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Evaluating the Problem Gambling Severity Index

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Abstract A large, integrated survey data set provided by the Ontario Problem Gambling Centre was used to investigate psychometric properties of the Problem Gambling Severity Index (PGSI). This nine-item self-report instrument was designed to measure a single, problem gambling construct. Unlike its nearest competitor—the South Oaks Gambling Screen (SOGS)—the PGSI was designed specifically for use with a general population rather than in a clinical context. The present analyses demonstrated that the PGSI does assess a single, underlying, factor, but that this is complicated by different, multiple factor structures for respondents with differing levels of problem gambling severity. The PGSI also demonstrated small to moderate correlations with measures of gambling frequency and faulty cognitions. Overall, the PGSI presents a viable alternative to the SOGS for assessing degrees of problem gambling severity in a non-clinical context.

Keywords Problem gambling · Problem Gambling Severity Index · South Oaks Gambling Screen · Assessment of problem gambling

Introduction

The rapidly increasing availability of gambling in North America has made the assessment of problem gambling (and the potential for problem gambling) a clear research priority. Particularly important are brief, self-report instruments that can be used for research purposes (e.g., epidemiological studies) as well as serving as an initial problem gambling screen in clinical contexts. Numerous measures have been developed in this regard (see National Research Council 1999; Abbott and Volberg 2006; Stinchfield et al. 2007) but the most well-known and frequently used measure has been the South Oaks Gambling Screen (SOGS) (Lesieur and Blume 1987). The SOGS and related measures were developed primarily for use as problem gambling screens in clinical contexts. More recently, however, alternative measures have been developed that were designed specifically for use with

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a general (rather than clinical) population. The purpose of the present research was to examine some of the psychometric properties of one of those measures, the Problem Gambling Severity Index (PGSI), a component of the Canadian Problem Gambling Inventory (CPGI).

South Oaks Gambling Screen (SOGS)

The starting point for the development of the SOGS was information provided by a group of problem gamblers regarding their behaviors, problems, attitudes, as well as their counselor's impressions of their gambling activities. This information served as the basis for the development of a set of questions that were then administered to a second group of patients. During this phase of the research, low frequency and redundant items were eliminated and a discriminant analysis reduced the number of items to 20. These items were then cross-validated on a relatively large group of pathological gamblers and an appropriate control, with the scale accurately classifying 97% of the pathological gamblers. These 20 items constituted the original SOGS. In this version, a lifetime time-frame was used for each question (e.g., Do you feel you have ever had a problem with gambling?); hence the scale could identify people as pathological gamblers even if they were in remission. This problem is avoided with alternative versions (SOGS-R) that use a twelve-month time-frame (Lesieur and Blume 1993).

The SOGS has been demonstrated to provide a reliable means of identifying people who are likely problem gamblers (Duvarci and Varan 2001; Lesieur and Blume 1987; Shaffer et al. 1999; Stinchfield 2002). Moreover, in clinical contexts its psychometric properties are adequate to good (Shaffer et al. 1999). However, the strategy used for developing the SOGS—specifically, its development in a clinical context—may limit its usefulness (Culleton 1989; Walker and Dickerson 1996). The reliance on problem gamblers for the generation of the SOGS items allowed for the development of a scale that captures important features of problem gambling, and in this way the SOGS is useful for identifying people who are currently problem gamblers. However, the SOGS does not include less severe behavioral items and hence may not do well at identifying people who are in the process of becoming problem gamblers (Strong et al. 2003). This is because the SOGS embodies a view of problem gambling as categorical rather than dimensional; with the SOGS, people are simply classified as problem gamblers or not. Similarly, the SOGS does not appear to perform well at identifying prevalence rates in a general populations; it tends to produce a relatively high number of false positives (Culleton 1989; but see Abbott and Volberg 1996).

Problem Gambling Severity Index (PGSI)

A recently developed alternative to the SOGS is the Problem Gambling Severity Index (PGSI), a subset of items from the Canadian Problem Gambling Inventory (CPGI). This instrument was constructed specifically to measure problem gambling in the general population. In this regard, the measure was more theoretically derived than the exclusively empirical approach guiding the development of the SOGS (Ferris and Wynne 2001; Ferris et al. 1999). The PGSI consists of nine items, four of which assess problem gambling behaviors (How often have you bet more than you could afford to lose? [***Bet***]; How often have you needed to gamble with larger amounts of money to get the same feeling of excitement? [***Tolerance***]; How often have you gone back another day to try to win back the

money you lost? [***Chase***]; How often have you borrowed money or sold anything to get money to gamble? [***Borrowed***]) and five that assess adverse consequences of gambling (How often have you felt you might have a problem with gambling?[***Felt problem***]; 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?[***Criticized***]; How often have you felt guilty about the way you gamble or what happens when you gamble?[***Felt guilty***]; How often has your gambling caused you any health problems, including stress or anxiety?[***Health problem***]; How often has your gambling caused any financial problems for you or your household?[***Financial problem***]). For each item, respondents answer on a four-alternative scale (0 = never, 1 = sometimes, 2 = most of the time, 3 = almost always).

It is important to note that there is considerable overlap between the PGSI items and the SOGS and DSM-based measures. Specifically, three of the gambling consequences items (Felt Problem, Criticized, Felt Guilty) were adopted from the SOGS; the two remaining consequences items (Health Problem; Financial Problem) were new and relatively unique to the PGSI. Two of the behavior items (Chasing; Tolerance) were reworded DSM items (a version of Chasing also appears on the SOGS). The Borrowing and Betting items were similar to SOGS items but different enough to deserve mention. The SOGS borrowing item refers to borrowing money to gamble and not paying it back; the PGSI items only refers to borrowing to gamble. In addition, the SOGS (but not the PGSI) contains a set of nine items that specify particular sources for borrowing money. The PGSI Bet item refers to betting more than one can afford to lose; the SOGS item refers to betting more than one intended.

Research on the PGSI has been limited. An initial report, however, indicated that it has fairly good psychometric properties (Ferris and Wynne 2001). In this initial study ($N = 3{,}120$), adequate reliability in terms of both internal consistency (alpha = .84) and test-retest reliability ($r = .78$) was reported. Evidence for validity was less clear. Respondents identified as problem gamblers did gamble more frequently and wagered larger amounts than moderate risk gamblers, who in turn gambled more frequently and wagered larger amounts than low-risk gamblers. These differences were not very large, however, and obtained levels of statistical significance were not reported. Clearly, more extensive evaluation of this measure with larger samples would be useful. Moreover, there are a number of unexamined and underexamined issues regarding the PGSI and the underlying construct that it purports to measure. The present research examined some of these issues using a combined data set made available by the Ontario Problem Gambling Research Centre.

The first issue concerned the factor structure of the PGSI. Specifically, does the PGSI tap a single, underlying factor? Theoretically, the PGSI was conceptualized as measuring a single, problem gambling factor (based, in part, on a continuum view of problem gambling), and initial analyses did provide support for a single factor (Ferris and Wynne 2001). Similarly, the nine PGSI items should correlate highly with one another (reflecting that single underlying factor) and hence result in high internal consistency (alpha coefficients).

A second and related issue is whether this single factor structure would emerge for groups of individuals differing on the problem gambling dimension. That is, would a single factor emerge when the analysis was limited to non-problem gamblers? This is an important issue and one that requires a relatively large sample to test. The present data set afforded such an opportunity. If the PGSI reflects a single underlying gambling continuum, and if the PGSI items all contribute in a roughly equal manner to its assessment, then the same factor should emerge for groups that vary in gambling severity. Similarly, the intercorrelations between the PGSI items should be roughly the same for these groups.

On the other hand, it is possible that some items are more indicative of certain levels of gambling behavior, and if that is the case, then different factor structures could emerge. To examine this, separate factor analyses were conducted for groups varying in gambling severity. This issue was also examined by evaluating the distribution of responses for each PGSI item as a function of problem gambling severity.

The final issue concerned the construct validity of the PGSI. One way to assess the construct validity of a measure of problem gambling is by examining its correlation with a behavioral measure of gambling such as gambling frequency (Ferris and Wynne 2001; Kuley and Jacobs 1988; Walters 1997). Most of the CPGI surveys contained items regarding the frequency with which respondents played a variety of different games.[1] Construct validity would be demonstrated if there were modest positive correlations between problem gambling (PGSI scores) and reported gambling frequency. Accordingly, sets of analyses were conducted that computed the correlations between various gambling frequency measures and several different problem gambling measures (PGSI scores as a continuous variable, PGSI treated categorically, abbreviated version of the PGSI).

Method

All analyses used the combined CPGI data set that was made available by the Ontario Problem Gambling Research Centre. This data consisted of responses from participants (18 years and older) in telephone surveys conducted in several different Canadian provinces between 2001 and 2005. Information regarding the separate samples is presented in Table 1. Included in this table are references for each survey that may be consulted for further methodological details. These surveys were created and conducted independently and hence differ in terms of sampling procedure and item content. However, each survey (with one exception) contained the nine PGSI items worded in an identical manner. The one exception was the National survey in which a dichotomous (rather than four-response) format was used for two of the PGSI items. Data from the National survey were excluded from all analyses that involved all PGSI items. Each survey also contained a subset of the CPGI items, although there was some variability in the wording of these items. For the present analyses, data were combined across surveys only when identical wording was employed (e.g., measures of gambling frequency). This resulted in the exclusion of data from some surveys. The wording of CPGI items used in the analyses is presented in the Results section.

Each survey used a random sampling procedure with various constraints (e.g., stratified by region) in order to approximate the demographic breakdown for that area. However, the specific rules for inclusion varied over surveys resulting in samples with different characteristics. An example of this is the fact that the reported response rates for the surveys varied widely (between 63. 6% for Alberta and 37% for Ontario, 2001), due, in part, to differing criteria for defining nonresponses. These different sampling procedures introduce error variance into the combined survey data and hence the results need to be interpreted with this in mind. At the same time, none of the analyses reported here involved any type of between-survey comparison, and hence the different survey procedures do not constitute an alternative explanation for any of the results reported here.

[1] Most surveys also contained items assessing amount spent gambling. However, question wording for these items varied considerably over surveys and hence it was not possible to use them.

Table 1 Surveys included in combined data set

Province	Year	*N*	Reference
National	2001	3,120	Ferris and Wynne (2001)
Alberta	2002	1,804	Smith and Wynne (2002)
Ontario	2001	4,631	Wiebe et al. (2001)
Ontario	2005	3,604	Wiebe et al. (2006)
Manitoba	2002	3,119	Patton et al. (2002)
British Columbia	2003	2,500	Ipsos-Reid and Gemini Research (2003)
Newfoundland	2005	2,597	Market Quest Research Group (2005)

Results

Unless otherwise noted, all reported analyses were based on participants who indicated that they had gambled at least once in the past 12 months. For most analyses this resulted in an overall *N* of 12,299. All analyses were performed with SPSS (version 15) and listwise deletion was used in order to keep the sample size consistent over analyses. Still, Ns did vary over some analyses because not all questions were included in all surveys. Table 2 presents the demographic breakdown for this sample. Following convention, respondents were classified into gambling subtypes based on their PGSI scores (summed responses to the nine PGSI items) as follows: 0 = non-problem gambler; 1–2 = low risk gambler, 3–7 = moderate risk gambler, 8 and over = problem gambler.

Table 2 Selected sample characteristics

	N	Percent
Gender		
Male	5,980	48.6
Female	6,319	51.4
Age		
18–24	1,184	9.6
25–34	2,217	18
35–44	2,760	22.4
45–54	2,627	21.4
55–64	1,748	14.2
65+	1,595	13
Refused	168	1.4
Province		
Alberta	1,472	12
British Columbia	2,126	17.3
Manitoba	570	4.6
Newfoundland	2,149	17.5
Ontario (2001)	3,734	30.4
Ontario (2005)	2,248	18.3
National	3,120	0.0[a]

Note: Excludes nongamblers

[a] Not included in most analyses because a dichotomous response format was used for two of the PGSI items

Factor Structure and Internal Consistency

Factor Analysis

A principal components analysis (PCA) was conducted on the entire sample, followed by analyses conducted separately for each gender and province. For the overall analysis, the PCA yielded a single factor with an eigenvalue greater than 1 (4.44) accounting for 49.44% of the variance. Factor loadings (see Table 3) all exceeded .63 and ranged between .634 (Borrow money to gamble) and .792 (Felt gambling was a problem and Gambling has caused financial problems). This factor structure replicated in the analyses conducted separately for males and females and for each province.

Separate analyses were conducted also for each gambling subtype (low risk, moderate risk, problem gambler). In contrast to the overall analysis, these analyses yielded multiple factor structures. In general, as problem gambling severity increased, the number of factors with eigenvalues greater than 1 decreased. For low risk gamblers, there were six factors with eigenvalues greater than 1 (and eight with eigenvalues greater than .9) indicating the lack of any clear factor structure. For the moderate risk group there were four factors with eigenvalues greater than 1, and for the problem gambling group there were three factors with eigenvalues greater than one. For the latter subgroup, a quartermax rotation resulted in a readily interpretable structure with the first factor tapping awareness of the existence of a gambling problem (feel it's a problem, .61; causes health problems, .72; causes financial problems, .57; criticized for gambling, .72), the second factor tapping dysfunctional behaviors (increased tolerance, .62; chasing, .74; borrowed/sold to get gambling money, .79), and a third factor consisting of two related items (bet more than could afford, .73; felt guilty about gambling, .70).

As a point of comparison, a parallel factor analysis was conducted with the 20 SOGS items.[2] Note that the PGSI and SOGS analyses are not directly comparable due to the considerably reduced sample size ($N = 3{,}283$) for the latter relative to the former ($N = 12{,}299$). In contrast to the PGSI, factor analysis of the SOGS yielded four factors with eigenvalues greater than 1. The first factor was comprised of items pertaining to borrowing money and losing time at work school. The second factor included a cluster of six behavior items (guilty, criticized, gambled more than could afford, felt gambling a problem, and chased) and household borrowing. The third factor contained two items (borrowing from bank; borrowing from credit card). And the fourth factor contained two behavior items (can't control, hide gambling evidence). These results are consistent with previous reported factor analyses suggesting that the SOGS taps several underlying dimensions related to problem gambling behavior (Oliveira et al. 2002; Stinchfield 2002).

Reliability

Coefficient alpha for the total sample was .855 and corrected item-total correlations ranged between .53 and .70 (see Table 3). Hence, internal consistency based on the entire sample was quite good. However, similar to the results of the factor analyses, these values changed when gambling subgroups were analyzed separately. Specifically, the alpha coefficients were negative for the low risk (−4.959) and moderate risk (−1.83) groups due to the

[2] There was only one survey (British Columbia) that contained both PGSI and SOGS items. Consistent with prior research (Ferris and Wynne 2001), there was a moderately high correlation between the SOGS and the PGSI ($r = .80$, $N = 2{,}126$) in this sample.

Table 3 Factor loadings and item-total correlations for all PGSI items

Item	Loading	Corrected item-total correlation
Bet	.66	.57
Tolerance	.68	.59
Chasing	.66	.56
Borrow	.63	.53
Felt problem	.79	.70
Health problem	.70	.60
Financial problem	.79	.70
Criticized	.68	.58
Felt guilty	.69	.60

negative correlations between items for these groups.[3] In contrast, for the problem gambling group the correlations between items were all positive and the alpha coefficient was .726. For problem gamblers the items correlate indicating a single pathological construct is being assessed and hence a single factor emerges. For everyone else, the scale is not assessing a single construct but rather a set of discrete items that are not necessarily correlated with each other.

Item Responses Across Gambling Subtypes

In order to examine the performance of each item further, responses to each of the nine PGSI items were analyzed as a function of gambling subtype. These analyses (presented in Table 4) were conducted twice, once based on respondents' original responses on the four-point scale (presented as means in Table 4), and once based on whether respondents answered affirmatively (i.e., sometimes, most of the time, or almost always) to an item regardless of frequency (presented as percentages in Table 4 and Fig. 1).

The variances differed over gambling groups (and the size of each group differed widely), and Levene's test for the equality of variances was significant for each item (all $ps < .01$). Because of this violation of the homogeneity of variance assumption, Welch's F was computed. There was a significant effect of gambling type for each PGSI item (all $Fs > 187$), and follow-up post-hoc tests (using Duncan's C) indicated that all means were significantly different ($p < .05$) from one another. Similarly, the percentage of respondents answering an item affirmatively (regardless of frequency) varied significantly over gambling subtype (all $\chi^2 > 200$), and each of the differences between subgroups was significant. These analyses demonstrate clearly that each of the nine PGSI items discriminates between gambling subgroups.

As can be seen in Fig. 1, the ordering of the endorsement of the nine items, with some exceptions to be noted, was relatively consistent over gambling subtypes. However, the items were clearly not endorsed at an equal rate. For all but the problem gamblers, the three most frequently endorsed items were chasing losses, feeling guilty about gambling, and betting more than one intended. For low-risk gamblers, these items were far more likely to be endorsed (26.2%–31.7%) than the other six items (all endorsed at less than 10%).

[3] A common misconception about alpha is that it can only vary between 0 and 1.0 (Streiner, 2003). However, if the correlations between some of the items are negative, than negative alphas can result, as in the present case.

Table 4 Responses to PGSI by gambling subtype

Item	Gambling subgroup		
	Low risk (1270)	Moderate risk (490)	Problem (147)
Chasing mean	.322	.769	1.73
Percent Yes	31.7%	52.7%	86.4%
Felt guilty mean	.291	.767	1.90
Percent Yes	28.3%	54.5%	90.5%
Bet mean	.276	.896	1.94
Percent Yes	26.2%	55.5%	91.2%
Tolerance mean	.102	.390	1.36
Percent Yes	9.9%	30.6%	70.7%
Criticized mean	.082	.357	1.35
Percent Yes	8.0%	27.3%	70.1%
Felt problem mean	.049	.349	1.69
Percent Yes	4.9%	28.6%	87.1%
Health problem mean	.075	.304	1.22
Percent Yes	7.2%	23.9%	66.7%
Financial problem mean	.026	.196	1.39
Percent Yes	2.6%	18.0%	76.2%
Borrow mean	.035	.120	.816
Percent Yes	3.5%	10.6%	48.3%

A similar gap between the top three items (52.7%–55.5%) and remaining six items (less than 31%) existed for the moderate-risk gamblers. In contrast, item endorsement was relatively more evenly distributed over the items for problem gamblers. Also, problem gamblers differed from the other subtypes in that the Felt like gambling was a problem item was the third most frequently endorsed item (it was sixth or lower for the other groups). The fact that the responses to the nine items were not distributed evenly (for all but the problem gamblers) is consistent with the lack of correlation between these items for these groups. This issued is addressed in more detail in the discussion.

Construct Validity

Gambling Frequency

The CPGI contains items allowing for some limited assessment of the construct validity of the PGSI. One set of questions that were common to most surveys assessed the reported frequency of participation in a variety of gambling activities. Two sets of analyses were conducted. In one set of analyses (similar to that reported in Ferris and Wynne 2001) the mean frequency (0 = Never, 1 = Less than once a month; 2 = At least once a month; 3 = At least once a week; 4 = Daily) with which respondents reported engaging in certain gambling activities (lottery, horse race betting, internet gambling, bingo, raffles, sports betting, slots, bookie) was examined as a function of gambling subtype. A composite frequency measure was computed as well: mean gambling frequency over all gambling items. A second set of analyses examined the percentage of respondents in each gambling

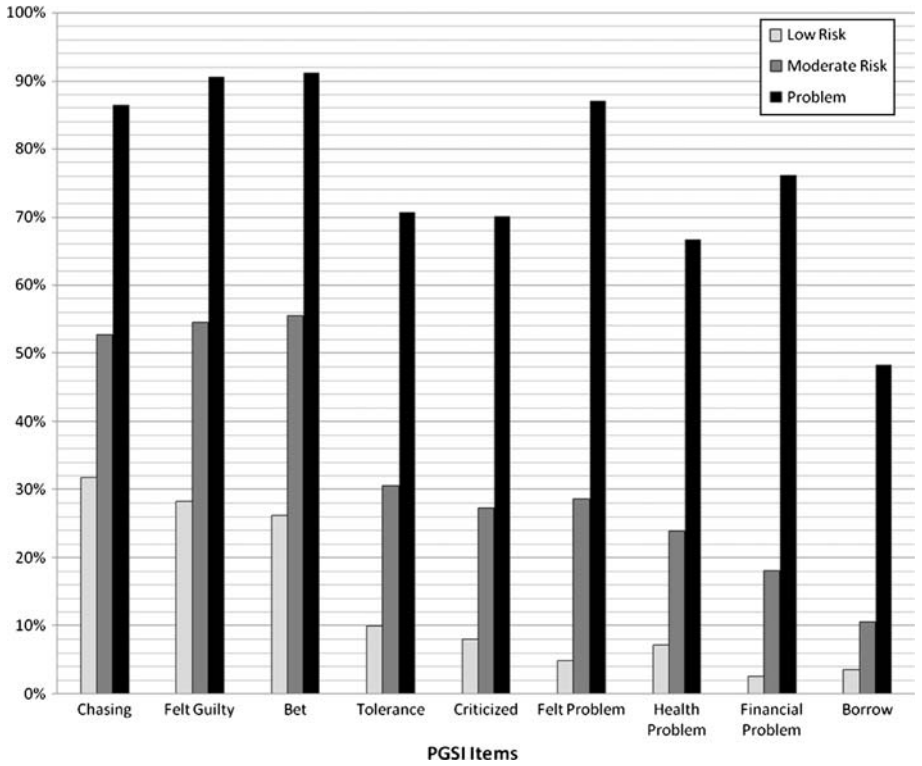

Fig. 1 Percentage of gambling subtypes endorsing each PGSI item

subtype who reported engaging in each gambling activity (regardless of frequency) during the past year. These two analyses are presented in Table 5.

The standard deviations for all gambling frequency measures differed over gambling groups (and the size of each group differed widely), and Levene's test for the equality of variances was significant for each activity (all $ps < .01$). Because the homogeneity of variance assumption was violated, Welch's F was computed and is reported in Table 5 (Duncan's C was used for all post-hoc tests.) There was a significant effect of gambling type for each gambling frequency measure with the exception of playing raffles. However, follow-up post-hoc tests indicated that not all means were significantly different from one another (see Table 5). Importantly, for each activity (with the exception of raffles) there was a significant difference between the nonproblem gamblers and each of the other three gambling subtypes. In other words, for each gambling activity, non-problem gamblers gambled significantly less often than respondents in the low risk, moderate risk, and problem gambling groups. In contrast, gambling frequency did not always differ significantly among the latter three groups. One exception to this general trend occurred for betting on horses and sports. For both activities, problem gamblers reported significantly greater frequency of both activities relative to the other gambling subtypes. Importantly, the difference between the gambling subtypes was significant for the overall measure of gambling frequency.

As can be seen in Table 5, results for the percentage of respondents engaging in each gambling activity generally parallel the results for the frequency of gambling participation.

Table 5 Gambling frequency as a function of gambling subtype

Activity	Gambling subgroup				F/χ^2
	Nonproblem	Low risk	Moderate	Problem	
Lottery (n)	6,304	774	291	79	
M	.54[a]	.82[b]	1.18[c]	1.23[c]	51.32**
SD	(.83)	(1.03)	(1.18)	(1.34)	
%	35.7[a]	46.7[b]	58.2[c]	58.4[c]	118.88**
Raffle (n)	9,926	1,178	448	125	
M	.65	.64	.64	.69	<1
SD	(.64)	(.70)	(.73)	(.82)	
%	58.3[a]	54.0[b]	52.4[b]	51.8[b]	14.2**
Horses (n)	9,965	1,183	451	126	
M	.05[a]	.12[b,c]	.17[c,d]	.30[d]	19.35**
SD	(.27)	(.41)	(.52)	(.76)	
%	4.9[a]	9.2[b,c]	11.0[c,d]	18[d]	109.89**
Bingo (n)	9,960	1,184	451	126	
M	.14[a]	.32[b]	.45[c]	.52[b,c]	41.82**
SD	(.50)	(.78)	(.95)	(.94)	
%	9.0[a]	17.6[b,c]	23.8[c,d]	31.1[d]	249.0**
Slots/VLT (n)	6,301	774	290	77	
M	.29[a]	.54[b]	.81[c]	1.16[c]	66.84**
SD	(.52)	(.72)	(.97)	(1.23)	
%	27.9[a]	45.6[b,c]	51.3[c,d]	62.1[d]	213.77**
Internet (n)	9,926	1,178	448	125	
M	.01[a]	.05[b]	.07[b]	.12[a,b]	8.1**
SD	(.17)	(.35)	(.41)	(.58)	
%	.8[a]	2.9[b]	3.4[b]	6.3[b]	81.69**
Sport seleck(n)	9,957	1,183	451	126	
M	.07[a]	.23[b]	.27[b]	.42[c]	35.62**
SD	(.36)	(.69)	(.77)	(.97)	
%	4.2[a]	12.2[b]	13.0[b]	18.6[b]	228.85*
Stocks (n)	9,953	1,182	447	125	
M	.09[a]	.22[b]	.21[b]	.24[a,b]	19.75**
SD	(.40)	(.64)	(.70)	(.72)	
%	8.4[a]	15.4[b]	13.1[b]	19.5[b]	68.68**
Bookie (n)	6,307	774	292	79	
M	.00[a]	.03[b]	.05[a,b]	.20[a,b]	6.16**
SD	(.31)	(.31)	(.37)	(.74)	
%	.2[a]	1.3[b,c]	2.6[c,d]	7.5[d]	130.01**
Total Freq.(n)	6,278	770	288	77	
M	1.76[a]	2.79[b]	3.70[c]	5.12[d]	102.25**
SD	(1.60)	(2.22)	(3.01)	(4.43)	

** $p < .01$ (two-tailed). Means that do not have a superscript in common are significantly different at $p < .05$ via Dunnett's C. The reported F is the Welch statistic

There was one interesting exception, however. A significantly greater percentage of nonproblem gamblers reported playing raffles than low-risk, moderate-risk, and problem gamblers.

Correlational Analyses

An additional set of analyses were conducted in which gambling frequency scores were correlated with PGSI scores (problem gambling treated as a continuous variable), gambling subtypes (problem gambling treated as a categorical variable), SOGS scores, and a subset of the three most frequently endorsed PGSI items (chase, bet, felt guilty). These results are presented in Table 6.

As can be seen in Table 6, the PGSI scores were significantly and positively correlated with frequency scores for each activity, again with the exception of Raffles. Even though significant, the correlations were not large and they ranged between .001 (Raffles) and .24 (casino slots). The correlation between total SOGS scores and each of these activities is also presented in this table. The correlations between the SOGS and each gambling frequency measure were smaller (but significant) than the corresponding PSGI-frequency correlations.

As noted above, a subset of PGSI items were endorsed at a much higher rate than the other items (at least for nonproblem gamblers). This suggests that these items may carry a disproportionate share of the weight in measuring problem gambling. Hence, it is possible that an abbreviated version of the scale consisting of the three items might perform as well as the full scale. To examine this possibility, responses to these three items were summed and served as an abbreviated problem gambling measure. Correlations between this measure and the gambling frequency measures were computed and are reported in Table 6. The correlations between the sum of these three items and the set of frequency measures (including the composite measure) were almost identical to the correlations with the full PGSI. In some instances, the correlation was actually higher for the subset than for the full PGSI (e.g., lottery, bingo, total frequency).

As a means of assessing the relative merits of treating the PGSI as a categorical versus continuous variable, correlations between the frequency measures and gambling subtype

Table 6 Correlations between gambling frequency and full PGSI (continuous and categorical), partial PGSI, and SOGS

Activity	Total PGSI Correlation	Categorical PGSI Correlation	SOGS Correlation	3-item PGSI
Lottery	.15**	.18**	.146**	.17**
Raffle	.001	−.004	.055**	.02
Horses	.10**	.116**	.086**	.095**
Bingo	.124**	.152**	.093**	.137**
Slots/VLT	.24**	.243**	.200**	.239**
Internet	.087**	.087**	.068**	.079**
Sport seleck	.115**	.15**	.110**	.119**
Stocks	.063**	.091**	.079**	.054**
Bookie	.14**	.137**	.110**	.109**
Total Freq.	.277**	.302**	.241**	.281**

** $p < .01$ (two-tailed)

categories (scored as 0–3) were computed. As can be seen in Table 6, treating problem gambling as a continuum did not explain a larger share of the variance in gambling frequency than did treating the PGSI categorically. In fact, for some activities it was less. This difference is notable given the built-in advantage that continuous measures have in this type of analysis. In short, this evidence provides support for an ordered, categorical view of problem gambling.

Faulty Cognitions

One important component of problem gambling is faulty beliefs regarding the nature of probability. Although the research is not entirely clear, there have been studies demonstrating that problem gamblers are more likely to demonstrate cognitive distortions than nonproblem gamblers (Griffiths 1994; Moore and Ohtsuka 1999). There are two CPGI items that assess beliefs about the probability of an outcome following a series of losses (i.e., gambler's fallacy) and the ability of systems to alter the outcome of chance events. Presented in Table 7 are the percentage of respondents in each gambling subtype that agreed (either agree or strongly agree) with the statement that one is more likely to win after a long sequence of losses (gamblers fallacy), and that one can improve one's chances by using a gambling system (system). Also included in the table are mean scores for the full response scale for each item (1 = Strongly Agree to 4 = Strongly Disagree). Chi squares were computed for the percentage measures, and Welch's F and Duncan's C for the means (again, due to violations of variance homogeneity).

There were significant effects for both cognitive measures. As can be seen in Table 7, belief in the gambler's fallacy and usefulness of gambling systems increased as problem gambling status increased. Hence, this provides additional support for the construct validity of the PGSI. Note, however, that the differences between subtypes were not all significant. As can be seen in Table 7, nonproblem gamblers were more likely to endorse these two items than were nongamblers, and all at-risk gamblers were more likely to endorse these beliefs than nonproblem gamblers. However, differences between low-risk, moderate risk, and problem gamblers were not significant.

Table 7 Faulty cognitions as a function of PGSI subtype

Cognition	Gambling subtype					
	Nongamblers (766)	Nonproblem (8087)	Low risk (997)	Moderate risk (369)	Problem (101)	($\chi 2/F$)
Gamblers fallacy						
Agree[a]	5.1%	9.3%	16%	23.9%	36.6%	208.4*
Mean	3.61[a]	3.34[b]	3.13[c]	3.04[c]	2.84[c]	65.32*
System belief						
Agree[b]	10.8%	17.7%	33.7%	39.0%	37.6%	288.4*
Mean	3.57[a]	3.21[b]	2.87[c]	2.97[c]	2.83[c]	85.65*

[a] Percentage that agree or strongly agree that after losing many times one is more likely to win

[b] Percentage that agree or strongly agree that one will win more with a strategy

Note: Means that do not share a subscript in common are significantly different at $p < .05$ using Duncan's C

* $p < .001$

Discussion

The purpose of the present research was to examine some of the psychometric properties of the nine-item Problem Gambling Severity Index. In contrast to the South Oaks Gambling Screen, this measure was developed explicitly for use with a general (rather than clinical) population. The present results suggest that the PGSI is tapping a single, underlying problem gambling construct. The results for both the factor analysis and the reliability analysis point to the existence of a single, underlying, problem gambling factor. This single factor is consistent with the theoretical aims of the developers of the PGSI. In contrast, the same analysis conducted on the SOGS items yielded multiple gambling factors, consistent with other reports of multiple factors for the SOGS (Oliveria et al. 2002; Stinchfield 2002).

The picture is more complicated than this, however. Although the single factor structure did replicate over gender and over provinces, it was the responses of the problem gamblers that were responsible for the single factor structure. When separate analyses were conducted for the different gambling subgroups, a single factor structure emerged only for the problem gambling group. In contrast, multiple factor structures emerged for the low- and moderate-risk gambling subgroups. Similarly, the alpha coefficients were negative for all subgroups except for the problem gambler subgroup. In short, for problem gamblers and only for problem gamblers, the PGSI assesses a single underlying problem gambling factor.

One interpretation of this pattern is that for low and moderate risk gamblers there are multiple ways in which potential problematic gambling may be manifested. For example, for one person it might be chasing losses, for another person it might be feeling guilty about gambling, and so on. However, as one progresses toward more problematic gambling, multiple features may co-occur. It must be kept in mind, however, that for non-problem gamblers, endorsement of the nine items was not randomly distributed. Respondents classified as low-risk or moderate-risk gamblers were far more likely to endorse chasing and feeling guilty than to endorse borrowing money or that their gambling was causing financial problems (see also Toce-Gerstein et al. 2003).

This distribution suggests the possibility of a progressive sequence. Initial problematic behavior involves a lack of control (chasing and betting more than one can afford) that gives rise to feelings of guilt. And it may be this behavior-emotion cluster that defines an initial stage of potential problem gambling. Despite the different pathways to pathological gambling (Blaszczynski and Nower 2002) and the varying functions that gambling might serve, it is a lack of control that appears to be the defining feature of early-stage pathological gambling. Note also that there is a temporal dimension to these items such that the betting and chasing items are temporally prior to the other seven items. In other words, the latter items are largely consequences of the lack of control or compulsion captured by the first two items. Hence, the essence of initial problem gambling is compulsion/lack of control, which if it persists results in the negative consequences captured by the remaining items.[4]

An important avenue for future research would be to attempt to identify additional gambling behaviors and consequences that may mark the initial stages of problem gambling severity. The present research suggests that faulty cognitions may be one candidate in this regard. The two items examined in this study—the gambler's fallacy and belief in systems—demonstrated just such a pattern. Nongamblers were significantly less likely to endorse these beliefs than were nonproblem gamblers, who were

[4] I thank an anonymous reviewer for suggesting this possibility.

significantly less likely to endorse these beliefs than any of the problem gambling groups. And differences between the problem gambling groups were not significant. These beliefs, then, are markers of a transition from nonproblem to problem gambling. Of course whether these beliefs facilitate movement to problem gambling status or merely reflect this transition is not clear. Longitudinal studies are required to address this and related issues involving the development of problem gambling status. It is clear, however, that our understanding and identification of problem gambling will require further conceptual and empirical work in order to clarify the key components of problem gambling as well as their developmental sequence.

The most frequent measure of pathological gambling over the past 20 years has been the SOGS and psychometric reviews of that measure have generally been favorable. In the present research, however, the psychometric properties of the SOGS were generally not as good as those of the PGSI (although comparisons need to be viewed cautiously due to the different sample sizes). The SOGS had a less clear factor structure, smaller alpha coefficient, and smaller correlations with the gambling frequency measures. Of course the accuracy of the SOGS and PGSI in terms of identifying problem gamblers was not examined, and that is precisely what the SOGS was designed to accomplish. However, for epidemiological and other nonclinical uses, the PGSI would appear to be the measure of choice.

It should be noted, however, that there is significant overlap between the SOGS and the PGSI. In fact, six of the nine PGSI items were similar to SOGS items. So, why does the PGSI perform better? One reason is that the PGSI uses a four-point response scale and the SOGS uses a dichotomous (Yes-No) format. Another reason is that the SOGS contains items that dilute the overall effectiveness of the measure when used in a general population. The large number of SOGS items that are concerned with various ways of acquiring money to gamble is a case in point. While these items may have important practical implications, their usefulness in research is not clear. To a certain extent there is a parallel issue with the PGSI. Specifically, three of the nine items (chase, bet, felt guilty) correlated as highly (and sometimes more highly) with the gambling frequency measures as the overall nine-item measure. In some situations, then (e.g., when screening for many different disorders at the same time), these three items could easily work just as well as the full nine-item set.

Although the PGSI fared better than the SOGS in terms of correlating with gambling frequency, the correlations for both measures were generally small. Although large correlations were not expected, the relatively small size was somewhat surprising. In addition, it is worth noting that these correlations varied widely. Frequency of raffle playing was totally unrelated to problem gambling scores; frequency of playing slots/VLTs was moderately related to PGSI scores. These differences suggest that certain types of gambling activities may be more attractive to problem gamblers and/or facilitate the development of problem gambling in people who chose to play them. This, too, would be an important direction for future research.

Overall, the PGSI represents an important instrument for the assessment of problem grambling. Given its background and theoretical underpinnings it is particularly well-suited for use with a general population. It is a relatively brief, clear, and straightforward instrument with adequate psychometric properties. On the other hand, the content of the measure is not dramatically different from the SOGS and hence there remains an overemphasis on items that identify the end-stages of pathological gambling and not the stages that are precursors of problem gambling.

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