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Article

Criterion-related and construct validity of the Problem Gambling Severity Index in a sample of South African gamblers

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Abstract

The Problem Gambling Severity Index, the scored module of the Canadian Problem Gambling Index, is a population-based survey instrument that is becoming the preferred epidemiological tool for estimating the prevalence of disordered gambling. While some validation evidence for the Problem Gambling Severity Index is available, very little is known about its psychometric characteristics in developing countries or in countries the populations of which are not highly Westernised. The aim of this study was to investigate the validity of the Problem Gambling Severity Index with a specific focus on its criterion-related and construct (concurrent) validity in a community sample of gamblers in South Africa (*n* = 127). To this end, the Problem Gambling Severity Index was administered alongside the Diagnostic Interview for Gambling Severity and measures known to associate with gambling severity (impulsivity, current debt, social problems, financial loss, race, sex). Results showed that the Problem Gambling Severity Index was predictive of Diagnostic Interview for Gambling Severity diagnosis from both a categorical and dimensional point of view and demonstrated high discrimination accuracy for subjects with problem gambling. Analysis of sensitivity and specificity at different cut-points suggests that a slightly lower Problem Gambling Severity Index score may be used as a screening cut-off for problem gambling among

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South African gamblers. The Problem Gambling Severity Index also showed significant correlations with the Barratt Impulsiveness Scale, a widely known measure of impulsivity, and with some of the predicted behavioural variables of interest (gambling activities, money lost to gambling, current debt, interpersonal conflict). This article therefore demonstrates initial criterion and concurrent validity for the Problem Gambling Severity Index for use in South African samples.

Keywords

Construct validity, criterion validity, Diagnostic Interview for Gambling Severity, impulsivity, Problem Gambling Severity Index, problem gambling

Following the introduction of legal gambling in South Africa in 1996, regulatory bodies and the gaming industry itself have maintained an active interest in the population-level effects of increased betting opportunities. Four large-scale prevalence studies have been conducted (Collins & Barr, 2001, 2003, 2006; Ross et al., 2010), the main purpose of which has been to monitor the extent of gambling activity over time and to estimate the prevalence of pathological and severe gambling. There have also been efforts to interrogate prevalence levels in specifically vulnerable South African populations (e.g., the peri-urban and rural poor in KwaZulu-Natal) (see Dellis et al., 2013). However, as is common with research in developing countries, reported findings are often compromised by the limited availability of locally validated measures. Although a number of internationally developed gambling screens are available (e.g., the South Oaks Gambling Screen [SOGS], Lesieur & Blume, 1987; the Canadian Problem Gambling Index [CPGI], Ferris & Wynne, 2001b; the Diagnostic Interview for Gambling Severity [DIGS], Winters, Specker, & Stinchfield, 1997, 2002), their psychometric properties have, by and large, not been investigated in South Africa, or in Africa more widely, where it is possible that the phenomenology of gambling differs in important ways from other countries. The empirical psychological literature is very largely based on data drawn from subjects in the developed world. Arnett (2008) reports, on the basis of a survey of top psychology journals between 2003 and 2007, that 96% of studies used subjects from Western and developed countries. These subjects are outliers on many psychological dimensions (for a recent review, see Henrich, Heine, & Norenzayan, 2010). The same consideration might well apply to gambling studies, where with the exception of prevalence research in Puerto Rico (Volberg & Vales, 2002) and Hungry (Kun, Balázs, Arnold, & Borbála, 2012), very few studies have engaged with gambling (or gambling measures) in non-Westernised countries.

In the absence of locally validated measures, instrument choice for research in South Africa is subject to parochial and typically pragmatic considerations rather than to scientific pedigree. Moreover, without a locally accumulating evidence base there is little impetus towards replication, or justifiable grounds for comparing findings with studies from other countries. These concerns make the validation of psychological tools especially important for research in South Africa.

Gambling screens – clinical versus population-derived

In *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*), pathological gambling is classified as an impulse control disorder. With the publication of *Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition* (*DSM-5*; American Psychiatric Association, 2013), it is renamed 'Gambling Disorder' and is reclassified under the new category of Addiction and Related disorders as the only specified addictive target that is not a substance. The *DSM-5* specification lowers the threshold for diagnosis from the former five to four criteria and eliminates one former item, 'has committed illegal acts such as forgery, fraud, theft or embezzlement to finance gambling'. In most prevalence studies based on *DSM-IV* screening, statistically infinitesimal proportions of subjects affirmed the eliminated item. Thus, previous prevalence estimates do not require revisitation in light of the change. However, in population-level assessments of disordered gambling, there are systematic differences in the performance of clinical versus population-derived screens. For example, the SOGS, a clinically derived measure used in a number of international surveys, is known to overestimate problem gambling – that is to produce a high number of false positives (Stinchfield, 2002; Thompson, Walker, Milton, & Djukic, 2005). This is not unexpected or necessarily unwanted for a clinical measure. Where first pass screening is followed by diagnostic interview, a modest false positive rate is preferable to missing those who may be in need of help. However, clinical screens used in survey research must ideally stand on their own, or at least be followed by more discriminating measures (Petry, 2005). In contrast to the SOGS, The Problem Gambling Severity Index (PGSI), the scored module of the CPGI, was designed specifically for population-based applications. Item selection for the measure was based on performance in a population survey. In addition, the PGSI measure incorporated three new (non-*DSM* based) items and structured scoring to indicate severity gradations in nominal categories. These changes reflect an incorporation of the wider social and economic elements of problem gambling severity that are under-represented in clinically derived screens such as the SOGS (Ferris &Wynne, 2001a). This public health approach is also especially relevant in countries where clinical assessments and services remain scarce (Neal, Delfabbro, & O'Neil, 2005).

The PGSI has recently been shown in a large population survey to outperform the SOGS in terms of item difficulty, construct validity, and classification validity (McMillen & Wenzel, 2006, see also Orford, Wardle, Griffiths, Sproston, & Erens, 2010). Moreover, the PGSI has been investigated in samples from Canada (Ferris & Wynne, 2001b), Australia (McMillen & Wenzel, 2006), Great Britain (Orford et al., 2010), China (Loo, Oei, & Raylu, 2011), and Singapore (Arthur et al., 2008). Recently, Sharp et al. (2012) employed item response theory methods to demonstrate the internal construct validity of the PGSI in a randomly selected representative sample ($N = 3000$) of urban adult South Africans. The PGSI was found to be unidimensional, and use of the nominal categories model provided additional information at higher values of the underlying construct relative to a simpler binary model. Differential item functioning (DIF) due to language translation (across six of the national languages) was not detected. The criterion validity of the PGSI in an African context has, however, not yet been examined. This is problematic, because even though the PGSI is based on a broader public health definition of problem gambling, it is important that the PGSI is predictive of *DSM*-based screening measures, as a first step, and structured clinical interview, as the final and gold standard for diagnosis.

In South Africa, the 2001, 2003, and 2006 prevalence studies relied on a set of questions developed informally by Gamblers Anonymous (established in Los Angeles in 1957), the Gamblers Anonymous 20 Questions (GA20; Gamblers Anonymous (GA), 1984). Unfortunately, as a screening measure, these questions have received very little psychometric attention. One Spanish study found a high correlation between the GA20 and the SOGS among groups of problem gamblers (PGs) and non-PG controls who gambled socially, lending some support to the measure (Ursua & Uribelarrea, 1998). However, despite its widespread use in outreach programmes, the psychometric performance of the GA20 in community surveys is unknown. While the results of previous South African prevalence studies reflect trends broadly in line with international research, overreliance on the GA20 may limit our understanding of nature and extent of problem gambling in South Africa. Moreover, a growing international consensus around the use of the PGSI in large-scale prevalence studies suggests it is a good candidate for validation in South Africa. A locally validated screen that is also in widespread international use would provide a useful basis for ongoing research, and enable more rigorous comparisons with findings from other countries.

Screen validity and poverty

Evidence that screen performance asymmetries are compounded in multi-ethnic heterogonous populations is of direct concern for research in South Africa, which has a highly ethically diverse population, and wide socio-economic inequality. The World Bank reports that 22% of the South African population lived below the poverty line in 2009, and that 38% had done so in 2000 (Statistics South Africa, 2010; World Bank, 2010). In human development, South Africa is ranked 110th in the world, with a human development index (HDI) of 0.597, falling in the 'medium' human development category. Life expectancy at birth is 52 years, mean years of schooling is 8.2 years, and gross domestic product (GDP) per capita (in 2008 dollars at purchasing power parity) is US$9812 (United Nations Development Programme, 2010). This is in sharp contrast to the countries accounting for the majority of large studies of gambling prevalence (Australia, Canada, New Zealand, the United Kingdom, and the United States) which all fall in the top eight countries in the 'very high' category of the HDI, with scores of 0.888 or higher. None has a life expectancy at birth of lower than 79 years, a value for mean years of schooling of fewer than 11.5 years, or a gross national product per capita (by the same method) of less than $25,000. Young and Stevens (2008) have shown in an Australian population survey that the SOGS overrepresents PGs among those of low socio-economic status (which was correlated with being ethnically indigenous) when compared to the PGSI. The researchers suggest that the high number of questions relating to money matters in the SOGS (e.g., arguments about the handling of money) may be causing the selective overrepresentation among poorer gamblers, a concern also raised by other groups (Battersby, Thomas, Tolchard, & Esterman, 2002; Duvarci, Varan, Coskunol, & Ersoy, 1997; Stinchfield, 2002; Walker & Dickerson, 1996). This explanation would appear to be supported by the high prevalence rates observed in a Puerto Rican study (6.8% pathological gamblers using the SOGS) (Volberg & Vales, 2002) as well as by the rapid rise in SOGS recorded gambling problems noted in post-socialist countries such as Hungry (Kun et al., 2012). However, as Young and Stevens (2008) do not compare their survey screening classifications among the poor with diagnosis via clinical interview, it is not clear how these findings should be interpreted with respect to the *DSM* classification. It could be that the PGSI in fact underestimates the extent of problem gambling among poorer subgroups. One way to rule this out, as well as to gather criterion-related validity evidence related to the optimal cut scores for the local use of the screen, would be to examine the extent to which the PGSI predicts interview administrated DIGS diagnosis in a South African population. This then is the first aim of the study.

The extent to which a test measures what it purports to measure is known as its construct validity. Despite extending the underlying *DSM* construct of pathological gambling to include a continuum of risk, the validation of the PGSI has still to a large degree been based on *DSM* reference standards (McMillen & Wenzel, 2006). Svetieva and Walker (2008) have been particularly critical in this regard, although their specific complaint concerns remnant *DSM* criteria in the PGSI despite its professed public health rationale. For these authors, this suggests circularity in *DSM*-based validation evidence. We, as with others (Orford et al., 2010), think this challenge is misplaced. It is unreasonable to expect clinical and public health concerns to evolve in isolation. Nevertheless, setting *DSM* criteria aside, to the extent that the construct assessed by the PGSI is associated with known behavioural correlates of problem gambling, we can build a stronger case for construct validity. In this respect, Currie, Hodgins, and Casey (2013) have analysed a large Canadian sample and found discriminant validity for the no-risk and high-risk categories but not for the low-risk or medium-risk categories. In this analysis, we do not address the extent to which the PGSI categories show discriminant validity (see Kincaid et al., 2013). Rather, our focus is on construct-related evidence for the disordered gambling (high-risk) construct given by the extent to which PGSI score co-varies with other associated measures and is sensitive to demographic variations in the South African sample. Thus, disordered gambling is known to be associated with impulsivity, current debt, game types, game frequency, social problems, financial loss, race, and sex (Currie et al., 2013; Dickerson & O'Connor, 2006). Examining measures of these correlates in a South African sample was thus the second aim of this study.

Method

Participants

Gamblers were recruited from two of South Africa's largest cities (Cape Town and Durban). Colour poster advertisements inviting gamblers to participate were distributed in a variety of community settings (libraries, community centres, grocery stores, transport stations) and ads were placed in several local community newspapers in Durban and Cape Town. Subjects were screened for alcohol and substance-use disorders. Substance abusing and dependent subjects were excluded due to the primary purpose of the sampling, which was to explore certain cognitive and behavioural correlates of problem gambling in isolation from frequently co-occurring disorders. Given the low base rate of problem gamblers in the general population we employed self-selection sampling to ensure adequate representation of our target group.

The final sample consisted of n = 127 gamblers, almost equal by gender (49% female, 51% male), and of large variance by age (M = 41.54, standard deviation (SD) = 13.41). Although ethnically and linguistically diverse (17% African, 22% Coloured, 12% Indian, 35% White, and 13% race refuse), all subjects were proficient in English and were therefore interviewed in English. Average education and income were relatively low (mode of education = Grades 7–11, median [Grade 12 = completed high school], median of annual income = ZAR30,000–ZAR72,000 [US$1 = ZAR6.69]) widely dispersed and asymmetrically distributed by race and sex. In particular, racial groups differed in annual income ($\chi^2 = 29.29$, $df = 12$, $p < .01$) and education ($\chi^2 = 32.89$, $df = 18$, $p < .05$), while income groups differed by sex ($\chi^2 = 10.04$, $df = 4$, $p < .05$).

Measures

The PGSI. The CPGI includes a section assessing gambling habits (adjustable to locally relevant game types) and a scored module assessing gambling problems. This scored module, the PGSI, consists of 9 items scored on a 4-point scale (0 = *Never*, 1 = *Sometimes*, 2 = *Most of the Time*, 3 = *Almost Always*). Items are framed over the past 12 months. When summed, scores provide an index of gambling severity and may also be used with cut-offs to group individuals into one of four categories (0 = *No-Risk Gambling*, 1–2 = *Low-risk Gambling*, 3–7 = *Moderate-Risk Gambling*, 8–27 = *Problem Gambling*). The validity (see above) and reliability of the PGSI are well established. The scale developers reported an internal consistency reliability of .84 (Cronbach's α), and test–retest reliability of .78 (Ferris & Wynne, 2001a). More recent studies have reported excellent internal consistency reliability (α = .90) (Orford et al., 2010; Williams & Volberg, 2013), but modest intra-class correlation coefficients (.63) for PGSI subtypes over longer periods (14 months) (Currie et al., 2013). However, using more sophisticated approaches to test–retest reliability (see Jacobson, Roberts, Berns, & McGlinchey, 1999), Currie et al. (2013) have shown that 92% of (non-zero scoring) respondents do not show a significant change in PGSI score over 14 months.

DIGS. The DIGS consists of 20 items matched to the 10 *DSM-IV* diagnostic criteria for pathological gambling (2 items per criterion). There are three response categories (*Very True, True, False*) which can be ordinally scored by item (2 = *Very True*, 1 = *True*, 0 = *False*) or nominally scored by disjunction for each criterion pair (1 = *Symptom*, 0 = *Non-symptom*). The items are framed in the past 12 months and lifetime. Summed ordinal scores provide an index of current and lifetime gambling severity (0–40), and symptom counts (0–10) with a cut-off of five symptoms distinguishing pathological from non-pathological groups. Convergent and discriminate validity evidence is available in support of the DIGS as an appropriate measure of the formal diagnostic criteria for pathological gambling. Excellent internal consistency reliability evidence (Cronbach's α exceeding .90) is also available – by overall sample and by gender and age subgroups. Stability coefficients (kappa) over 1 week exceed .80 (Winters et al., 2002).

Barratt Impulsiveness Scale. The Barratt Impulsiveness Scale–II (BIS-II; Patton, Stanford, & Barratt, 1995) is a 30-item, 4-point Likert scale questionnaire (*Rarely/Never, Occasionally, Often, Almost Always*). Items are not framed within any specific time period. When summed, the scale provides a total score (30–120) indexing impulsiveness, as well as scores for three second-order subscales (*Non-planning Impulsivity, Motor Impulsivity, Attentional Impulsivity*) and six first-order subscales (*Attention, Motor, Self-Control, Cognitive Complexity, Perseverance, Cognitive Instability*). A recent review on the widely used BIS-II supports the strong validity of the scale – assessed by correlations with similar self-report measures, as well as with clinical populations (e.g., substance-use disordered, suicide attempters), and assessments of cognitive and neurocognitive function. The internal consistency of the scale is good (Cronbach's α > .80) (Stanford et al., 2009).

Procedures

The study was approved by ethical review boards of the University of Alabama at Birmingham, the University of KwaZulu-Natal, and the University of Cape Town. The PGSI was administered telephonically as might be typical in large population surveys. Appointments were arranged for interview administration of the DIGS by trained research assistants and for completion of the BIS-II by self-report. Given the shortage of clinically trained mental health professionals in South Africa, it is not uncommon to train lay individuals in psychiatric interview administration (e.g., Herman et al., 2009). Three post-graduate-level research assistants received instruction in DIGS administration and were observed by the trainer (the second author [C.S.], a clinical psychologist) implementing the interview during mock interviews. Corrective feedback was provided and research assistants were again observed until diagnostic accuracy was deemed adequate. C.S. remained available for consultation throughout the study period. Given special practical challenges in conducting research in a developing country setting, it was not possible to conduct a 'test–retest reliability study' in which the interview is repeated with the same subject within a short period of time by a second interviewer to determine inter-rater reliability. Neither was it possible to video- or audiotape interviews. Although not ideal, training ensured that the interviewers were in agreement with respect to their understanding of the diagnostic criteria and DIGS methodology (Winters et al., 1997). The PGSI and DIGS were administered by the same research assistants, but interviewers did not refer back to PGSI scores and were therefore blind to PGSI scores at the time of administering the DIGS.

Data analyses

The study aimed to achieve statistically adequate numbers of respondents in each of the four PGSI groups. Psychometric analysis was conducted with the following sample proportions: 37%

Problem Gambling, 27% *Moderate-Risk Gambling*, 18% *Low-Risk Gambling*, and 18% *No-Risk Gambling*. For criterion validity, we first investigated the relationship between the PGSI and the DIGS through chi-square and correlational analyses. Next, we used receiver operating characteristic (ROC) analyses to investigate the sensitivity (Se) and specificity (Sp) of the PGSI in predicting DIGS diagnosis, and report on three common predictive indices. Where relevant, we also report odds ratios (ORs). Concurrent validity was investigated through a combination of chi-square and correlational analyses. Internal consistency reliability was assessed by Cronbach's α (Cronbach, 1951).

Results

Internal consistency reliability

The α coefficient for the 9 items of the PGSI was .93, suggesting that the items had excellent internal consistency. Inter-item correlations were favourable for the majority of items, with the exception of Item 2, 'Have you needed to gamble with larger amounts of money to get the same feeling of excitement,' which had all inter-item correlations below .60 and five correlations below .50. Alphas by gender (female, α = .94, male, α = .92) were both excellent, although inter-item correlations were lower for males than females for Item 7, 'Have people criticised your betting or told you that you had a gambling problem.' Specifically for males, all items had less than .60 item correlations and five items were less than .50. For females only 3 items were less than .60. Alphas for subgroups by race were excellent (African, α = .90; Coloured, α = .92; Indian, α = .92; White, α = .95), although the strength of specific inter-item correlations varied by group. The African group had fairly low correlations for Item 7 (see above), the Coloured group had low correlations for Item 1 – 'Have you bet more than you could afford to lose' and the Indian group had low correlations for Item 2 (see above).

The alpha coefficient for the 40 items of the DIGS (last 12 months) was .98, suggesting that the items have excellent internal consistency. Alphas by gender (female, α = .98, male, α = .97) and by race (African, α = .97; Coloured, α = .98; Indian, α = .97; White, α = .98) were excellent.

The alpha coefficient for 30 items of the BIS-II was .85, suggesting that the items have a good internal consistency. Alphas by gender (female, α = .88, male, α = .82) and by race (African, Wα = .79; Coloured, α = .88; Indian, α = .84; White, α = .90) were good to excellent.

Criterion validity: PGSI accurately predicts performance on the DIGS

The PGSI was predictive of DIGS diagnosis from both a categorical and dimensional point of view. Correlational analyses (Spearman's rho) showed that the PGSI correlated significantly with the DIGS on current severity score ($r = .87$, $p < .01$). The PGSI also correlated significantly with lifetime severity score ($r = .86$, $p < .01$) and symptom count ($r = .87$, $p < .01$). Furthermore, PGSI groups were significantly different by DIGS classification ($\chi^2 = 66.78$, $df = 3$, $p < .01$). Those with a score of 8+ on the PGSI were 31.9 times more likely (OR) to be classified as pathological gamblers by the DIGS. Inspection of the standardised residuals (≥ −2) associated with each cell revealed that significantly fewer subjects identified by the DIGS as *cases* were represented in the *No-Risk* and *Low-Risk* categories of the PGSI, and significantly more *cases* were represented in the *Problem Gambling* category of the PGSI.

ROC curves of the overall sample are shown in Figure 1.

In Table 1, ROC analysis results are reported for the overall sample and for subgroups based on sex and race. For the entire sample, the PGSI had an area under the curve (AUC) of .94 (standard

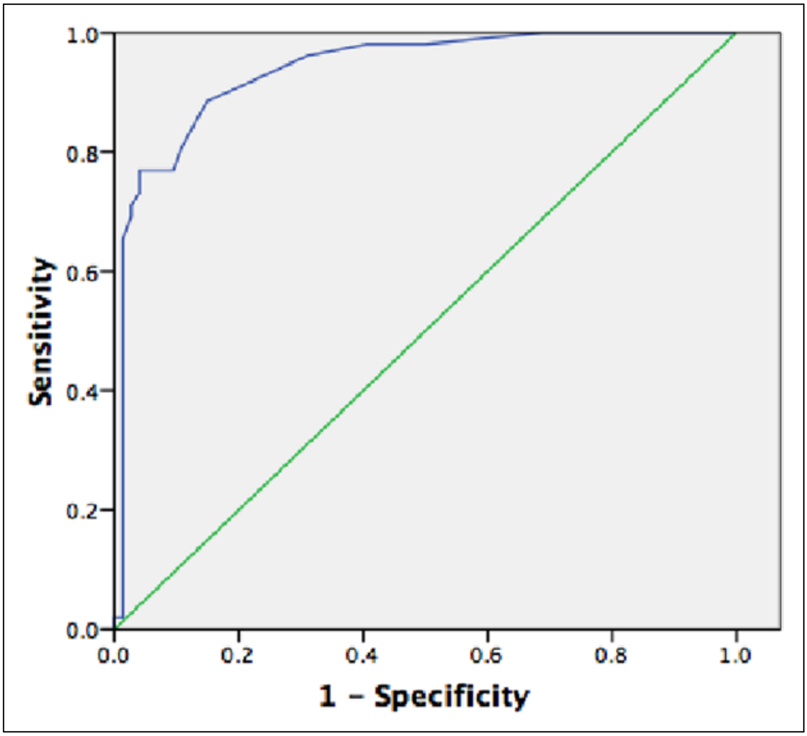

Figure 1. ROC curve of the overall sample.
ROC: receiver operating characteristic; DIGS: Diagnostic Interview for Gambling Severity; PGSI: Problem Gambling Severity Index; AUC: area under the curve; SE: standard error.
There were 52 positive cases and 74 negative cases for problem gambling (based on DIGS diagnosis). A single respondent was missing a PGSI score. The AUC of the PGSI is .94 (SE = 0.02; p < .00), indicating high accuracy in discriminating respondents with problem gambling.

Table 1. ROC analysis of PGSI by sex and race.

Group	Problem gambling (DIGS)		
	Prevalence (%)	AUC	SE
Overall, n = 127	42	0.94**	0.02
Male, n = 65	43	0.93**	0.03
Female, n = 62	40	0.95**	0.03
African, n = 22	41	0.91*	0.07
Coloured, n = 28	57	0.97**	0.03
Indian, n = 15	13	0.92	0.07
White, n = 45	44	0.96**	0.03
Refuse, n = 17	35	1.00*	0.00

ROC: receiver operating characteristic; PGSI: Problem Gambling Severity Index; DIGS: Diagnostic Interview for Gambling Severity; AUC: area under the curve; SE: standard error.
*p < .05; **p < .01.

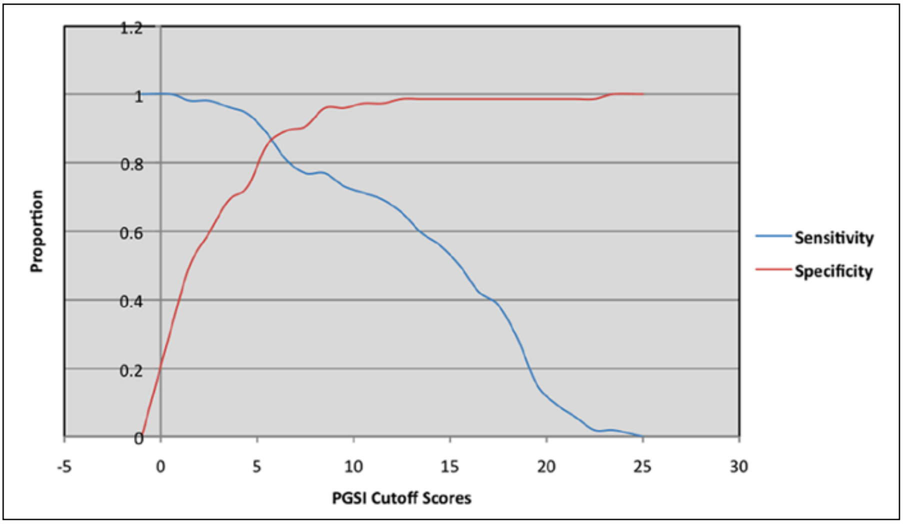

Figure 2. Sensitivity and specificity plotted against different cut-off scores on the PGSI. The optimal cut-point is determined by the intersect point of sensitivity and specificity.
PGSI: Problem Gambling Severity Index.

error (*SE*) = .02, $p < .01$) indicating high diagnostic accuracy. Across subgroups the PGSI performed equally well, with AUC and SE indicating high accuracy for discriminating subjects with problem gambling across both sex and race. Almost all subgroup discriminations were significant ($p < .05$). The only exception was with the Indian population group, for whom the PGSI did not significantly discriminate subjects with PG ($p = .06$).

Figure 2 shows sensitivity and specificity at different cut-points (cut-off scores) on the PGSI. The optimal cut-points for discriminating problem gambling were determined by the intersect point of sensitivity and specificity. In the overall sample, the optimal cut-off score was 5.5 for the PGSI (Se = .89; Sp = .85). Optimal cut-points were also calculated for subgroups based on sex and race. By race, a score of 5.5 was optimal for all except the Indian and Refuse subgroups (15, and 9.5 respectively), while by sex, the optimal cut-point for males was higher than for females (6.5 and 4.5). At the sample cut-point of 5.5, African (Se = .88; Sp = .85) and Coloured (Se = .88; Sp = .83) groups had the highest sensitivity (.88), while the White group (Se = .85; Sp = .92) had the highest specificity (.92). By sex, the male (Se = .92; Sp = .81) group had the highest sensitivity (.93), while the female group (Se = .83; Sp = .89) had the highest specificity (.83).

Table 2 shows the predictive indices at cut-points of 3, 5, and 8 for the PGSI.

Construct validity: PGSI and traditional correlates of gambling severity

Spearman correlations showed that the PGSI correlated modestly, but significantly with the frequency of playing cards with friends ($r = .20$, $p < .05$), playing cards at casinos ($r = .22$, $p < .05$), animal betting ($r = .22$, $p < .00$), sport event betting ($r = .24$, $p < .00$), dice ($r = .21$, $p < .05$), lottery ($r = .30$, $p < .00$), and slots ($r = .57$, $p < .01$). It also correlated significantly with total money lost during lifetime ($r = .71$, $p < .01$) and current debt ($r = .52$, $p < .00$). As expected, the PGSI additionally correlated with indices of interpersonal conflict, including number of days in conflict with

Table 2. Classification accuracy of the PGSI.

	PGSI 3+	PGSI 5+	PGSI 8+
Positive predictive power	63	71	85
Negative predictive power	98	95	85
Diagnostic efficiency	75	82	82

PGSI: Problem Gambling Severity Index.
Positive predictive power: percentage of individuals who are designated as problem gamblers on the screen are confirmed as problem gamblers in the interview assessment. Negative predictive power: percentage of individuals who are designated as non-problem gamblers on the screen are confirmed as non-problem gamblers in the interview assessment. Diagnostic efficiency: number of true positives (correctly identified as problem gamblers) + true negatives (correctly identified as non-problem gamblers) divided by the total sample size.

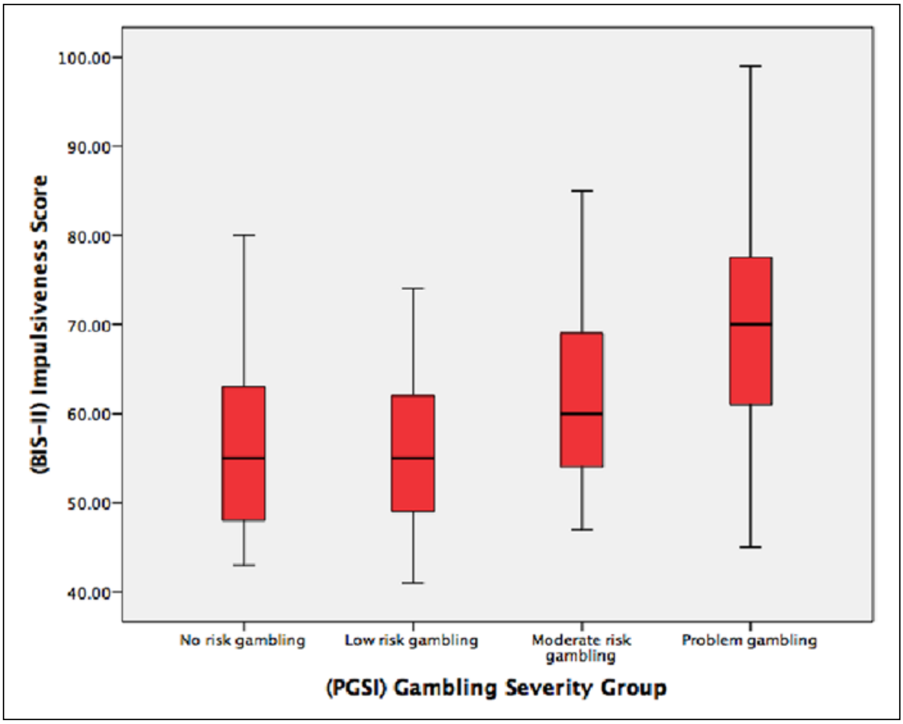

Figure 3. The relationship between impulsivity and group status on the PGSI.
BIS-II: Barratt Impulsiveness Scale; PGSI: Problem Gambling Severity Index.

close friends ($r = .20$, $p < .05$), and extent of bother by problems with non-family members ($r = .30$, $p < .01$).

The PGSI showed a highly significant positive correlation with the BIS-II total score ($r = .50$, $p < .00$) and with *all* first-order and second-order subscales. The highest correlation coefficient was for the Attentional Impulsivity subscale ($r = .90$, $p < .01$). The total BIS-II score was also significantly different between PGSI groups, $F(3, 117) = 12.03$, $p < .01$, as were *all* BIS-II subscale scores (see Figure 3).

Contrary to expectations, the PGSI did not show relationships with sex or race. Nor did it correlate significantly with income, although group differences were suggestive ($\chi^2 = 19.31$, $df = 12$, $p = .08$; OR = 1.53 for PGSI 8+ among poorer [less than ZAR72,000 income per year] compared to better-off groups), with group-by-group comparisons showing a significant decrease in income between *Low-Risk* and *Moderate-Risk* gambling groups ($\chi^2 = 13.26$, $df = 4$, $p < .05$; Kendall's tau-b = −.39, $p < .01$). The PGSI did, however, show a significant negative correlation with education ($r = -.16$, $p < .05$; Spearman's rho).

To further explore possible race and sex differences, we conducted item analyses. This revealed significant differences by sex for Item 1, 'Have you bet more than you could really afford to lose?' ($\chi^2 = 12.59$, $df = 3$, $p < .05$), with males being more likely to answer 'most of the time' (OR = 4.3) and females more likely to answer 'almost always' (OR = 6.2). Sex differences were also detected for Item 9, 'Have you felt guilty about the way you gamble or about what happens when you gamble?' ($\chi^2 = 17.45$, $df = 3$, $p < .01$), with males being more likely to feel guilty 'some of the time' (OR = 2.2) than females, who were more likely to 'never' feel guilty (OR = 4.27). Race groups differed significantly in endorsement of Item 6, 'Has betting caused you any health problems, including stress or anxiety?' ($\chi^2 = 18.91$, $df = 9$, $p < .05$) with African and White groups being more likely to report 'never' having experienced health problems as a result of gambling (OR = 2.1 and OR = 2.0, respectively).

Discussion

Results of this study suggest that the PGSI shows promise for measuring gambling problems in the South African population. This is reassuring for a number of reasons. Complex instruments involving questions that rely on subtle conceptual distinctions often raise problems of interpretive consistency across translations in multi-ethnic settings (Drennan, Levett, & Swartz, 1991). The challenge is especially acute in South Africa, where there are 11 national languages. Measures that can successfully bridge languages are thus highly valued by researchers and clinicians alike.

In addition, administration of structured interview–based measures is often logistically impractical because they are expensive and time consuming. Screening tools are ideal. Moreover, the use of quick and easy-to-administer population screens like the PGSI is especially attractive in low resource countries like South Africa. Currently, there is serious lack of clinically trained and skilled professionals in South Africa. It has been estimated that South Africa has a rate of four psychologists per 100,000 population compared with 26.4 psychologists per 100,000 in the United States (World Health Organization, 2002). In a review of referrals from a community outreach service in South Africa, Petersen (2004) concluded that given this paucity of specialist psychological and psychiatric services there is an urgent need for the development and validation of psychometric assessment tools suitable for use in primary care community settings.

This is the first South African study to investigate the PGSI for criterion and construct validity. Findings support the criterion validity of the PGSI as highly predictive of interview-based DIGS diagnosis. A clinical cut-off determined by ROC analyses produced comparable, though slightly lower, thresholds than reported for the PGSI elsewhere (Ferris & Wynne, 2001b). This may be due to multiple reasons. It could be that the threshold for problem gambling is truly different in the South African context. Similar threshold adjustments to psychiatric screens, based on ROC analysis, have been made for other disorders (e.g., Myer et al., 2008) and research interest in the relationship between culture and mental health is common in South Africa (Ellis, 2003; Swartz, 1998). Moreover, as a designed population rather than clinically based screen, we might expect the PGSI to respond to local variation in gambling-related harm. Other reasons may relate to the fact that the procedures used to establish cut-points in the original validation of the PGSI are unclear and may not have included ROC analysis (Ferris & Wynne, 2001a, 2001b). Indeed, the authors note that the low base rate of problem gambling observed in their population survey complicates the validation evidence. Thus for example, with 100% specificity observed across all criterion measures, cut-points could only be determined by sensitivity, which by clinical interview included only nine PGSI-identified problem gamblers (two of which were false positives) (Ferris & Wynne, 2001b). If we ignore the false negatives in our research, our study shows that a cut-point of 8 produces 77% sensitivity, which is not unlike the 77% and 62% reported against clinical interview and SOGS measures respectively (Ferris & Wynne, 2001b). On the other hand, the cut score of 5.5 that we find to be optimally predictive for clinical assessment is relatively close to the cut score of 5 found by Williams and Volberg (2013) for a large Ontario sample. Williams and Volberg (2013) did not perform categorical, dimensional or ROC analyses on their sample as we do. However, we applied their percentage indictors for positive predictive power, negative predictive power, and diagnostic efficiency to similar calculations on our sample for comparative purposes, yielding similar results for 5 and 8 cut-points. Clearly though, more work is required to further refine cut-points.

Interestingly, the measure performed less well among Indian participants, and was associated with a higher cut-off for males, suggesting that diagnosis in males requires more significant severity on the PGSI compared to females. It is not clear why these cultural and gender differences were observed. A number of Indian participants were GA members who jointly learnt about the study through group meetings. It is possible that in their eagerness to tell their story these respondents assented to items in the 12-month frame of the PGSI, which were then answered more accurately when given the opportunity to respond to DIGS items framed for both lifetime and the last 12 months. Gender differences in item endorsement have been noted in a British study, and interestingly for the same items (Item 1 and Item 9; Orford et al., 2010). However, while we find lower male to female endorsement for Item 1 (betting more than could afford to lose) we find the opposite for Item 9, with males being more likely to endorse feeling guilty. It seems these items might be especially responsive to gender-cultural variation, which in turn might affect optimal cut-points for problem gambling.

Our behavioural findings also provide support for the construct validity of PGSI in that the measure correlated significantly with phenomena previously shown to be associated with gambling severity.

The fact that the PGSI has shown criterion and concurrent validity is promising. However, there are a number of limitations in this study that should be noted. First, the criterion measure for this study (the DIGS) has not itself been culturally validated in the South African context against clinical diagnosis. While it is useful to validate a population screen against an interview-based measure, it is even more useful if the criterion measure itself has been culturally validated before being used in a different country. Measure development is still in its infancy in South Africa (Sharp, Skinner, Motsaathebe, & Ross, 2011), and relatively few instruments have been validated across demographic sub-populations. It is therefore commonplace for Western measures to be used.

Subjects self-selected in this study, both in response to advertisements and in attending appointments. The sample of problem gamblers investigated might thus differ in important ways from problem gamblers in the general population – the intended target of the PGSI screen. Also, we included only subjects who were proficient with spoken English and excluded substance-dependent or substance-abusing subjects. Each of these sampling choices limits the generalisability of our psychometric findings. To some extent, the second of these concerns is mitigated by the fact that DIF of the PGSI due to language translation (across six South African languages) was not detected by Sharp et al. (2012). However, the high rates of substance-related comorbidity among problem gamblers is a clear sample limitation, as is its self-selected character. A valuable next step would be to investigate the cultural validity of the DIGS, PGSI, and other measures used in this study, with a randomly selected sample, so that these measures can be used with greater confidence in the wider population.

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