity of problem gambling” and “The scoring categories for the PGSI are a useful way of classifying level of problem gambling risk”. As to whether “The PGSI could be improved by revising the scoring system”, 35% of responders strongly agreed/agreed and 38% were neutral on this item. The remaining opinions to the eight questions are described in Table 6.5.

Table 6.4
Respondent Characteristics (N= 142)

Characteristic		Mean (SD) or %
Age of respondent		44.4 (11.8) years
Gender (% female)		63%
Provide clinical services (%)		39%
Years in the field of gambling		8.3 (7.2)
Number of times used PGSI in research project		3.5 (3.2)
Location		
	Canada	77.8
	USA	13.7
	Other	8.5
Educational level		
	Bachelor Degree	23.9
	Master's Degree	23.9
	PhD	35.9
	MD	3.4
	Certificate	8.5
	No formal degree	.9
	Other	3.4
Primary work setting		
	University	35.0
	Hospital	11.1
	Community Health/Mental Health Clinic	7.7
	Addiction Treatment Program	21.4
	Government	12.8
	Other	12.0
Primary position		
	Researcher	35.6
	Clinician	29.7
	Researcher-Clinician	7.6
	Administration	12.7
	Policy Maker	9.3
	Student	5.1

Recognizing that opinions on the PGSI may be influenced by respondent characteristics, we explored how nationality (Canada vs. U.S./other), primary position (researcher vs. other), and experience with the PGSI in research (yes vs. no) correlated with attitudes toward the scale. Chi-square analyses revealed no significant findings at the $p < .01$ level. There is no evidence that Canadians or researchers who have used the PGSI in research studies were predisposed to give favourable opinions of the scale.

Table 6.5
Opinions on the PGSI and its scoring system[a]

Question	strongly disagree or disagree	neutral	strongly agree or agree
The PGSI is an effective tool for identifying problem gamblers	4%	14%	59%
False positives are a concern with the PGSI	18%	38%	21%
The PGSI is an effective tool for identifying persons at risk for problem gambling	3%	22%	52%
False negatives are a concern with the PGSI	19%	35%	24%
The PGSI is an effective tool for assessing low-risk gambling	20%	27%	31%
The total score on the PGSI is a useful way of assessing severity of problem gambling	5%	24%	48%
The scoring categories for the PGSI are a useful way of classifying level of problem gambling risk.	10%	20%	48%
The PGSI could be improved by revising the scoring system.	5%	38%	35%

[a] Only respondents who rated their knowledge of the PGSI as good or better completed these questions (N= 108).

Expert ranking of PGSI item scoring weights

The overall rankings of severity for the nine PGSI items are found in Table 6.6. Responders were allowed to choose only one level of symptom severity per PGSI item. The order of ranking was determined by a weighting system of the number of expert respondents who indicated that persons answering sometimes, most of the time, or almost always to each item was characteristic of severe, moderate, mild or no gambling problems, respectively. Answers of sometimes were given a weight of 1, most of the time a weight of 2 and almost always a weight of 3. Total responses to each severe, moderate, mild or no problem were multiplied by their relative weights at each level. A percentage of responses for each level of severity was then calculated from the total number of respondents for all levels. The item with the highest proportion of respondents rating the symptom as indicative of severe problem gambling was borrowing money (59%). At a 33% response rate of severity, the symptom feelings of guilt was ranked last at number 9.

Table 6.6
Overall rankings of severity of each PGSI item

Symptom assessed by PGSI	Overall ranking of severity	Severe	Moderate	Mild	No problem
Borrowing money	1	59%	24%	9%	4%
Financial problems	2	56%	26%	7%	4%
Betting more than can afford to lose	3	46%	28%	19%	7%
Health problems	4	45%	30%	16%	4%
Chasing losses	5	45%	26%	18%	6%
Recognizes one has a problem	6	43%	30%	17%	4%
Tolerance	7	42%	29%	19%	7%
Criticized by others	8	42%	28%	18%	7%
Feelings of guilt	9	33%	27%	25%	7%

The scoring for each item's response choices were derived by examining the severity rankings made by at least 50% of respondents (Table 6.7). For example, betting more than one can afford to lose most of the time or almost always was ranked by over half of the experts as likely indicating a severe level of problem gambling. Using this approach, the scores developed for each response choice are shown in Table 6.6. For four PGSI items, the scoring is unchanged (sometimes = 1, most of the time = 2, and almost always = 3) from the original scoring rules. For the remaining items a slight modification to the scoring rules is justified based on the expert rankings. In each case, the scoring is scaled upwards such that a sometimes level of the symptom's presence is assigned a score of 2 and the most of the time or almost always symptom levels are assigned scores of 3.

We explored the impact of adopting this modified scoring of the response choices on the proportion of gamblers labeled as low-risk, moderate-risk, and problem gamblers (the non-gambler category does not change because these gamblers score zero on all items). Using the original scoring rules for the PGSI subtypes, the proportion who fall into the moderate-risk and problem gambler group increase by 1% respectively when the response choices are weighted as per expert opinion (see Table 6.8). Using the novel scoring rules, the proportion falling into low-risk, moderate-risk, and probable problem gambler groups was unchanged when the rescored response choices based on expert opinion was applied.

Table 6.7
Opinions on the relative weight of PGSI item response choices in determining severity of gambling problem

PGSI Item	Highest Ranked Severity Level from Gambling Experts	Response weights
Betting more than can afford to lose		
Sometimes	Mild (49%)	1
Most of the time	Severe (54%)	3
Almost Always	Severe (82%)	3
Chasing losses		
Sometimes	Mild (41%)/Moderate (40%)	2
Most of the time	Severe (54%)	3
Almost Always	Severe (78%)	3
Criticized by others		
Sometimes	Mild (42%)	1
Most of the time	Moderate (46%)	2
Almost Always	Severe (77%)	3
Tolerance		
Sometimes	Mild (49%)	1
Most of the time	Severe (46%)	2
Almost Always	Severe (78%)	3
Recognizes one has a problem		
Sometimes	Mild (46%)	1
Most of the time	Moderate (43%)/Severe (45%)	2
Almost Always	Severe (79%)	3
Borrowing money		
Sometimes	Moderate (50%)	2
Most of the time	Severe (74%)	3
Almost Always	Severe (85%)	3
Feelings of guilt		
Sometimes	Mild (57%)	1
Most of the time	Moderate (43%)	2
Almost Always	Severe (64%)	3
Financial problems		
Sometimes	Moderate (57%)	2
Most of the time	Severe (71%)	3
Almost Always	Severe (85%)	3
Health problems		
Sometimes	Mild (41%)/Moderate (41%)	2
Most of the time	Severe (50%)	3
Almost Always	Severe (80%)	3

Table 6.8
Impact of using expert opinion on the relative scoring weight of PGSI item response choices on the proportion of gamblers in each PGSI category

	Original PGSI gambler subtypes			
	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-2)	Moderate-Risk (MR) (PGSI = 3-7)	Problem Gambling (PG) (PGSI = 8-27)
Original PGSI scoring of response choices [a]	85%	10%	4%	1%
PGSI scoring based on expert weighting of response choices [b]	85%	8%	5%	2%
Mean total score	0	1.3	4.1	13.1
	Novel PGSI gambler subtypes			
	Non-Problem (NP) (PGSI = 0)	Low-Risk (LR) (PGSI = 1-4)	Moderate-Risk (MR) (PGSI = 5-8)	Probable Problem (PG) (PGSI = 9-27)
Original PGSI scoring of response choices [a]	85%	12%	2%	1%
PGSI scoring based on expert weighting of response choices [b]	85%	12%	2%	1%
Mean total score	0	1.7	5.2	15.2

Note: Data source – CPGI and CCHS-1.2 merged datafile; [a] $p < .01$. [a] Coding : Sometimes = 1, most of the time =2 almost always =3. [b] Coding show in Table 6.7

Classifying PGSI Symptoms as Core, Low-risk, or Neither

Expert survey responders rated all nine PGSI items as either a core aspect, indicator, or neither as a symptom of problem gambling. As seen in Table 6.9, the majority or respondents rated the following PGSI items as being core aspects of problem gambling: 'Betting more than one can really afford to lose'; 'Needing to gamble with larger amounts of money to get the same feeling of excitement'; and 'Gambling caused financial problems.' The remaining symptoms were judged to be indicators of problem gambling ('Going back another day to try to win back the money lost,' 'People criticizing one's gambling problem,' 'Feeling that one might have a problem with gambling,' 'Borrowing money or selling anything to get money to gamble,' 'Feeling guilty about the way one gambles or what happens while one is gambling,' and 'Gambling caused health problems.'). In total, three PGSI symptoms appear to be core aspects or problem gambling and six appear to be indicators. No PGSI symptoms were ranked by the majority of respondents as being neither a core aspect nor indicator of problem gambling.

Table 6.9

Ratings of individual PGSI symptoms is indicators of problem gambling

	Category symptom is seen typically		Rating as core aspect or indicator of problem gambling	
PGSI Item Indicator	Category	Percent rated	Type of symptom	Majority Rank
Betting more than afford				
	Recreational	13%	Neither	3
	At Risk	68%	Indicator	2
	Problem	82%	Core Aspect	1
Chasing losses				
	Recreational	3%	Neither	3
	At Risk	44%	Indicator	1
	Problem	85%	Core Aspect	2
Criticized by others				
	Recreational	18%	Neither	3
	At Risk	71%	Indicator	1
	Problem	76%	Core Aspect	2
Tolerance				
	Recreational	11%	Neither	3
	At Risk	55%	Indicator	2
	Problem	80%	Core Aspect	1
Gambling is a problem				
	Recreational	8%	Neither	3
	At Risk	63%	Indicator	1
	Problem	71%	Core Aspect	2
Borrowing money				
	Recreational	12%	Neither	3
	At Risk	68%	Indicator	1
	Problem	77%	Core Aspect	2
Feelings of guilt				
	Recreational	19%	Neither	3
	At Risk	68%	Indicator	1
	Problem	71%	Core Aspect	2
Financial problems				
	Recreational	3%	Neither	3
	At Risk	52%	Indicator	2
	Problem	87%	Core Aspect	1
Health problems				
	Recreational	3%	Neither	3
	At Risk	49%	Indicator	1
	Problem	83%	Core Aspect	2
Gambling weekly or more				
	Recreational	37%		
	At Risk	75%		
	Problem	65%		
> 1% income on gambling				
	Recreational	38%		
	At Risk	59%	Not applicable	
	Problem	54%		
Spending > $1000 per year on gambling				
	Recreational	44%		
	At Risk	63%		
	Problem	60%		

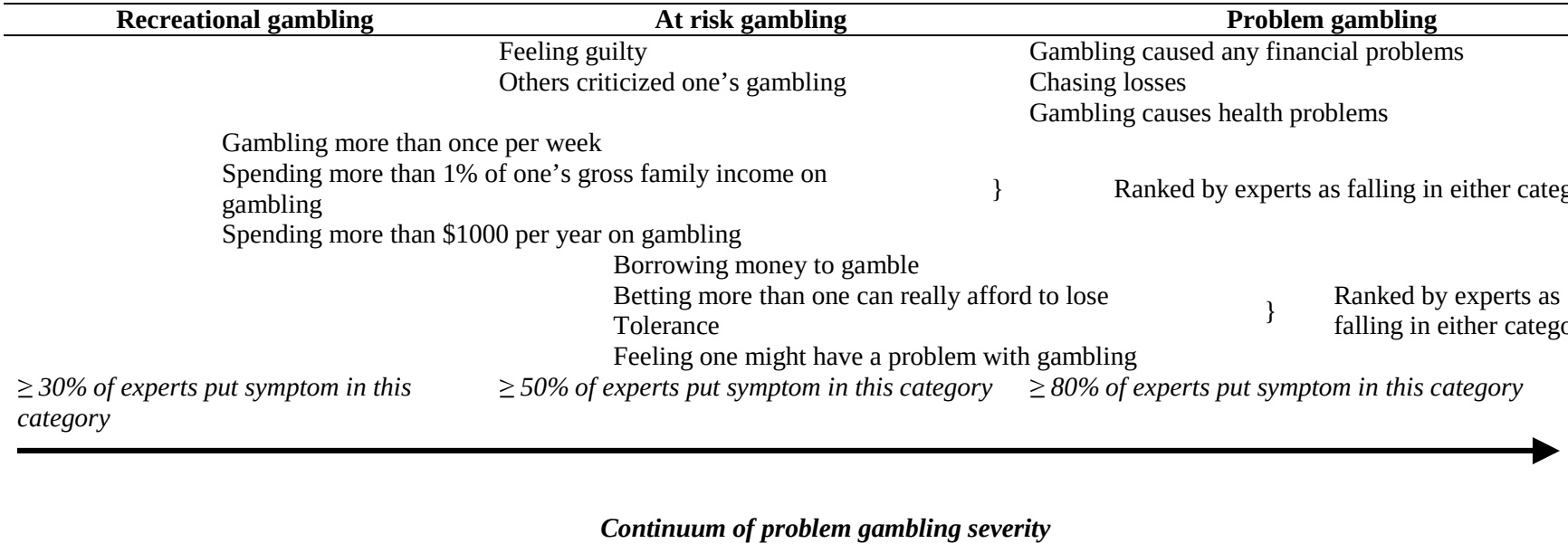


Figure 6.2. Emergence of PGSI symptoms and quantitative measures of gambling intensity at different levels of problem gambling severity

PGSI symptoms that characterize recreational gamblers, at risk gamblers or problem gamblers

Approaching the question of what level of severity does each PGSI item represent in a slightly different way, we asked respondents to categorize each symptom as being representative of recreational, at risk or problem gamblers. The intent of this question was to determine if the PGSI covers symptoms of both at risk and problem gambling levels of severity. We also included in this question the low-risk gambling limits to assess who quantitative indicators of gambling risk compared with the PGSI items. The 3 additional indicators were 'Gambling more than once per week', 'Spending more than 1% of one's gross family income on gambling' and 'Spending more than $1000 per year on gambling'. Experts were able to choose multiple responses to each question (i.e., a PGSI item could be seen in any combination of Recreational, At Risk, and Problem Gamblers). Table 6.9 presents the results. As expected, the majority of respondents rated the nine PGSI symptoms as likely to appear in problem gamblers. Less than 20% of respondents also felt these symptoms would appear in recreational gamblers. Over half of respondents felt each PGSI symptom could also appear in at risk gamblers. Our attempt to pictorially capture these results is shown in Figure 6.2. The overall findings suggest the PGSI does cover the continuum of gambling from at risk to problematic levels.

Discussion

Based on the opinions of the experts surveyed we reach the following conclusions about the PGSI:

1) The PGSI is a well-regarded instrument overall. Most experts feel it is useful in identifying both at risk and problem gamblers. About 20% of experts voiced concerns of false positives and false negatives with the scale however the majority was neutral on these questions suggesting they may not have a basis for providing an opinion. Similarly about one third felt the scoring system could be improved but one third were also neutral on the question. There was no evidence of participant bias toward the PGSI by virtue of being Canadian or a researcher with experience in using the scale.

2) The PGSI includes items characteristic of both problem and low-risk gamblers. Six of the items were judged to be indicators of problem gambling rather than core aspects. Hence, the scale is not overrepresented by symptoms one would only expect to see in problem gamblers. This finding is consistent with the intention of the instrument—to measure the continuum of risk from non-symptomatic to problem gambling levels of severity. In short, the PGSI has excellent face validity as a measure of problem gambling severity.

3) The present Likert scale used by the PGSI item assumes that equivalency of severity for each scale level across all symptoms (i.e., reporting feelings of guilt 'sometimes' is equivalent in severity to borrowing money 'sometimes'). The assumption was challenged by the expert rankings of relative weight of the Likert scale options across the items. Specifically, the present scoring system (sometimes = 1, most of the time = 2, and almost always = 3) was confirmed for only four items. A modified scoring system, giving more weight to the sometimes category, would be justified for the remaining five PGSI items. Applying the modified scoring system had a modest impact on the proportion of gamblers falling into the low-risk, moderate-risk, and problem gamblers categories. Specifically, more gamblers are labeled moderate-risk and problem gamblers using the modified response choice scoring.

4) Quantitative thresholds of gambling intensity were rated by experts as also being indicators of low-risk gamblers. These indicators (i.e., the low-risk gambling limits or comparable thresholds of gambling behaviours) could be explored as new items for the PGSI. Other brief screening tools in the field of addictions employ items assessing quantitative dimensions of consumption as measures of risk (c.f., AUDIT for alcohol disorder screening). An advantage of such items is that they do not rely on the emergence of specific consequences of gambling to be endorsed.

Section 7

Conclusions

1. The CPGI is well-regarded by researchers and clinicians in Canada and elsewhere. Experts who participated in our survey felt the PGSI is useful in identifying both at risk and problem gamblers. About one third of the sample felt the scoring system could be improved however a large proportion of respondents declined to offer an opinion on this issue. It is possible that many users of the CPGI are unaware of any concerns with the scoring system.
2. The PGSI in its present form demonstrates strong internal validity. The factor structure was confirmed with both exploratory and confirmatory methods. All items load on the one-factor model. The factor structure is valid for both the 4-point Likert scaled items and when the items are dichotomously scored by collapsing the sometimes, most of the time, and almost always response choices into a single score. Internal reliability is better with the Likert scaled items. The factor structure is invariant across subgroups defined by gender, age, income level, and game types.
3. The Rasch analysis supports the PGSI as an internally reliable, continuous measure of problem gambling severity. No miss-fitting items were identified and there was evidence of clinically significant differential item functioning with only one item, borrowing money to gamble. Similar results were found with the Likert and dichotomously scored items. Measurement precision is better with the Likert scored PGSI but coverage of symptoms across the continuum of problem gambling severity was slightly better with the dichotomous items. Overall, dichotomous scoring does not substantially improve the internal validity of the PGSI.
4. The factor structure and Rasch model fit of the PGSI is superior to other comparable measures of problem gambling severity notably the SOGS and DSM-IV based scales including the NODS.
5. Gaps in the coverage of problem gambling severity are evident in the PGSI. The Rasch models suggests a large gap exists in the severity of problem gambling reflected in the items betting more than one can afford to lose and recognition of gambling problem. This portion of the continuum corresponds to the low-risk and moderate-risk range of the PGSI scoring categories (i.e., gamblers who endorse between one to four symptoms). The addition of new PGSI items that reflect mid-range problem gambling severity would provide better coverage of symptoms that are characteristic of low and moderate-risk gamblers.
6. The relative order of PGSI symptoms ranked by level of problem gambling severity being assessed is similar to the SOGS and DSM-IV based scales, at least for the items that are

comparable across instruments. Moreover, there was good agreement between the Rasch model ranking of symptoms by severity and the opinions of gambling experts.

7. The present taxonomy for gambler subtypes based on total PGSI score has four levels: non-problem, low-risk, moderate-risk, and problem gamblers. The non-problem gambler subtype (PGSI = 0) appears to be a distinct group of gamblers on most dimensions. This group represents the typical, normative Canadian gambler. The problem gambler category (PGSI > 7) also appears to be a distinct group of gamblers on all dimensions. The differences between this category and closest adjacent category, moderate-risk gamblers, were large enough to be considered clinically meaningful on many key dimensions. Overall, there is sufficient evidence to retain these PGSI subtypes with minimal changes.
8. Differences between the low-risk and moderate-risk PGSI subtypes were not statistically significant for most of the dimensions analyzed. These gambler subtypes, based on the current PGSI scoring cutoffs, are not sufficiently different to justify their retention as distinct categories of gamblers. There are two options for improving the classification of mid-level problem gambling severity (i.e., gamblers who score greater than zero but under 9 on the PGSI): (1) merge the low and moderate-risk categories into a single PGSI subtype of 'at-risk gamblers,' with the PGSI score used as a quantitative index of degree of risk that ranges from 1 to 7. (2) modify the PGSI scoring cut-off rules creating two new mid-level categories consisting of low-risk gamblers (PGSI = 1 to 4) and moderate-risk gamblers (PGSI = 5 to 7). These categories better separate gamblers with mid-level severity of problems into two levels of risk than the previous groupings. The pros and cons of this and other changes to the scoring system are detailed in Table 7.1
9. The temporal reliability for the four PGSI subtypes, using both the original scoring rules and the novel scoring rules, is satisfactory for a retest interval of approximately 14 months. Using both the intraclass correlation coefficient and reliable change index to assess reliability, the majority of gamblers do not shift PGSI subtype over time. As predicted, shift in PGSI subtype over time corresponded to a change in level of gambling intensity—ie., an increase in PGSI score that resulted in a gambler being classified as a higher risk gambler could be explained by an increase in gambling expenditure.
10. There is no statistical evidence justifying item-level weights for the PGSI items. In regression models predicting both measures of gambling intensity and number of DSM-IV symptoms of pathological gambling the confidence intervals around the coefficients overlapped for the majority of PGSI symptoms. This suggests there is no statistical basis for weighting specific PGSI items as contributing more to the total score. We acknowledge there are significant limitations in the data available that prevent the development of robust weights at this time.

Revising the PGSI scoring system

The results from our analyses suggest that revisions to the scoring system could improve the assessment of mid-level problem gambling severity. It should be noted that revisions to the PGSI would not necessarily improve the identification of problem gamblers, which is one of the primary purposes of the instrument. In this capacity, the PGSI does an adequate job and is psychometrically stronger than comparable gambling scales. On one hand, a revised scoring system could enhance the validity of the gamblers in the middle range of problem severity. On the other hand, any revision to the scoring system that results in changing the cut-off for problem

gambling would require a new validation study to justify this cut-off. For example, altering the scoring of the Likert response choices—giving more weight to a 'sometimes' response—would result in more gamblers be classified as problem gamblers under the original scoring cut-off.

It is possible a new validation study could be done with existing data. For example, the LLLP study included additional measures of DSM-IV pathological gambling. However, this study includes only Alberta gamblers and specifically oversampled at risk gamblers. A larger, more representative sample would be desired. Future validation work should also incorporate changes to the diagnostic criteria for pathological gambling being planned for the release of the DSM-V [1]. We recommend waiting for the release of the DSM-V before changing the cut-off for clinical diagnostic purposes.

Table 7.1 provides various options for revising the scoring system. Most of these options are intended to improve the validity of the PGSI subtypes of low and moderate-risk gamblers. One option, for example is to alter the scoring of the Likert response choices for the items chasing losing borrowing money, financial problems, and health problems —specifically, giving more weight to a 'sometimes' response (assigning a score of 2 rather than 1) and equating the scoring of the 'most of the time' and 'almost always' responses (both get scores of 3). Because this would result in more gamblers be classified as moderate-risk and problem gamblers under the original scoring cut-off, validation of new cut-offs would be required. Modification such as this are an attempt to compensate for a poorly worded Likert scale—that is, the lack of discrimination between the 'most of the time' and 'almost always' choices. If the PGSI is revised and a new validation study planned, we strongly suggest revising the Likert scale in the process. Two options are listed: removing the 'almost always' choice to create a shorter 3-point scale, or adopting the Australian revision of having five response choices (never=0, sometimes = 1, rarely = 1, often = 2, always =3) for each item [57].

Another option is to add new items that specifically assess mid-level problem gambling severity. New items could increase the range of scores for gamblers classified as low-risk or moderate-risk. An increased score range could also enhance the distinctiveness of these subtypes. Quantitative measures of gambling intensity (frequency of gambling, expenditure on gambling, duration of gambling sessions) could also be considered for new items. These items could be formatted dichotomously in the form exceeding low-risk thresholds (e.g., gambling weekly or more), or with a graduated scale with higher scores assigned to more intense gambling (e.g., 0 = less than monthly, 1 = monthly, 2 = weekly, 3 = more than weekly). One of the challenges in using quantitative measures of gambling intensity is managing the enormous variety of game types and relative meaning of different measures of intensity. For example, playing EGMs weekly carries a greater risk of gambling harm than playing the lottery weekly. One option is to limit the scope of quantitative measures to high risk games (i.e., specifically ask about frequency or expenditure on EGMs and casino games rather than any gambling).

Table 7.1

Pros and Cons of Modifying the PGSI scoring rules

Change to scoring system	Pros	Cons
Modify the relative weights of the Likert scale response choices giving more weight to a response of sometimes and most of the time for certain items (scoring rules shown in Table 6.7).	• Would utilize expert opinions to recognize that certain symptoms are more indicative of problem gambling at lower levels of frequency.	• Increases the scores of gamblers in the low and moderate-risk groups according to the original PGSI cut-offs. The proportion of gamblers considered moderate-risk and problem gamblers increases. • Would need to validate a new PGSI cut-off for problem gambling.
Use a dichotomous scale (Yes/No or Never vs. Sometimes) for each item rather than the Likert scale.	• Factor structure would remain unchanged. • May shorten time to complete the PGSI, allowing for new items to be added without increasing length of instrument.	• Would reduce the range of total score. • Measurement precision and internal reliability is better with Likert scaled PGSI. • Would need to validate a new PGSI cut-off for problem gambling.
Collapse the' most of the time' and 'almost always' response choices to create a 3-point scale for each item (never, sometimes, most of the time).	• Justifiable given the most of the time' and 'almost always' are similar in wording and the almost always category is rarely endorsed. • An alternative to a dichotomous scale.	• Would need to validate a new PGSI cut-off for problem gambling. • Would reduce range of total PGSI score from 0 – 27 to 0 – 18.
Change the descriptions of the Likert scale response choices to better delineate frequency between the sometimes and almost always level. Australia has adopted five response choice scale while retaining the score range of 0 to 3 (never=0, sometimes/rarely = 1, often = 2, always =3) for each item.	• Monte Carlo simulations suggest this revised Likert scale would change the overall distribution of scores, increasing the proportion of gamblers labeled as low-risk and moderate-risk, and decreasing the proportion labeled non-problem.	• Would require a new validation study establish new cut-offs for low-risk, moderate-risk and problem gamblers.
Change scoring of PGSI subtypes for low-risk and moderate-risk gamblers by equating the range of possible scores for these categories (low-risk = 1 to 4; moderate-risk gamblers = 5 to 8).	• Has no impact on the non-problem subtype and minimal impact on the problem gambler category. • Creates two gambler subtypes between the non-problem and problem gambler severity levels that better represent the gradient	• Would need to validate a new PGSI cut-off (>9) for problem gambling otherwise gamblers with a PGSI=8 would no longer be consider problem gamblers. • The difference between moderate-risk and problem gamblers is less pronounced than the difference between moderate-risk and problem

	of increasing severity. • The low-risk and moderate-risk gambler subtypes are more distinct than low-risk and moderate-risk under the original scoring rules in terms of gambling intensity and game preference.	gamblers. This may reduce the specificity of the cut-off for problem gamblers.
As above, but retain PGSI ≥ 8 as the cut-off for problem gamblers by defining moderate-risk gamblers as PGSI 5 to 7.	• Would not require validation of a new cut-off for defining problem gamblers. • Only modest differences in the subtype defined as PGSI = 5 to 8 vs. PGSI = 5 to 7.	• Different range of scores for all four subtypes (Non-problem = 1, low-risk = 4, moderate-risk = 3, and problem gamblers = 20)

Section 8

Recommendations

Recommendations that could be implemented immediately.

The results from our analyses suggest that revisions to the existing scoring system would improve the assessment of mid-level problem gambling severity. Specifically, we recommend that the low-risk and moderate-risk subtypes be eliminated in favour of two new mid-level categories consisting of low-risk gamblers defined as a PGSI score of 1 to 4 and moderate-risk gamblers defined as a PGSI score of 5 to 7. Ideally, these subtypes would have the same range of scores (4) however defining moderate-risk gamblers as scoring from 5 to 8 would require validation of a new cut-off for problem gamblers (e.g., ≥ 9). Our findings suggest this is little difference in defining moderate-risk gamblers with the upper range being 7 rather than 8 so keeping the original cut-off for defining problem gamblers as PGSI ≥ 8 would allow for comparisons of previous and future prevalence studies.

Recommendations that would require the collection of new data.

The remaining recommendations pertain to the development of new PGSI items and an overhaul of the Likert response scale. These recommendations would require a new validation study to collect normative data and establish new cut-offs for the PGSi subtypes. The specific recommendations are:

1) Adopt a new Likert scale that replaces the 'most of the time' and 'almost always' choices. It has been noted that these response choices are very similar in wording and 'almost always' is rarely endorsed. Two options for improving the Likert scale include: removing the 'almost always' choice to create a shorter 3-point scale (never, sometimes or most of the time), or adopting the Australian revision of having five response choices (never=0, rarely = 1, sometimes = 1, often = 2, always =3) for each item. In the Australian scoring system, rarely and sometimes receive the same score. Given that the PGSI performs similarly when the items are dichotomously scored or Likert scored, we recommend shortening the number of response choices per item in favour of adding more items to expand the range of symptoms in the low and moderate-risk categories.

2) Add new items that specifically assess mid-level problem gambling severity to increase the range of scores for gamblers classified as low-risk or moderate-risk. An increased score range could also enhance the distinctiveness of these subtypes and aid in the detection of gamblers who are approaching the clinical threshold for problem gambling.

3) Consider the addition of quantitative measures of gambling intensity (frequency of gambling, expenditure on gambling, duration of gambling sessions) as new items.

4) Future validation work on the PGSI should incorporate changes to the diagnostic criteria for pathological gambling being planned for the release of the DSM-5 [1]. We recommend waiting for the release of the DSM-5 before changing the cut-off for problem gamblers for clinical diagnostic purposes.

5) The development of item-level weights for the PGSI would require a valid, external criterion to assess the relative contribution of the individual PGSI items in predicting. The ideal criterion would be an another indicator of problem gambling severity that is distinct from the PGSI --e.g., collateral ratings of problem severity obtained from a family member or clinician--and not exclusively based on DSM-IV criteria. A future CPGI population survey could attempt to collect collateral ratings of problem gambling severity for a sample of participants for use in a weight development study.

Section 9

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APPENDICES

Appendix A. Copy of the CPGI used in Measuring Gambling and Problem Gambling in Alberta Using the Canadian Problem Gambling Severity Index (C.P.G.I.) by Smith & Wynne, 2002.

CANADIAN PROBLEM GAMBLING INDEX

(N=1804)

Hello, my name is _____ and I'm calling (long distance) from the Population Research Laboratory at the University of Alberta. Have I dialed XXX-XXXX? Your phone number was selected at random by computer as belonging to a household in Alberta.
We are currently conducting a research survey on the gambling activities and attitudes of Albertans. The information gathered in this study will help researchers better understand gambling behaviour and develop programs and services for Albertans with gambling problems. We are interested in a wide representation of viewpoints and would like to speak with people who gamble as well as those who do not gamble.

To ensure that we speak with a good cross-section of people in the province, could you please tell me the number of men aged 18 and older who live in your household?

_____ # of men aged 18 and older

And the number of women aged 18 and older?

_____ # of women aged 18 and older

We don't always interview the person who answers the telephone. For this study I would like to interview the (a) (male/female) member of the household. Would that person be available to speak with me?

1 Yes-proceed
2 No-schedule callback for person (or code appropriately)

INTERVIEWER NOTE: REPEAT INTRODUCTION IF ANOTHER PERSON COMES TO PHONE.

Enter gender of respondent

1 Male
2 Female

I would like to interview you and I'm hoping that now is a good time for you. The interview will take about 15 minutes, depending on the questions that apply to you. Is now a convenient time for you?

1 Yes-proceed
2 No-schedule callback (or code appropriately)

Before I go on, I would like to assure you that your participation in this interview is completely voluntary. If there are any questions you don't wish to answer, please point these out to me and we'll go on to the next question. You, of course, have the right to end this phone call at any time. The information we are requesting in this interview is protected under the Alberta Freedom of Information and Protection of Privacy Act and will be used only for research purposes.
Nobody will be identified individually in any reports coming out of the survey. If you have any questions about this study, you can call Cathy Drixler, Project Coordinator at the Population Research Lab (at 780-492-4659, ext. 229). May we proceed?

1 Yes
2 No-Arrange callback or code appropriately

First, I would like to ask you some questions about gambling activities you may participate in. People spend money and gamble on many different things including buying lottery tickets, playing BINGO, or

playing card games with their friends. I am going to read you a list of activities and I would like you to tell me which of these you have bet or spent money on in the past 12 months.

1. In the past 12 months, have you bet or spent money on….(READ. SELECT ALL THAT APPLY)
2.

Lottery tickets such as 649, Super 7, or POGO
Daily lottery tickets like Pick 3
Instant-win or scratch tickets (e.g., break-open, pull tabs, Nevada strips)
Raffle tickets or fundraising tickets
BINGO
Card or board games with family or friends (for money)
Video lottery terminals (VLTs) (i.e., in bar or restaurant lounge)
Casino slot machines
Arcade or video games for money
Gambling on the Internet
Sports Select (e.g., Pro Line, Over/Under, Point Spread)
Sports pools (e.g., charity-sponsored or at work)
Outcome of sporting events (other than sports pool or Sports Select)
Sports with a bookie
Horse races at the track or off-track
Games at Alberta casinos other than coin slots or VLTs (e.g., poker, blackjack, roulette)
Games at casinos outside Alberta (e.g., Las Vegas, Regina) other than coin slots or VLTs (e.g., poker, blackjack, roulette)
Stocks, options, commodities markets but NOT mutual funds or RRSPs
Games of skill for money like golf, pool, bowling, darts
Card games in non-regulated settings other than with family/friends (e.g., card rooms)
Other forms of gambling 1 (specify) _____
Other forms of gambling 2 (specify) _____
No response

IF RESPONDENT HAS NOT GAMBLED IN THE PAST 12 MONTHS, SKIP TO Q28A

For each activity that respondent has participated in during the past 12 months ask questions 2-7:

2. In the past 12 months, how often did you bet or spend money on _____?
Would you say…(READ)
1 Daily
2 2 to 6 times/week
3 About once/week
4 2-3 times/month
5 About once/month
6 Between 6-11 times/year
7 Between 1-5 times/year
8 Don't know
0 No response

3. In the past 12 months, how many minutes or hours did you normally spend EACH TIME betting or spending money on _____?

_____ Number of minutes (EXACT MINUTES. NO ROUNDING)

481 More than 8 hours
998 Don't know
999 No response

4. In the past 12 months, how much money, not including winnings, did you spend on _____ in a typical month?

_____ Number of dollars
99998 Don't know
99999 No response

NOTE: Spending means out of pocket and doesn't include money won and then spent

5. In the past 12 months, what is the largest amount of money you spent on _____ in any one day?

_____ Number of dollars

99998 Don't know
99999 No response

6. When you spend money on _____, who do you participate with or go with? (READ TO PROMPT IF NECESSARY. IF MORE THAN ONE RESPONSE, SELECT '6' AND RECORD RESPONSES)

1 Alone
2 With spouse or partner
3 With other family members
4 With friends or co-workers
5 With some other individual or group (Specify)
6 More than one of selections above (Specify)
7 Don't know
0 No response

7. What are the main reasons why you participate in _____? (DO NOT READ. IF MORE THAN ONE RESPONSE, SELECT '12' AND RECORD ALL RESPONSES)

1 In order to do things with your friends
2 For excitement or as a challenge
3 As a hobby
4 To win money
5 To support worthy causes
6 Out of curiosity
7 For entertainment or fun
8 To distract yourself from everyday problems
9 Because you're good at it
10 To be alone
11 Other (specify)
12 More than one reason (specify)
13 Don't know
0 No response

The next questions are part of a standard measurement scale that was recently developed in Canada for use in gambling surveys similar to this one. For each question I would like you to base your answer on the past 12 months. Some of these questions may not apply to you but please try to answer as accurately as possible. Remember that all your answers are strictly confidential. The categories to use for each question are never, sometimes, most of the time, or almost always.

8. Thinking about the past 12 months, have you bet more than you could really afford to lose? Would you say…(READ)

1 Never

2 Sometimes 3 Most of the time
4 Almost always
5 Don't know
0 No response

9. (Thinking about the past 12 months)…have you needed to gamble with larger amounts of money to get the same feeling of excitement? (Would you say…(READ))

10. (Thinking about the past 12 months)…have you gone back another day to try to win back the money you lost? (Would you say… (READ))

11. (Thinking about the past 12 months)…have you borrowed money or sold anything to get money to gamble? (Would you say… (READ))

12. (Thinking about the past 12 months)…have you felt that you might have a problem with gambling? (Would you say… (READ))

13. (Thinking about the past 12 months)…have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true? (Would you say… (READ))

14. (Thinking about the past 12 months)…have you felt guilty about the way you gamble or what happens when you gamble? (Would you say… (READ))

15. (Thinking about the past 12 months)…has your gambling caused you any health problems, including stress or anxiety? (Would you say… (READ))

16. (Thinking about the past 12 months)…has your gambling caused any financial problems for you or your household? (Would you say… (READ))

17. (Thinking about the past 12 months)…have you felt like you would like to stop betting money or gambling but you didn't think that you could? (Would you say… (READ))

18. (Thinking about the past 12 months)…have you hidden betting slips, lottery tickets, gambling money, IOUs, or other signs of betting or gambling from your partner, children, or other important people in your life? (Would you say… (READ))

19. (Thinking about the past 12 months)…have you gambled as a way of escaping problems or to help you feel better when you were depressed? (Would you say… (READ))

20. (Thinking about the past 12 months)…have you lied to family members or others to hide your gambling? (Would you say… (READ))

21. (Thinking about the past 12 months)…have you bet or spent more money than you wanted to on gambling? (Would you say… (READ))

22. (Thinking about the past 12 months)…have you tried to quit or cut down on your gambling but were unable to do it? (Would you say… (READ))

23. (Thinking about the past 12 months)…have you had difficulty sleeping because of your gambling? (Would you say… (READ))

24. (Thinking about the past 12 months)…have you felt irritable or restless when you tried to cut down or stop gambling for a while? (Would you say… (READ))

25. (Thinking about the past 12 months)…has your gambling caused any problems between you and any of your family members or friends? (Would you say… (READ))

26. (Thinking about the past 12 months)…have you stolen anything or done anything illegal such as write bad cheques so that you could have money to gamble? (Would you say… (READ))

27. (Thinking about the past 12 months)…have you almost lost a relationship, a job, or an educational or career opportunity because of your gambling? (Would you say… (READ))

The next questions explore some of your gambling experiences, beliefs, alcohol and drug use, and health-related issues. Once again, your answers will be kept strictly confidential.

28a. How old were you when you first gambled for money?
_____ Age
775 Never tried gambling (SKIP TO Q31)
885 Five years of age or younger (but no specific age given)
998 Don't know (SKIP TO Q31)
999 No response (SKIP TO Q31)

28b. What type of gambling was that? (DO NOT READ. SELECT ONE RESPONSE ONLY. READ CATEGORIES IF PROMPT NEEDED).
Lottery tickets such as 649, Super 7, or POGO
Daily lottery tickets like Pick 3
Instant-win or scratch tickets (e.g., break-open, pull tabs, Nevada strips)
Raffle tickets or fundraising tickets
BINGO
Card or board games with family or friends (for money)
Video lottery terminals (VLTs) (i.e., in bar or restaurant lounge)
Casino slot machines
Arcade or video games for money
Gambling on the Internet
Sports Select (e.g., Pro Line, Over/Under, Point Spread)
Sports pools (e.g., charity-sponsored or at work)
Outcome of sporting events (other than sports pool or Sports Select)
Sports with a bookie Horse races at the track or off-track
Games at Alberta casinos other than coin slots or VLTs (e.g., poker, blackjack, roulette)
Games at casinos outside Alberta (e.g., Las Vegas, Regina) other than coin slots or VLTs (e.g., poker, blackjack, roulette)
Stocks, options, commodities markets but not mutual funds or RRSPs
Games of skill for money like golf, pool, bowling, darts
Card games in non-regulated settings other than with family/friends (e.g., card rooms)
Other forms of gambling (specify) _____
No response

29. Do you remember a big win when you first started gambling?
1 Yes
2 No
3 Don't know
0 No response

30. Do you remember a big LOSS when you first started gambling?
1 Yes
2 No
3 Don't know
0 No response

Please tell me how much you agree or disagree with the following statements.

31. While gambling, after losing many times in a row, you are more likely to win. Would you say you…(READ)
1 Strongly agree
2 Agree
3 Disagree
4 Strongly disagree
5 Don't know

0 No response

32. While gambling, you could win more if you used a certain system or strategy. Would you say…(READ)
1 Strongly agree
2 Agree
3 Disagree
4 Strongly disagree
5 Don't know
0 No response

For the next series of questions, please answer yes or no.

33. Has anyone in your family EVER had a gambling problem?
1 Yes
2 No
3 Don't know
0 No response

34. Has anyone in your family EVER had an alcohol or drug problem?
1 Yes
2 No 3 Don't know
0 No response
IF RESPONSE IN Q28 WAS NEVER GAMBLED OR IF HASN'T GAMBLED IN PAST 12 MONTHS, SKIP TO Q37

35. In the past 12 months, have you used alcohol or drugs while gambling?
1 Yes
2 No
3 Don't know
0 No response

36. In the past 12 months, have you gambled while you were drunk or high?
1 Yes
2 No
3 Don't know
0 No response

37. In the past 12 months, have you felt you might have an alcohol or drug problem?
1 Yes
2 No
3 Don't know
0 No response

38. In the past 12 months, if something painful happened in your life, did you have the urge to gamble?
1 Yes (includes having the urge as well as doing it)
2 No
3 Don't know
0 No response

39. In the past 12 months, if something painful happened in your life, did you have the urge to have a drink?
1 Yes (includes having the urge as well as doing it)
2 No
3 Don't know
0 No response

40. In the past 12 months, if something painful happened in your life did you have the urge to use drugs or medication?
    1 Yes (includes having the urge as well as doing it)
    2 No
    3 Don't know
    0 No response

41. Still thinking about the past 12 months, have you been under a doctor's care because of physical or emotional problems brought on by stress?
    1 Yes
    2 No
    3 Don't know
    0 No response

42. In the past 12 months, was there ever a time when you felt sad, blue, or depressed for TWO WEEKS OR MORE in a row?
    1 Yes
    2 No (SKIP TO Q44)
    3 Don't know (SKIP TO Q44)
    0 No response (SKIP TO Q44)

43. During this time, did you take medication or antidepressants for your depression?
    1 Yes
    2 No
    3 Don't know
    0 No response

44. In the past 12 months, have you seriously thought about attempting suicide?
    1 Yes
    2 No (SKIP Q46)
    3 Don't know (SKIP Q46)
    0 No response (SKIP Q46)

45a. During this time, have you ever attempted suicide?
    1 Yes
    2 No (SKIP TO Q46)
    3 Don't know (SKIP TO Q46)
    0 No response (SKIP TO Q46)

45b. Were these suicidal thoughts or attempts related to your gambling?
    1 Yes
    2 No (SKIP Q46)
    3 Don't know (SKIP Q46)
    0 No response (SKIP Q46)

Appendix B. Table Comparing the CPGI used in different Provinces

Comparison of CPGI items across provincial surveys included in the CPGI Integrated Dataset

Survey	Gambling types	Harms assessed	Frequency scale	Amount spent scale	Time spent scale
Alberta	1.6/49, Super 7 2.Daily lottery 3.Instant win/scratch 4.Raffle tickets, fundraising 5.Bingo 6.Casino 7.Card/board games 8.VLT outside casinos 9.Casino slot machines 10.Arcade video 10. Internet 11. Sports Select 12. Sports pool, sporting events 13. Sports with a bookie 14. Horse races (at track and off) 15. Games of Alberta casinos other than VLT 16. Games of other casinos other than VLT 17. Stocks,investments 18. Games of skill 19. Card games in non-regulated settings 20. Other	1.Bet more than afford to lose 2.Gamble with larger amounts 3.Gone back to win 4.Borrowed $ 5.Felt had problem with gambling 6.People criticized 7.Guilty 8.Health problems (stress/anxiety) 9.Financial problems 10. Wanted stop but couldn't 11. Hidden signs of gambling 12. Gambled to forget 13. Lied to family 14. Spent more than wanted 15. Tried to cut down but unable 16. Difficulty sleeping 17. Irritable/restless 18. Relationship problems 19. Illegal activities 20. Lost a relationship or job	1 Daily 2 Between 2 to 6 times a week 3 About once a week 4 Between 2 to 3 times a month 5 About once a month 6 Between 6 to 11 times a year 7 Between 1 to 5 times a year 8 M Don't know 9 M Not applicable Sport select → q387	<u>Past 12 months, amount spent on specific activity</u> -Exact amount in $ on each activity <u>Past 12 months, largest amount spent on activity</u> - exact $	<u>Past 12 months, amount of minutes spend EACH TIME</u> - Exact number of minutes
Ontario 2001	1.6/49, Super 7 2.Instant win/scratch 3.Raffle tickets, fundraising 4. Horse races 5.Bingo 6.VLT/slots inside casinos 7.Games of casinos other than VLT/slots 8.VLTs other than casinos 9.Sports Select 10. Sports pool, sporting events 11. Card/board games 12. Games of skill 13. Arcade video 14. Internet 15. Bookie 16. Stocks 17. Games of out of province casinos	1.Bet more than afford to lose 2.Gamble with larger amounts 3.Gone back to win 4.Borrowed $ 5.Felt had problem with gambling 6.Health problems (stress/anxiety) 7.People criticized 8.Financial problems 9.Guilty 10. Petty crime to support gambling q1048 Relationship problems (yes/no) Work problem (yes/no) Loneliness (yes/no) Illegal activity (yes/no) Suicide thoughts (yes/no) Petty crime (yes/no)	1. Daily 2. At least once per week 3. At least once per month 4. Less than once a month 5. Never 6. I do not gamble 7. Don't know 8. Refused Sport select → q388	<u>Past 12 months, amount spent on a typical occasion</u> -exact $ VLTs outside casinos → q359 <u>Past 12 months, amount spent on any type of gambling</u> (total) -exact $	<u>Past 12 months, amount of minutes spend in total in a typical month</u> - exact number of minutes (< 8 hrs) - more than 8 hours

BC	1.Raffle tickets, fundraising 2.6/49, Super 7, Daily lottery 3.Bingo 4.Casinos 5.VLT/slots outside casinos 6.Sports Select 7.Horse races 8.Sports pool, sporting events, bookie 9.Cards & games of skill 10. Internet 11. Stocks,investments 12. Other gambling	CPGI 1.Bet more than afford to lose 2.(Spend more than intended) q888 3.Gamble with larger amounts 4.Gone back to win 5.Borrowed $ 6.Felt had problem with gambling 7.People criticized 8.Guilty 9.Health problems (stress/anxiety) 10. Financial problems 11. Gambled to forget 12. Illegal activities	1 Daily (30+ times per month) 2 Several times a week (6 – 29 times per month) 3 Several times a month (3 -5 times per month) 4 Once a month or less (6 – 12 times per year) 5 Only a few days per year (1- 5 times per year) 6 Not at all in the past 12 months (0 times) 7 DK/NS Sport select → q386	Amount spent in average month Less than $1 $1 to $10 $11 to $49 $50 to $99 $100 to $199 $200 to $299 $300 to $499 $500 to $999 More than $1000	
Ontario 2005	1. Lottery tickets 2. Instant-win/scratch tickets 3. Raffles or fundraising tickets 4. Horse races (on and off track) 5. Bingo 6. Casino slot machines 7. Casino table games 8. Sport select 9. Sports pools/outcome of sporting events 10. Cards/board games 11. Games of skill (pool, bowling, darts) 12. Arcade/video games 13. Internet (day trading, casino table games, VLTS/slot machines, poker and sports betting) 14. Sports with bookie 15. Short term speculative stock/commodity purchases 16. Out of province lottery casinos 17. Overall gambling past year participation	1. Bet more than could afford to lose q941, q1049, q1050 (12, 6, past few months) 2. Gamble with larger amounts of money for excitement q951, q1051, q1052 3. Borrow money/sell something q970, q1055, q1056 4. Felt have problem q982, q1057, q1058 5. Health problems (stress, anxiety) q988, q1059, q1060 6. People criticized q1031, q1061, q1062 7. Caused financial problems q994, q1063, q1064 8. Felt guilty q1018, q1065, q1066 9. Difficulties related to gambling q1076 10. Relationship problems q1096, q1097 11. Negatively affects job performance q1100, q1101 12. Harder to make money last from pay day to pay day q1098, q1099 13. Thought about suicide q1105, q1106 14. Illegal activity q1107, q1108 15. Gambled with money budgeted for something else q1113, q1114 16. Gone back to win q959, q1053, q1054	0 M did not gamble 1 Daily 2 At least once a week 3 At least once a month 4 Less than once a month 98 M Refused 99 M Don't know Sport select → q389 **Exact number of occasions - instant win/scratch tickets - horse races - bingo - casino slot machines - casino table games (q337)	Per year amount spent on specific type of gambling - exact amount Bingo → Per month how much spent on activity Casino table games → per month spent on activity (q340)	Hours spent on activity?? Minutes spent on activity Horse race → typical month

Manitoba	1. Lottery tickets 2. Instant win/scratch tickets 3. Raffles or fundraising tickets 4. Horse races 5. Bingo 6. Casinos 7. Casino slot machines 8. Casino table games 9. VLTs outside casinos 10. Sports select 11. Keno at casino 12. Sports events 13. Internet 14. Other gambling activities	1. Felt had problem with gambling q886, q983 2. Felt guilty q893, q1019 3. People criticized q891, q1014 4. Gamble more than intended q889 5. Like to stop but couldn't q895 6. Gone back to win q882, q960 7. Claimed to be winning when losing q884 8. Hidden signs from family q897 9. Arguments with family q900, q903 10. Lost time from work/school q909 11. Borrowed $ not paid back q906 Borrowed $ q971 12. Used household money to gamble q912 13. Used partner's money to gamble q915 … money from various places 14. Bad cheques (illegal activity) q936 15. Bet more than could afford to lose q942 16. Need to gamble with more money to get excitement q946 17. Health problems q989 18. Caused financial problems q995 19. Reoccurring financial, work, family problems q1025	1 Never 2 Less than once a month 3 Number of times 4 Don't know 5 Refused **Exact number of occasions in past 12 months VLTs outside casinos → q356	<u>Average amount spent on specific type of gambling at one time</u> - exact $ casino table games → q347 VLTs outside casinos → q375	<u>Average hours spent at one time on specific type of gambling</u> (horse race, bingo, etc.) casino table games → q348 VLTs outside casinos → 376
Newfoundland	1. Lottery tickets 2. Instant win/scratch tickets 3. Raffles or fundraising tickets 4. Horse races 5. Bingo 6. VLTs 7. Pro-line or Over/under 8. Sports pools/outcome of sporting events 9. Cards/board games 10. Poker 11. Games of skill 12. Arcade/video games 13. Internet 14. Short term speculative stocks/commodity purchasee 15. Out of province gambling at casinos 16. Other forms	1. Bet more than could afford to lose q11a_nfl 2. Needed to gamble with larger amounts of money to feel excitement q11b_nfl 3. Went back to win q11c_nfl 4. Borrowed $ q11d_nfl 5. Felt had problem q11e_nfl 6. Health problems q11f_nfl 7. People criticized q11g_nfl 8. Financial problems q11h_nfl 9. Felt guilty q11i_nfl q12m1 to q12m7 → which of following problems have you experienced from gambling 1 Income loss/debt 2 Relationship problems 3 Physical health problems 4 Mental health problems 5 Work problems	1 Daily 2 2 to 6 times/week 3 About once/week 4 2-3 times/month 5 About once/month 6 Between 6-11 times/year 7 Between 1-5 times/year 98 Don't know 99 Refused	Total amount spent on gambling activity - exact $ Total amount spent on gambling past 12 months	

		6 Loneliness/increased isolation 90 Other: Specify 97 None 98 DK/NA 99 Refusal			
National	1. Lottery tickets 2. Daily lottery tickets 3. Instant win/scratch tickets 4. Raffles or fundraising tickets 5. Horse races (on and off track) 6. Bingo 7. Casinos 8. Casino slot machines 9. Poker in a casino 10. Backjack in a casino 11. Roulette in a casino 12. Keno in a casino 13. Craps in a casino 14. Sport Select 15. Cards/board games 16. Games of skill 17. Arcade/video games 18. Internet 19. Sports with a bookie 20. Stocks/Commodities markets	1. Felt had problem with gambling q885, q978 2. Gamble more than intended q887 3. People criticized q890 4. Felt guilty q 892 5. Felt like stopping but couldn't q894 6. Hidden signs of gambling from people in life q896 7. Argued with people re: gambling q898 8. Borrowed $ (not paid back) q904 → borrowed/sold to get $ q966 9. Lost time from work/school q907 10. Sold personal property q931 11. Bet more than could afford to lose q937 12. Gambled to escape/feel better q943 13. Lied to family q953 14. Broken self set limits q952 15. Spend larger amounts for excitement q947 ?? 16. Relationship problems (family/friends) q961 17. Difficulty sleeping q963 18. Gone without eating/sleeping to gamble longer q965 19. Unable to stop thinking of gambling q972 20. Bet/spent more than wanted q973 21. Gambled longer than planned q975 22. Health problems (stress/anxiety) q984 23. Financial problems q990 24. Tried to cut down but couldn't q997 25. Almost lost relationship/job q999 26. Illegal activities q1003 27. Irritable/restless q1006 28. Thought/attempt of suicide q1102 29. Gone back to win q881	1 Daily 2 2-6 Times Week 3 About Once A Week 4 2-3 Times Month 5 About Once A Month 6 Between 6-11 Times Year 7 Between 2-5 Times Year 8 About Once A Year 9 Never 97 I Do Not Gamble 98 D.K. 99 Refused Sport select → q385	<u>Past 12 months, largest amount spent on specific type of gambling in one day</u> -exact $ VLTs outside casino → q367 <u>Past 12 months, amount spent on specific type of gambling in typical month</u> -exact $ VLTs outside casino → q366	<u>Number of hours and number of minutes spent on gambling activity EACH TIME ??</u> VLTs outside casino → q364 and q365

Appendix C. Table Comparing CPGI Demographics Questions

Comparison of demographic questions used in provincial surveys included in the CPGI Integrated Dataset

Survey	Age	Race	Education	Income
Alberta 2002	q1387 – Age in 2001 0M No response q1389 Age group 0M No response 1 18-24 2 25-34 3 35-44 4 45-54 5 55-64 6 65+ 7 (DK/NS) Respage – Respondent age	q1451 to q1495 - Ethnic group you <u>most</u> identify with. Can be coded as white/non-white (multiple answers accepted)	q1577 – What is the highest level of education that you have completed?* 1 No schooling 2 Some elementary school 3 Completed elementary school 4 Some high school/junior high 5 Completed high school 6 Some community college 7 Some technical school 8 Completed community college (e.g., certificate, diploma) 9 Completed technical school (e.g., certificate, diploma) 10 Some University 11 Completed Bachelor's Degree (Arts, Science, Engineering, etc.) 12 Completed Master's degree: MA, MSc, MLS, MSW, etc. 13 Completed Doctoral Degree: PhD, "doctorate" 14 Professional Degree 15 M Don't know *Recode: 1 - 5 = 0 6 - 14 = 1	q1604 – What was your total household income last year?* 0 M No response 1 Under $20,000 2 $20,000 – 30,000 3 $30,000 - 40,000 4 $40,000 - 50,000 5 $50,000 - 60,000 6 $60,000 - 70,000 7 $70,000 - 80,000 8 $80,000 - 90,000 9 $90,000 - 100,000 10 $100,000 - 120,000 11 $120,000 - 150,000 12 More than $150,000 13 M Don't know *Recode to median value 1 = 10,000; 2 = 25,000; 3 = 35,000; 4 = 45,000 5 = 45,000; 6 = 65,000; 7 = 75,000 8 = 85,000; 9 = 95,000; 10 = 110,000 11 = 135,000; 12 = $150,000
Ontario 2001	q1390 – age category 1 18-24 2 25-34 3 35-49 4 50-59 5 60+ 6 DK 7 Refused 8 Under 60 q1394 – age: senior groups Respage – Respondent age	q1496 to q1559 - Ethnic or cultural group you or your ancestors belong on first coming to this country? (Person can indicate more than one group) Recode: 0 = white; if respondent does <u>not</u> endorse in Z5_1 to Z5_60 belonging to Native Indian/Inuit, Bahamian, Bangladeshi, Black / African, Chilean, Chinese, East Indian, El Salvadorian, Ethiopian, Guyanese, Haitian, Inuit, Jamaican Japanese, Korean,	q1578 - Highest level of education 1 Some high school / junior high or less 2 Completed high school 3 Some post secondary school 4 Completed post secondary school 5 Completed post graduate education 6 Don't know 7 Refused *Recode: 1 – 2 = 0 3 – 5 = 1	q1605 – Household income level* Total household income: 1 Less than $20,000 2 Less than $30,000 3 Less than $40,000 4 Less than $50,000 5 Less than $60,000 6 Less than $70,000 7 Less than $80,000 8 Less than $90,000 9 Less than $100,000 10 Less than $120,000 11 Less than $150,000 12 $150,000 or more 13 Don't know/Refused *Recode to median value 1 = 10,000; 2 = 25,000; 3 = 35,000; 4 = 45,000

		Lebanese, Metis, Nigerian, Pakistani, Philipino, Sikh, Somalian, Sri Lankan, Tamil, Trinidadian, Vietnamese (i.e., assume they are while unless they indicate otherwise) 1 = respondent endorses in Z5_1 to Z5_60 belonging to one of the above groups.		5 = 45,000; 6 = 65,000; 7 = 75,000 8 = 85,000; 9 = 95,000; 10 = 110,000 11 = 135,000; 12 = $150,000
BC	q1387 – categories of age 1 18-24 2 25-34 3 35-44 4 45-54 5 55-64 6 65+	q1407 to q1450 - Ethnic or cultural group did you or your ancestors belong to on first coming to this country? (multiple answers accepted) Recode: 0 = white; if respondent does <u>not</u> endorse in Q84 belonging to aboriginal, Chinese, East Indian, Filipino,Japenese, or Korean (i.e., assume they are while unless they indicate otherwise) 1 = respondent endorses in Q84 belonging to aboriginal, Chinese, East Indian, Filipino,Japenese, or Korean groups.	q1576 – What is the highest level of formal education that you have completed? 1= Grade school or some high school 2= Completed high school 3= Post secondary technical school 4= Some college or university 5= Completed college diploma 6 =Completed university degree 7 = Post-grad degree (Masters, Ph.D, etc.) 8 = (DK/NS) *Recode: 1 – 2 = 0 3 – 7 = 1	q1602 – Which of the following broad categories best describes your family income? 1 Under $30,000 2 $30,000 to just under $60,000 3 $60,000 to just under $100,000 4 $100,000 or more 5 (DK/NS)
Ontario 2005	q1380 – Age: 1 18 to 24 2 25 to 34 3 35 to 49 4 50 to 59 5 60+ 98M Refused 99M Don't know	q1560 to q1566 - How would you best describe your ethnicity or your family's origin? (Multiple answers accepted)	q1579 – What is your current or highest level of education? 1 No formal schooling 2 Some elementary school 3 Some high school/junior high 4 Some community college 5 Some CGEP 6 Some trade/technical/vocational school 8 Some teacher s college 9 Some Graduate school (MA, MSc,MSW, etc.) 10 Some PhD 11 Some professional degree(law, medicine, pharmacy) 12 Completed elementary school 13 Completed high school/junior high/GED	q1609 – Combined total for all members of your household for the last year 98 M Refused 99 M Don't know q1610 – Combined total for all members of your household for the last year (categories) 1 less than $20,000 2 between $20,000 and $39,999 3 between $40,000 and $59,999 4 between $60,000 and $79,999 5 between $80,000 and $99,999

			14 Completed commumity college 15 Completed CGEP 16 Completed trade/technical/vocational school 17 Completed University degree (B.A. B.Sc) 18 Completed teacher s college 19 Completed Graduate degree (MA, MSc, MSW, etc.) 20 Completed PhD 21 Completed professional degree(law, medicine, pharmacy) 98 M Refused 99 M Don't know q1580 – Recorded Education 1 No high school education 2 Some high school 3 Completed high school 4 Some post-secondary 5 Completed post-secondary 6 Competed post-graduate 98 M Refused 99 M Don't know	6 between $100,000 and $119,999 7 between $120,000 and $139,999 8 between $140,000 and $159,999 9 between $160,000 and $179,999 10 between $180,000 and $199,999 11 $200,000 or more 98 M Refused 99 M Don't know q1607, q1608, q1614 record personal income
Manitoba 2002	Respage - age	q1572 – Which ethnic or cultural group do you mainly identify with?	q1581 – What is the highest level of education you have completed? 1 Less than high school 2 Completed high school 3 Some college or university 4 Completed college or university 5 Don't know 6 Refused	q1606 – Which of the following categories best describes your combined household income? 1 Less than $10,000 2 Less than $20,000 3 Less than $30,000 4 Less than $40,000 5 Less than $50,000 6 Less than $60,000 7 Less than $70,000 8 $70,000 or more 9 Don't know / Refused
Newfoundland	age_nfl – Age categories you belong? 1 19-24 2 25-34 3 35-44 4 45-54 5 55-64 6 65+ 99 Refusal	q64m1_nfl to q64m9_nfl – To what ethnic or cultural group did you or your ancestors belong on first coming to this county? (Multiple answers accepted)	q59_nfl – Which of the following best describes the highest level of education you have completed? 1 Some high school/junior high or less 2 Completed high school 3 Some post secondary school 4 Completed post secondary school 5 Completed post graduate education 98 DK/NA	Q62_nfl – Which of the following broad categories best describes how much income you and other members of your household received in the year ending December 31, 2004? Include income from all sources (i.e. savings, pensions, rent, employment) 1 $20,000 or less 2 $20,001 to $30,000 3 $30,001 to $40,000

			99 Refusal	4 $40,001 to $50,000 5 $50,001 to $60,000 6 $60,001 to $70,000 7 $70,001 to $80,000 8 $80,001 to $90,000 9 $90,001 to $100,000 10 More than $100,000 98 Don't Know/No Answer 99 Refusal
National	q1382 – Respondent's year of birth 99998 DK 99999 Refused Respage - age	q1404 – Ethnic/Cultural group first mention q1405 – Ethnic/Cultural group second mention q1406 In addition to being Canadian, what ethnic group or cultural group	q1575 – Highest level of education completed 1 No schooling 2 Some Elementary School 3 Completed elementary school 4 Some high school/jr high 5 Completed high school 6 Some community college 7 Some technical school 8 Completed community college 9 Completed technical school 10 Some university 11 Completed Bachelor's degree 12 Completed Master's degree 13 Completed Doctoral degree 14 Professional degree 98 DK 99 Refused	q1601 – Total household income (thousands) 999998 DK 999999 Refused q1603 – Total household income (categories) 1 <$20,000 2 $20,000 - $29,999 3 $30,000 - $39,999 4 $40,000 - $49,999 5 $50,000 - $59,999 6 $60,000 - $69,999 7 $70,000 - $79,999 8 $80,000 - $89,999 9 $90,000 - $99,999 10 $100,000 - $120,000 11 $120,000 - $150,000 12 $150,000+ 98 DK 99 Refused

Appendix D. Copy of the CPGI used in the CCHS-1.2 survey

PATHOLOGICAL GAMBLING

People have different definitions of gambling. They may bet money and gamble on many different things, including buying lottery tickets, playing bingo or playing card games with their family or friends.

The next questions are about gambling activities and experiences. Some of these questions may not apply to you, however they need to be asked of all respondents.

CPGB_01A **In the past 12 months, how often have you bet or spent money on instant win/scratch tickets or daily lottery tickets (Keno, Pick 3, Encore, Banco, Extra)?**

INTERVIEWER: Read categories to respondent. Exclude all other kinds of lottery tickets such as 6/49, Super 7, sports lotteries and fund raising tickets.

1 Daily
2 Between 2 to 6 times a week
3 About once a week
4 Between 2 to 3 times a month
5 About once a month
6 Between 6 to 11 times a year
7 Between 1 to 5 times a year
8 Never
DK, R

CPG_C01A If CPG_Q01A = R, go to CPG_ND.
Otherwise, go to CPG_Q01B.

CPG_Q01B **(In the past 12 months,) how often have you bet or spent money on lottery tickets such as 6/49 and Super 7, raffles or fund–raising tickets?**
1 Daily
2 Between 2 to 6 times a week
3 About once a week
4 Between 2 to 3 times a month
5 About once a month
6 Between 6 to 11 times a year
7 Between 1 to 5 times a year
8 Never
DK, R
****remaining game frequency questions use the same scale**

CPG_Q01C **(In the past 12 months,) how often have you bet or spent money on Bingo?**

CPG_Q01D **(In the past 12 months,) how often have you bet or spent money playing cards or board games with family or friends?**

CPG_Q01E **(In the past 12 months,) how often have you bet or spent money on video lottery terminals (VLTs) outside of casinos?**

CPG_Q01F **(In the past 12 months,) how often have you bet or spent money on coin slots or VLTs at a casino?**

CPG_Q01G **(In the past 12 months,) how often have you bet or spent money on casino games other than coin slots or VLTs (for example, poker, roulette, blackjack, Keno)?**

CPG_Q01H **(In the past 12 months,) how often have you bet or spent money on Internet or arcade gambling?**

CPG_Q01I **In the past 12 months, how often have you bet or spent money on live horse racing at the track or off track?**

CPG_Q01J **(In the past 12 months,) how often have you bet or spent money on sports such as sports lotteries (Sport Select, Pro-Line, Mise-au-jeu, Total), sports pool or sporting events?**

CPG_Q01K **(In the past 12 months,) how often have you bet or spent money on speculative investments such as stocks, options or commodities?** INTERVIEWER: Speculative investments refers to buying high-risk stocks, but does not include low-risk bonds, RRSPs and/or mutual funds.

CPG_Q01L **In the past 12 months, how often have you bet or spent money on games of skill such as pool, golf, bowling or darts?**

CPG_Q01M **(In the past 12 months,) how often have you bet or spent money on any other forms of gambling such as dog races, gambling at casino nights/country fairs, bet on sports with a bookie or gambling pools at work?**

CPG_Q01N **In the past 12 months, how much money, not including winnings, did you spend on all of your gambling activities?** INTERVIEWER: Read categories to respondent.
1 **Between 1 dollar and 50 dollars**
2 **Between 51 dollars and 100 dollars**
3 **Between 101 dollars and 250 dollars**
4 **Between 251 dollars and 500 dollars**
5 **Between 501 dollars and 1000 dollars**
6 **More than 1000 dollars**
DK, R

The next questions are about gambling attitudes and experiences. Again, all the questions will refer to the past 12 months.

INTERVIEWER: Press <Enter> to continue.

CPG_Q02 **In the past 12 months, how often have you bet or spent more money than you wanted to on gambling?** INTERVIEWER: Read categories to respondent.
1 **Never**
2 **Sometimes**
3 **Most of the time**
4 **Almost always**
5 **I am not a gambler** (Go to CPG_ND)
DK
R (Go to CPG_ND)
****remaining problem questions use the same scale**

CPG_Q03 **(In the past 12 months), how often have you needed to gamble with larger amounts of money to get the same feeling of excitement?**

CPG_Q04 (**In the past 12 months), when you gambled, how often did you go back another day to try to win back the money you lost?**

CPG_Q05 **In the past 12 months, how often have you borrowed money or sold anything to get money to gamble?**

CPG_Q06 **(In the past 12 months,) how often have you felt that you might have a problem with gambling?**

CPG_Q07 **(In the past 12 months,) how often has gambling caused you any health problems, including stress or anxiety?**

CPG_Q08 **(In the past 12 months,) how often have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?**

CPG_Q09 **(In the past 12 months,) how often has your gambling caused financial problems for you or your family?**

CPG_Q10 **In the past 12 months, how often have you felt guilty about the way you gamble or what happens when you gamble?**

CPG_Q11 **(In the past 12 months,) how often have you lied to family members or others to hide your gambling?**

CPG_Q12 **(In the past 12 months,) how often have you wanted to stop betting money or gambling, but didn't think you could?**

CPG_Q13 **In the past 12 months, how often have you bet more than you could really afford to lose?**

CPG_Q14 (**In the past 12 months), have you tried to quit or cut down on your gambling but were unable to do it?**

CPG_Q15 (**In the past 12 months,) have you gambled as a way of forgetting problems or to feel better when you were depressed?**

CPG_Q16 **(In the past 12 months,) has your gambling caused any problems with your relationship with any of your family members or friends?**

Appendix E. CCHS-1.2 Questions on Mental Disorders

CCHS-1.2 Questions on:

Self-Perceived Health

Variable Name GENB_01
Question Name GEN_Q01
Concept Self-perceived health
Question In general, would you say your health is: (excellent, very good, good, fair or poor)?
Length 1
Universe All respondents
Note
Position 17

Self-Perceived Stress

Variable Name GENB_07
Question Name GEN_Q07
Concept Self-perceived stress
Question Thinking about the amount of stress in your life, would you say that most days are: (not at all stressful, not very stressful, a bit stressful, quite a bit stressful, extremely stressful)?
Length 1
Universe All respondents
Note
Position 24

Psychological Well-Being

1) **Psychological Well-Being Manifestation Scale (WBMMS)**
2) **Variable Name:** PWBBDPWB

Based on: PWBB_01, PWBB_02, PWBB_03, PWBB_04, PWBB_05, PWBB_06, PWBB_07, PWBB_08, PWBB_09, PWBB_10, PWBB_11, PWBB_12, PWBB_13, PWBB_14, PWBB_15, PWBB_16, PWBB_17, PWBB_18, PWBB_19, PWBB_20, PWBB_21, PWBB_22, PWBB_23, PWBB_24, PWBB_25

Description: This scale, which assesses psychological well-being, is based on the proposed questions from Raymond Massé. Higher scores indicate greater well-being.

Source: Raymond Massé (Laval University)
"Élaboration et validation d'un outil de mesure du bien-être psychologique : L'ÉMMBEP" R. Massé, C. Poulin, C. Dassa, J. Lambert, S. Bélair, M.A. Battaglini. Revue Canadienne de Santé Publique, Vol. 89. No. 5, pp. 352-357.
Respondent's score on the psychological well-being scale. Higher values indicate higher wellbeing.

Variable Name PWBB_01
Question Name PWB_Q01
Concept Frequency - felt self-confident - past month
Question During the past month, you felt self-confident.

Variable Name PWBB_02
Question Name PWB_Q02
Concept Frequency - satisfied with accomplishments - past month
Question During the past month, you felt satisfied with what you were able to accomplish, you felt proud of yourself.

Variable Name PWBB_03
Question Name PWB_Q03
Concept Frequency - took on lots of projects - past month
Question (During the past month,) you were a "go-getter", you took on lots of projects.

Variable Name PWBB_04
Question Name PWB_Q04
Concept Frequency - felt emotionally balanced - past month
Question (During the past month,) you felt emotionally balanced.

Variable Name PWBB_05
Question Name PWB_Q05
Concept Frequency - felt loved and appreciated - past month
Question (During the past month,) you felt loved and appreciated.

Variable Name PWBB_06
Question Name PWB_Q06
Concept Frequency - had goals and ambitions - past month
Question (During the past month,) you had goals and ambitions.

Variable Name PWBB_07
Question Name PWB_Q07
Concept Frequency - felt like having fun - past month
Question (During the past month,) you felt like having fun, participating in sports and all your favourite activities and hobbies.

Variable Name PWBB_08
Question Name PWB_Q08
Concept Frequency - felt useful - past month
Question During the past month, you felt useful.

Variable Name PWBB_09
Question Name PWB_Q09
Concept Frequency - smiled easily - past month
Question (During the past month,) you smiled easily.

Variable Name PWBB_10
Question Name PWB_Q10
Concept Frequency - was true to self - past month
Question (During the past month,) you were true to yourself, being natural at all times.

Variable Name PWBB_11
Question Name PWB_Q11
Concept Frequency - did good job listening to friends - past month
Question (During the past month,) you did a good job of listening to your friends.

Variable Name PWBB_12
Question Name PWB_Q12
Concept Frequency - was curious and interested - past month
Question (During the past month,) you were curious and interested in all sorts of things.

Variable Name PWBB_13
Question Name PWB_Q13
Concept Frequency - was able to clearly sort things out - past month
Question (During the past month,) you were able to clearly sort things out when faced with complicated situations.

Variable Name PWBB_14
Question Name PWB_Q14
Concept Frequency - found life exciting - past month
Question (During the past month,) you found life exciting and you wanted to enjoy every moment of it.

Variable Name PWBB_15
Question Name PWB_Q15
Concept Frequency - life was well-balanced - past month
Question (During the past month,) your life was well-balanced between your family, personal and professional activities.

Variable Name PWBB_16
Question Name PWB_Q16
Concept Frequency - was calm and level-headed - past month
Question During the past month, you were quite calm and level-headed.

Variable Name PWBB_17
Question Name PWB_Q17
Concept Frequency - easily found answers - past month
Question (During the past month,) you were able to easily find answers to your problems.

Variable Name PWBB_18
Question Name PWB_Q18
Concept Frequency - got along well with others - past month
Question (During the past month,) you got along well with everyone around you.

Variable Name PWBB_19
Question Name PWB_Q19
Concept Frequency - lived at normal pace - past month
Question (During the past month,) you lived at a normal pace, not doing anything excessively.

Variable Name PWBB_20
Question Name PWB_Q20
Concept Frequency - impression of enjoying life - past month
Question (During the past month,) you had the impression of really enjoying life.

Variable Name PWBB_21
Question Name PWB_Q21
Concept Frequency - had good sense of humour - past month

Question (During the past month,) you had a good sense of humour, easily making your friends laugh.

Variable Name PWBB_22
Question Name PWB_Q22
Concept Frequency - was at peace with self - past month
Question (During the past month,) you felt good, at peace with yourself.

Variable Name PWBB_23
Question Name PWB_Q23
Concept Frequency - felt healthy/in good shape - past month
Question (During the past month,) you felt healthy and in good shape.

Variable Name PWBB_24
Question Name PWB_Q24
Concept Frequency - face situations positively - past month
Question (During the past month,) you were able to face difficult situations in a positive way.

Variable Name PWBB_25
Question Name PWB_Q25
Concept Frequency - had good morale - past month
Question (During the past month,) your morale was good.

Variable Name PWBBDPWB
Question Name
Concept Psychological well-being scale - past month - (D)
Question

Mood Disorders

The questions on mood disorders were modified for the CCHS-1.2 from the World Mental Health version of the Composite International Diagnostic Interview (WMH-CIDI). The WMH-CIDI is a standardized method of assessment for mental disorders, operationalized to the DSM-IV criteria. For the purposes of the CCHS-1.2 measured mood disorders were major depression episodes and manic episodes. 12-month diagnoses of mood disorders were used for the purposes of these analyses to match the time period of gambling questions asked.

Anxiety Disorders

Three anxiety disorders were assessed using the WMH-CIDI questionnaire adapted for the CCHS -1.2: agoraphobia, panic disorder, and social phobia. The presence of any one of these disorders in the past 12 months classified a person as having a 12-month diagnosis of any anxiety disorder. Again, the 12-month diagnosis was used to align with the time-period assessed in the relevant gambling variables.

Substance Dependence

Any substance dependence was diagnosed in the CCHS-1.2 version of the WMH-CIDI as dependence of alcohol or illicit drugs in the past 12 months. At least one dependency qualified a person to be placed into this category. Data was only collected for the previous 12 months in the CCHS-1.2, and this data was used for all relevant comparisons.

Appendix F. Expert Opinion Survey

Dear Colleague,

We are working on a project to evaluate the psychometric properties and utility of the Canadian Problem Gambling Index (CPGI). The CPGI has become the most widely used measurement tool in Canada for assessing risk of problem gambling. It has been used in numerous population surveys, research studies, and in some cases in clinical settings. The CPGI is
also used in other countries including Australia, Iceland, and Norway. The main quantitative scale in the CPGI is the Problem Gambling Severity Index (PSGI), which is scored by summing the item totals for nine consequences and behavioural symptoms of problem gambling.

As one component of a larger study, we are seeking the opinions of researchers, clinicians, and policy makers on the PGSI and its scoring system. The purpose of the study is to determine if the PGSI, in its present form, provides a valid and reliable index of problem gambling severity or whether improvements are needed to the scale. You do not need to be familiar with the CPGI to complete this survey. Our main interest is your opinion on how well the consequences and symptoms of
problem gambling being assessed by the PGSI reflect problem gambling severity at different levels. The results should provide some insight on the relative weighting of each item toward the total score.

The online survey should take you less than 10 minutes to complete. It can be found at
http://www.surveymonkey.com/s/RG9TGRZ

If you would prefer to complete the survey by hand, a paper copy is attached. It can be mailed to:

Dr. Shawn Currie
Alberta Health Services - Information Management, Evaluation & Research Unit
10101 Southport Rd SW
Calgary, AB
T2W 3N2
Canada

Unfortunately, there is no direct compensation for participating. We will have a draw for a $100 gift certificate for Amazon.com (or the local book distributor of your choice); just enter your email address at the end of the survey to be entered in this draw. We can also send all participants a summary report of the results.

This project is funded by the Canadian Centre on Substance Abuse.

Sincerely,

Shawn Currie, Ph.D.
University of Calgary
scurrie@ucalgary.ca

PGSI Survey

Thanking for taking this survey on the Canadian Problem Gambling Index (CPGI). It should only take about 10 minutes to complete. Please try to answer all the questions.

Opinions on Scoring Weights

The main quantitative scale in the CPGI is the Problem Gambling Severity Index (PSGI), which is scored by summing the item totals for nine symptoms of problem gambling. The response choices for each item are never, sometimes, most of the time, and almost always. The time frame for all items is the past 12 months.

For each PGSI item-severity level combination, rate on a scale of 1 to 4 the degree to which the response is indicative of a gambler experiencing problems. Please rate each level of severity: sometimes, most of the time, and almost always.

Choose circle a response for each line.

1. (In the past 12 months…) have you bet more than you could really afford to lose?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

2. Have you needed to gamble with larger amounts of money to get the same feeling of excitement

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

3. Have you borrowed money or sold anything to get money to gamble?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

4. When you gambled, did you go back another day to try to win back the money you lost?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

5. Have you felt that you might have a problem with gambling?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

6. Has gambling caused you any health problems, including stress or anxiety?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

7. Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

8. Has your gambling caused any financial problems for you or your household?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

9. Have you felt guilty about the way you gamble or what happens when you gamble?

	A response at this level **likely indicates no gambling problem**	A response at this level **likely indicates a mild gambling problem**	A response at this level **likely indicates a moderate gambling problem**	A response at this level **likely indicates a severe gambling problem**
"Sometimes"	1	2	3	4
"Most of the time"	1	2	3	4
"Almost always"	1	2	3	4

Classify each of the following symptoms as being a core aspect of problem gambling (i.e., a defining symptom one would expect to see in all problem gamblers), an indicator of problem gambling (i.e., a symptom that may indicate a gambling disorder is present but may not be observed in all gamblers), or neither (i.e., would be see infrequently in problem gamblers):

	Choose (✓) only one		
Symptoms assessed by PGSI	**Core aspect**	**Indicator**	**Neither**
Betting more than one can really afford to lose	○	○	○
Needing to gamble with larger amounts of money to get the same feeling of excitement	○	○	○
Going back another day to try to win back the money lost	○	○	○
Borrowing money or selling anything to get money to gamble	○	○	○
Feeling that one might have a problem with gambling	○	○	○
Gambling causes any health problems, including stress or anxiety	○	○	○
People criticizing one's betting or being told one has a gambling problem, regardless of whether or not they thought it was true	○	○	○
Gambling caused any financial problems	○	○	○
Feeling guilty about the way one gambles or what happens while one is gambling	○	○	○

Which of the following symptoms would most expect to see in gamblers 'at risk' for developing a gambling disorder. [At-risk is defined here as an individual who is at greater risk of developing a gambling problem at some point in the future]. Multiple responses per line are allowed. For example, if you believe that experiencing financial problems could be present in both at risk and problem gamblers, check both boxes.

	Check (✓) as many as apply		
Indicators	**Likely to be seen in recreational gamblers**	**Likely to be seen in 'at risk' gamblers**	**Likely to be seen in problem gamblers**
Betting more than one can really afford to lose	○	○	○
Needing to gamble with larger amounts of money to get the same feeling of excitement	○	○	○
Going back another day to try to win back the money lost	○	○	○
Borrowing money or selling anything to get money to gamble	○	○	○
Feeling that one might have a problem with gambling	○	○	○
Gambling causes any health problems, including stress or anxiety	○	○	○
People criticizing one's betting or being told one has a gambling problem, regardless of whether or not they thought it was true	○	○	○
Gambling caused any financial problems	○	○	○
Feeling guilty about the way one gambles or what happens while one is gambling	○	○	○
Gambling more than once per week	○	○	○
Spending more than 1% of one's gross family income on gambling	○	○	○
Spending more than $1000 per year on gambling	○	○	○

Rate your level of knowledge of the PGSI

I am not familiar with the CPGI or PGSI at all ○ ⇒ Skip to section "Tell us about yourself"
Excellent ○
Very good ○
Good ○
Minimal ○

Have you used the PGSI in any research projects?

No ○
Yes ○ ⇒ How many (including ones in development)_____

How many times have you used the PGSI clinically with gamblers?

Never ○
Rarely ○
Sometimes ○
Frequently ○

Rate how much you agree with the following statements.

	strongly disagree	disagree	neutral	agree	strongly agree
The PGSI is an effective tool for identifying **problem gamblers**	○	○	○	○	○
False positives (incorrectly identifying individuals as **problem gamblers**) are a concern with the PGSI	○	○	○	○	○
The PGSI is an effective tool for identifying persons at risk for **problem gambling**	○	○	○	○	○
False negatives (identifying individuals as **problem gamblers** when they do have a problem) are a concern with the PGSI	○	○	○	○	○
The PGSI is an effective tool for assessing low risk gambling	○	○	○	○	○
The total score on the PGSI (range 0 to 27) is a useful way of assessing severity of **problem gambling**	○	○	○	○	○
The scoring categories for the PGSI (0 = 'non-problem gambler;' 1 to 2 = 'low-risk;' 3 to 7 = 'moderate-risk;' 8 to 27 = 'problem-gambler') is a useful way of classifying level of **problem gambling** risk.	○	○	○	○	○
The PGSI could be improved by revising the scoring system.	○	○	○	○	○

Tell us about yourself:

1. What has been your primary position over the last 5 years? (Check only one)

Researcher ○
Clinician ○
Clinician-researcher ○
Administration ○
Policy maker ○
Other, specify: ○

2. What has been your primary work setting over the last 5 years?

University ○
Hospital ○
Community health/mental health clinic ○

Addiction treatment program ○
Government ○
Other, specify: ○

3. How many years have you been working in the field of gambling (treatment, research, policy)?

[ ] years

1. What is your educational background? (check highest level achieved)

Bachelor degree ○
Masters degree ○
Ph.D. ○
Medical doctor ○
Certificate/degree/diploma in addiction counseling ○
No formal degree/diploma ○
Other ○ ⇒ Specify: _____

5. Where are you based?

Canada ○
US ○
Other ○ ⇒ Specify: _____

6. a. Do you provide clinical services for gamblers as part of your job?

Yes ○
No ○

7. In what year were you born?

19[ ]

8. What is your gender?

Male ○
Female ○

Thank you for completing this survey!!

If you would like a copy of the results, please provide your e-mail address below:

E-mail	

If you would like to be included in the draw for the $100 gift card, please provide your e-mail address below:

E-mail	