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First Evidence of Comorbidity of Problem Gambling and Other Psychiatric Problems in a Representative Urban Sample of South Africa

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Abstract We investigate the extent to which problem gambling in a recent South African sample, as measured by the Problem Gambling Severity Index (PGSI), is comorbid with depression, anxiety and substance abuse. Data are from the 2010 South African National Urban Prevalence Study of Gambling Behavior. A representative sample of the urban adult population in South Africa (N = 3,000). Responses to the 9-item PGSI and ratings on the Beck Depression Index, the Beck Anxiety Inventory, and the World Health Organization Alcohol, Smoking and Substance Involvement Screening Tool (WHO ASSIST). Cross tabulations and Chi square analyses along with logistic regression analyses with and without controls for socio-demographic and/or socio-economic variables were used to identify comorbidities. The prevalence of depression, anxiety, alcohol and substance use were clearly higher among the sample at risk for problem gambling. Black African racial status and living in areas characterized by migrant mining workers was associated with increased risk of problem gambling and comorbidities. There is strong evidence that findings of comorbidities between pathological gambling and depression, anxiety and substance abuse in developed countries generalize to the developing country of South Africa. Historical context, however, gives those comorbidities a unique demographic distribution.

Keywords Pathological gambling · Comorbidity · Depression · Anxiety · Substance abuse

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Introduction

The fourth edition of the Diagnostic and Statistical Manual for Mental Disorders (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association 2000) classifies pathological gambling (PG) as an impulse control disorder and lists ten symptoms of which positive endorsement of five indicates disorder. The newly published fifth edition of the DSM (5th ed.; DSM-5; American Psychiatric Association 2013) re-classifies PG as "Gambling Disorder", groups it within a new category of "Substance-Related and Addictive Disorders," and revises the diagnostic traits. However, the study reported here, along with all other studies we cite, were carried out before the current revision, so analyses presuppose the DSM-IV-TR diagnostic criteria. Thus, the paper will work with that categorization and definition. In all, the only major substantive change for DSM-5 specific criteria was dropping the criteria for 'illegal acts'; thus, we consider the use of the DSM-IV-TR criteria in the current study relevant.

Studies using DSM-IV-TR criteria indicate prevalence figures of between 0.4 and 2.0 % in US and Canadian populations (Petry et al. 2005; Gerstein et al. 1999; Welte et al. 2002). Similar rates (0.5–2 %) have been reported for non-western countries (Shaffer et al. 2004). Over the last decade, several authors (Shaffer et al. 2004; Petry et al. 2005; el-Guebaly et al. 2006) have pointed out that the study of prevalence rates should include investigation of comorbidities of PG as this may increase our understanding of its determinants beyond socio-economic factors. This is important because a better understanding of PG's etiological pathways can inform the design of prevention or early intervention strategies. Moreover, to fully appreciate health and social impacts of PG, it is necessary to assess comorbid psychiatric disorders. Finally, several studies have shown that comorbid psychiatric disorders predict higher persistence and severity (Ladd and Petry 2003) of PG, facts which are clearly relevant to identifying maximally effective treatments and interventions.

Although several studies have established the relations between PG and a range of mental health disorders in treatment-seeking samples, as documented by Petry (2005), investigations in general population surveys have been rarer, and have been confined to developed countries. Bland et al. (1993) compared pathological and non-gamblers and found that the former were 2.3 times more likely than the latter to report a lifetime history of mood disorder. Similarly, Cunningham-Williams et al. (1998) found that pathological gamblers were at least three times as likely as non-gamblers to report depression. Using a brief telephone survey of depression, Thorson et al. (1994) demonstrated no relationship between depression symptoms and PG. Using a more rigorous study design, Petry et al. (2005) demonstrated that pathological gamblers were at least four times more likely than those without PG to suffer from a mood disorder, even after controlling for socio-demographic and socio-economic factors. This represents a methodological advance on previous studies, as it is well-known that socio-demographic and socio-economic factors influence rates of psychopathology in general (Johnson et al. 1999), and depression in particular (Lorant et al. 2003), and should be controlled for where possible. Kessler et al. (2008) found that among US adults the risk for having a mood disorder was 3.7 times higher among those for whom PG was indicated.

With regard to the comorbidity between PG and anxiety disorders, Cunningham-Williams et al. (1998) demonstrated a higher likelihood for pathological gamblers to suffer from phobias (but not other anxiety disorders), while Bland et al. (1993) showed significant differences between pathological gamblers and non-gamblers for any anxiety disorder and agoraphobia. Petry et al. (2005) demonstrated that pathological gamblers were three times

more likely to suffer from any anxiety disorder, with panic disorder (with agoraphobia) carrying the highest likelihood (OR 5.2; 95 % CI 2.6–10.5) adjusting for socio-demographic and socio-economic variables. Kessler et al. (2008) reported that PG increased the risk for anxiety disorder in their national sample of US adults by 3.1 times.

The National Epidemiologic Survey on Alcohol and Related Conditions (Petry et al. 2005) also demonstrated that of all the psychiatric conditions included in the study (mood, anxiety, personality and substance use disorders), alcohol use disorder was associated with the largest odds ratio for PG (OR 6.0; 95 % CI 3.8–9.7, adjusting for socio-demographic and socio-economic variables). Kessler et al. (2008) found that PG increased the baseline risk of substance abuse disorder by 5.5 times. Other studies have shown 23–40 % rates of comorbid substance abuse and PG problems (Bland et al. 1993; Cunningham-Williams et al. 1998; Thorson et al. 1994; Welte et al. 2001).

Taken together, these studies clearly suggest comorbidity between PG, depression, anxiety and substance use disorders. These population level findings are supported by recent neurobiological evidence that common or overlapping neural pathways subsystems are involved in addiction, depression and anxiety (Rao 2006; Volkow 2004) and that PG involves pathways involved in substance abuse (van Holst et al. 2010). The indicated areas are known to be essentially involved in processing rewards, executive control, and response to emotional stimuli and stress.

These recent epidemiological studies of comorbidities of pathological gambling are noteworthy because previous reports on comorbidities associated with gambling problems have suffered from over-reliance on clinical samples. Studies in clinical samples may be biased, because individuals with more severe symptoms or more comorbid problems may be more inclined to seek treatment, thereby inflating comorbidity estimates (Petry et al. 2005; Heyman 2009). Moreover, obtaining reliable estimates of comorbidity through the use of clinical samples is challenged by differences in samples, program inclusion criteria, setting characteristics and measurement tools (el-Guebaly et al. 2006). National population-based studies address this problem and should therefore be considered the gold standard in investigating comorbidity between conditions (Petry et al. 2005; el-Guebaly et al. 2006; Kessler et al. 2008).

With the exception of one Brazilian survey, national comorbidity studies have so far been confined to developed countries. To our knowledge, no systematic data have been collected on the comorbidity of gambling problems in African countries. Surveys have been conducted in South Africa by the National Responsible Gambling Programme (NRGP) in 2003 and 2006 (Collins and Barr 2003, 2006) to ascertain prevalence rates. Those studies showed that 'problem gambling' rates were 6.8 % in 2003 and 4.8 % in 2006. It would be hasty to conclude from this that South Africa is characterized by higher levels of PG than previously surveyed countries. Unlike the NRGP surveys, which relied on the Gamblers Anonymous 20 questions, most peer-reviewed prevalence studies make use either of a screen based directly on the DSM-IV-TR diagnostic criteria, or the Problem Gambling Severity Index (PGSI). The latter is a component of the Canadian Problem Gambling Index (CPGI; Ferris and Wynne 2001), and aims to identify not only prevalence of PG, but also the distribution of severity of risk for new cases. Instead of merely defining a threshold for PG, the PGSI defines 3 thresholds, for low, moderate and high risk for PG respectively. Another advantage of using the PGSI is that it may address an important limitation of current national comorbidity studies that some national surveys, particularly less recent ones, have used non-DSM-based scales to assess problems gambling, e.g. the South Oaks Gambling Screen (SOGS) (Lesieur and Blume 1987), which was designed for use in clinical populations rather than general populations. Relatedly, not all national

comorbidity studies make use of measures that distinguish grades of severity of PG, or presence of behavior that indicates risk for PG below diagnostic threshold. The notion of a "continuum of risk associated with gambling of which full-blown PG represents the extreme" (El-Guebaly et al. 2006) has become a guiding principle of recent study designs in gambling research, and is also reflected in the new diagnostic criteria for Gambling Disorder in DSM-5 (though see Kincaid et al. 2013 for grounds for caution about this). This is reflected in the methodology reported here. In keeping with other recent studies, we will henceforth refer to "problem gambling" to denote a cluster of behaviors associated with moderate to high risk for PG. People who would be diagnosed with PG by means of a structured clinical interview fall within this category.

Against this background, we report data from the National Urban Prevalence Study of Gambling Behaviour (NUPSGB; Ross et al. 2010) with the aim of examining patterns of comorbidity for problem gambling, anxiety, depression and substance use disorder in a national representative urban sample in South Africa. We expected patterns of comorbidity similar to those in developed nations to emerge, but also expected to see unique socio-economic and socio-demographic factors specific to South Africa. To address the issue of a continuum of risk associated with gambling we employed the PGSI. Not only is this the first study to use the PGSI in a representative sample of urban South Africans, it is also one of the few that examines the associations between problem gambling, depression, anxiety and substance use disorder while controlling for the effects of socio-demographic and socio-economic factors specific to the African context.

Though South Africa hosts substantial pockets of high wealth and sophisticated infrastructure, it is not a developed country as economists understand that construct. Per capita gross domestic product, at under $8,000 (World Bank 2014a), is less than a quarter of the mean in the developed countries as classified by the World Bank. At least 24 % of South Africans between school-leaving and retirement ages are unemployed (Statistics South Africa 2013), 13.8 % lived on <$1.25 per day when the World Bank last gathered poverty headcount data for the country (World Bank 2014b), and the country's overall level of inequality (as measured by the GINI coefficient) is among the highest in the world (World Bank 2014b).

Methods

Participants

The NUPSGB study involved a face-to-face individual survey of $N = 3{,}000$ adult (+18 years of age) individuals (51.2 % male; mean age = 39.34; $SD = 15.77$) in the Cape Town, Durban, Johannesburg and Tshwane metropoles of South Africa, conducted by trained fieldworkers. The sample consisted of 65.3 % Black, 11.8 % Coloured,[1] 5 % Indian, and 19.7 % White. Enumeration Areas (EAs), defined according to the 2001 national census, were the primary sampling units used in the study and data were adjusted for clustering at this level. The data were also stratified according to metropolitan area and were weighted to reflect design characteristics of the NUPSGB study and to account for oversampling. The weighted data are representative of the adult population of the sampled

[1] The term 'Coloured' is the preferred self-designation for an ethnically and culturally distinctive population, located primarily in South Africa's Western Cape province, who are descended from a mixture of people present in the area in the seventeenth century, of whom the largest group were immigrants brought as slaves from Indonesia. Some of these ancestors were also indigenous Khoisan people.

metropolitan areas of South Africa on a variety of socio-economic variables including region, age, race/ethnicity, and sex, based on the All Media and Products Survey (AMPS).[2]

Measures

For the current study all measures were translated and back-translated in the 6 most widely used official languages of South Africa (isiZulu, Sesotho, Afrikaans, English, isiXhosa and Setswana).

Problem Gambling

The PGSI (Ferris and Wynne 2001) is a brief and easily administered population screen that consists of 9 items, 4 of which assess PG-associated behaviors (betting, tolerance, chasing, borrowing); and 5 of which assess adverse consequences of gambling (problems with gambling, criticism by others, guilt, health problems, financial problems). Scores of 0 are labeled as nonproblem gambling, 1 or 2 as low risk for problem gambling, 3–7 as moderate risk, and 8 and above as high risk for problem gambling or problem gamblers. The initial validation study of the PGSI demonstrated a unidimensional factor structure, good internal consistency ($\alpha = 0.84$), adequate test–retest reliability ($r = 0.78$) and construct validity as evidenced by correlations with gambling frequency (Ferris and Wynne 2001). Recently criterion-related and construct validity evidence for use of the PGSI in South African samples has been demonstrated (Dellis et al. 2014).

Given the main focus of the NUPSGB study on problem gambling, differential item functioning analyses on the 4 language groups that represent the majority of the sample (English, Afrikaans, Sesotho and Isizulu) was carried out. Findings demonstrated equivalence of item functioning on this measure (deleted for blind review) across language groups, thereby supporting the internal construct validity of this measure for use in South African samples.

Depression

The Beck Depression Inventory II (BDI-II; Beck et al. 1996) is a 21-item clinically derived self-assessment scale measuring the degree of state depression conceptualized as an abnormal state manifested by signs and symptoms such as low subjective mood, pessimism and nihilistic attitudes, loss of spontaneity, self-dissatisfaction, guilt, punishment, self-dislike, self-accusation, sense of failure, crying, irritability, social withdrawal, indecisiveness, body image change, weight loss, loss of appetite, somatic preoccupation, loss of libido and suicidal ideation. Individuals are asked to rate themselves on a 0–3 spectrum (0 = least, 3 = most) with a total score of 63 (most severely depressed). The BDI takes 5–10 min to complete and has adequate reliability and validity data (Beck et al. 1988).

The BDI-II is probably the most widely used self-report measure of depression and has been used in and validated in many countries, including South Africa (Berard et al. 1998; Steele and Edwards 2008a, b). In one of the most thorough investigations of the BDI in the South African context, Steele and Edwards (2008a, b) demonstrated that the psychometric properties of the translated scales were comparable to those of the original English

[2] The AMPS is conducted annually and is representative of the metropolitan areas of South Africa. The AMPS was used to weight the data because it more accurately reflected the demographic profile in South African metropolitan areas in 2008 than the outdated 2001 Census.

versions. Measures of internal consistency were as high as those for the validation studies in the USA and good item-scale correlations were obtained.

Anxiety

The Beck Anxiety Inventory (BAI; Beck et al. 1988) is a 21-item clinically derived self-assessment scale measuring degree of state anxiety. The scale has been constructed to maximally discriminate between symptoms of anxiety and depression. It has the same format as the BDI, and takes <5 min to complete. It has adequate validity and reliability (Beck et al. 1988). As with the BDI, Steele and Edwards (2008a, b) demonstrated equivalent psychometric properties of the BAI in a South African sample.

Substance Use Disorders

The World Health Organization Alcohol, Smoking and Substance Involvement Screening Test (WHO ASSIST) was developed to provide a reliable and valid screening instrument for use in primary care settings to identify people with both moderate and severe substance use problems (WHO ASSIST Working Group 2002). To our knowledge, the screen has not been used or validated in South Africa, but its psychometric properties were investigated recently in a sample of 1,047 subjects across seven countries selected to represent a broad range of cultures, political and economic systems in which substance-related problems are prevalent, and to enhance the cross-national generalizability of the findings (WHO ASSIST Working Group 2002). These countries included a number of developing countries, and specifically a southern African country, Zimbabwe, that linguistically and culturally overlaps with South Africa. Findings demonstrated that the WHO ASSIST is a valid screening test for identifying psychoactive substance use in individuals who use a number of substances and have varying degrees of substance involvement.

Socio-demographic and Socio-economic Measures

Socio-demographic variables were sex, race, age, marital status, and city of residence ("urban centre"). Socio-economic variables were education and income.

Data Analytic Strategy

Prevalence of gambling problems was examined through frequency analyses. Next, using cross tabulations and Chi square analyses, we examined demographic and socio-economic characteristics of problem gamblers, as well as levels of depression, anxiety and substance use disorder as a function of gambling severity (low/no risk vs. moderate/high risk as scored by the PGSI). Finally, odds ratios (ORs), derived from a series of logistic regression analyses with and without controls for socio-demographic and/or socio-economic variables, were used to study associations of PG with depression, anxiety and substance use disorders using continuous scores. In these analyses we entered the relevant psychiatric problem in the first block, and then added demographic variables in the second block to show that even after adjusting for demographic variables, relations between psychiatric problems and problem gambling persist. Analyses were performed using a combination of SPSS 20 and STATA 10 software. The NUPSGB calculated weights were used to adjust the data for the design effects of the NUPSGB.

Results

Prevalence of Gambling Problems

The PGSI is not administered to those who have never gambled. In our sample, 43.3 % of the NUPSGB study participants reported that they had never gambled and 36.2 % fell into the "no risk" category. People who had never gambled were grouped with those in the "no risk" category when deriving group status on the PGSI (79.5 %, n = 2,365).[3] Of those that have gambled, 10.4 % (n = 310) of the sample fell into the low risk category; 7 % (n = 228) into the moderate risk category and 3 % into the high risk category (n = 97). Due to the low endorsement for the high risk category, the two "problem gambling" categories (moderate and high risk for PG) were combined for the remainder of the analyses to increase power, following the example of other community-based studies of comorbidity (e.g. el-Guebaly et al. 2006). This resulted in two groups differing in severity of risk for PG: no/low risk (n = 2,675; 89.2 %) and moderate/high risk (n = 325; 10.8 %)—the latter, being referred to in the literature as "problem gamblers" (Welte et al. 2004).

Demographic and Socio-economic Characteristics of Problem Gamblers

Table 1 summarizes the prevalence of demographic and socio-economic characteristics, first for the sample as a whole, and then broken down into the PGSI risk categories. Note that the number of individuals and population proportions diverge due to the inclusion of sampling weights in the analysis.

Results show statistically significant differences between no/low risk and moderate/high risk groups along several dimensions. Gender [$F(1, 300) = 12.96$, $p < 0.01$],[4] racial status [$F(2.84, 850.71) = 18.18$, $p < 0.01$], age [$F(2.71, 814.20) = 3.89$, $p < 0.05$], marital status [$F(1, 300) = 9.89$, $p < 0.01$], education [$F(2.89, 868.42) = 10.34$, $p < 0.01$], employment status [$F(3.75, 1{,}124.21) = 10.53$, $p < 0.01$], and urban area [$F(4.80, 1{,}439.62) = 5.18$, $p < 0.01$] differed significantly according to gambling category.

Prevalence of Depression, Anxiety, Alcohol and Substance Use Among Problem Gamblers

Table 2 summarizes the prevalence of depression, anxiety, alcohol and substance use, first for the sample as a whole, and then broken down into the two PGSI risk categories. While rates of these disorders were higher for problem gamblers for all type of disorders, rates were especially elevated for alcohol use disorder.

Association of Problem Gambling with Depression, Anxiety and Substance Use Controlling for Socio-demographic and Socio-economic Factors

Associations of problem gambling with depression, anxiety, and substance use in the moderate/high categories are shown in Table 3 in the form of odds ratios (ORs).

[3] The number of individuals (n) diverges from the proportion that is reported due to the sampling weights that have been applied to the data to make them representative of the adult population.

[4] Pearson Chi square statistics were computed to determine whether the distribution of gambling categories differed according to socio-economic characteristics. The Pearson chi-square statistic is corrected for the survey design (i.e., sampling weights, clustering, and stratification) and is converted into an F statistic.

Table 1 Demographic and socio-economic characteristics of the study sample

	Full sample (n = 3,000) n (%)	No/low-risk (n = 2,675) n (%)	Mod/high risk (n = 325) n (%)	F statistic
Sex				
Male	1,500 (51.2 %)	1,313 (50.2 %)	187 (60.3 %)	12.96**
Female	1,500 (48.8 %)	1,362 (49.8 %)	138 (39.7 %)	
Race				
Black	1,906 (56.8 %)	1,617 (53.7 %)	289 (84.3 %)	18.18**
White	590 (23.5 %)	581 (25.5 %)	9 (5.2 %)	
Coloured	355 (13.3 %)	334 (14.0 %)	21 (7.3 %)	
Indian	149 (6.4 %)	143 (6.8 %)	6 (3.2 %)	
Age				
18–29	1,012 (29.0 %)	869 (28.2 %)	143 (36.1 %)	3.89*
30–44	976 (35.3 %)	861 (35.0 %)	115 (37.8 %)	
45–64	746 (26.9 %)	690 (27.6 %)	56 (21.0 %)	
65+	266 (8.8 %)	255 (9.2 %)	11 (5.1 %)	
Marital status				
Married/living as married	1,221 (44.1 %)	1,124 (45.1 %)	97 (34.9 %)	9.89**
Not married	1,779 (55.9 %)	1,551 (54.9 %)	228 (65.1 %)	
Education				
No schooling	58 (1.9 %)	50 (1.9 %)	8 (3.1 %)	10.34**
Less than high school	1,489 (49.6 %)	1,298 (48.2 %)	191 (61.6 %)	
High school	1,028 (34.1 %)	920 (34.4 %)	108 (31.0 %)	
Some college or higher	404 (14.4 %)	388 (15.5 %)	16 (4.3 %)	
Employment status				
Full-time	1,260 (44.2 %)	1,145 (45.2 %)	115 (34.7 %)	10.53**
Part-time/occasional	287 (9.6 %)	249 (9.3 %)	38 (12.5 %)	
Unemployed	928 (29.9 %)	784 (28.3 %)	144 (44.4 %)	
Student	191 (5.4 %)	174 (5.6 %)	17 (3.8 %)	
Retired	334 (10.9 %)	323 (11.6 %)	11 (4.6 %)	
Urban area				
Cape Town	660 (22.0 %)	621 (23.2 %)	39 (11.2 %)	5.18**
Durban	600 (20.3 %)	549 (20.7 %)	51 (16.9 %)	
Johannesburg/Soweto	597 (20.0 %)	510 (19.1 %)	87 (28.1 %)	
Tshwane	430 (14.3 %)	409 (15.2 %)	21 (6.7 %)	
West Rand	130 (4.3 %)	109 (4.2 %)	21 (4.8 %)	
East Rand	583 (19.1 %)	477 (17.6 %)	106 (32.3 %)	

** Represents significance at the 1 % level, * represents significance at the 5 % level

Each psychiatric problem was analyzed as a predictor variable in separate logistic regressions with PGSI categorization (non problem gambling vs. problem gambling) as the outcome variable. Following Petry et al. (2005) we report results for three models. In Model 1 the psychiatric disorder of interest (e.g. depression) was entered without adjusting for socio-demographic or socio-economic characteristics. In Model 2, socio-demographic

Table 2 Prevalence of depression, anxiety, alcohol and substance use for the study sample

	Full sample (n = 3,000) n (%)	No/low-risk (n = 2,675) n (%)	Mod/high risk (n = 325) n (%)	χ^2
Depression				
Minimal/mild	2,732 (92.4 %)	2,469 (93.7 %)	263 (81.3 %)	33.73**
Moderate/severe	241 (7.6 %)	180 (6.3 %)	61 (18.7 %)	
Anxiety				
Minimal/mild	2,625 (87.8 %)	2,390 (89.7 %)	235 (71.3 %)	38.90**
Moderate/severe	375 (12.2 %)	285 (10.3 %)	90 (28.7 %)	
Alcohol use				
Low	2,545 (85.1 %)	2,347 (87.8 %)	198 (60.6 %)	129.89**
Moderate/high	455 (14.9 %)	328 (12.2 %)	127 (39.4 %)	
Any SUD (excl alc & nic)				
Low	2,857 (95.8 %)	2,575 (96.7 %)	282 (88.1 %)	42.59**
Moderate/high	143 (4.2 %)	100 (3.3 %)	43 (11.9 %)	

** Represents significance at the 1 % level, * represents significance at the 5 % level

Table 3 Associations of problem gambling with depression, anxiety, and substance use in the moderate/high categories in the form of odds ratios (ORs)

	Unadjusted OR (Model 1)		Adjusted OR controlling for socio-demographic characteristics (Model 2)		Adjusted OR controlling for socio-demographic and socio-economic characteristics (Model 3)	
	OR	95 % CI	OR	95 % CI	OR	95 % CI
Moderate/severe Depression	3.41**	2.2–5.3	2.44**	1.5–3.9	2.17**	1.4–3.5
Moderate/severe Anxiety	3.50**	2.3–5.3	2.62**	1.7–4.1	2.45**	1.6–3.8
Moderate/severe Alcohol use	4.68**	3.5–6.2	4.03**	2.9–5.5	3.88**	2.8–5.3
Moderate/severe SUD	3.93**	2.5–6.1	3.44**	2.1–5.5	3.09**	1.9–4.9

** Represents significance at the 1 % level, * represents significance at the 5 % level

predictors (sex, race, age, marital status, and urban centre) were entered, and in Model 3 the socio-economic variables (education and employment status) were entered.

Depression was clearly related to problem gambling with statistically significant ORs in excess of 2 under all specifications. This implies that individuals who exhibit symptoms of depression are at least twice as likely to be problem gamblers than individuals who do not exhibit these symptoms. Similar results were found for anxiety, alcohol and substance use. Of these, moderate/severe alcohol use had the highest odds-ratio for likelihood of being a problem gambler, with the odds increasing more than three-fold in the presence of moderate/severe alcohol use.

The measures of psychopathology employed in this study are often used continuously. We therefore investigated the increase in continuous scores on the psychopathology measures as a function of PGSI group status. Figure 1a shows the increase in mean BDI with each PGSI category ($F = 12.79$; $df = 3$; $p < 0.01$). Figure 1b, c show similar results

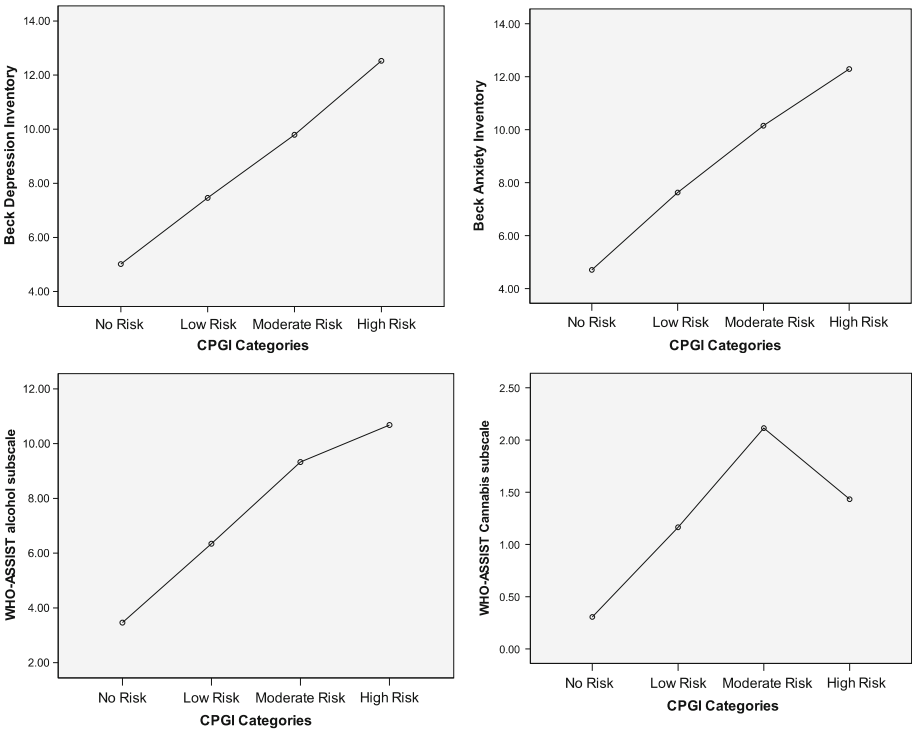

Fig. 1 Increases in depression, anxiety, alcohol and cannabis use as a function of PGSI risk category

for BAI (F = 16.89; $df = 3$; $p < 0.01$) and alcohol use on the WHO ASSIST (F = 30.89; $df = 3$; $p < 0.01$).

To investigate the effect of PGSI category on a continuous measure of substance use, we employed the WHO ASSIST subscale for cannabis use since this was the most prevalent form of substance use among subjects. Interestingly, here, the highest mean rating for cannabis use was associated with moderate levels of problem gambling (F = 7.36; $df = 3$; $p < 0.01$).

Association Between Comorbid Status and Socio-demographic and Socio-economic Variables

To investigate the association between comorbid status (problem gambling with depression/anxiety) and socio-demographic and socio-economic variables, we created 3 groups: (1) no disorder, (2) either depression, anxiety or problem gambling but no comorbidity, and (3) comorbid for depression/anxiety and problem gambling. Of the full sample, 39 (1.2 %) were comorbid for depression/anxiety and problem gambling, 20.6 % had one of the three disorders but were not comorbid, and 78.2 % had no disorder. Table 4 summarizes the descriptive statistics on differences between these three groups on socio-demographic and socio-economic variables. Inspection of the standardized residuals in the Chi square analyses suggested that Black racial status, young adulthood, and a lack of education were associated with comorbidity between problem gambling and depression/anxiety.

Table 4 Association between comorbid status (no disorder; or either depression, anxiety or problem gambling but no comorbidity; or comorbid for depression/anxiety and problem gambling) and socio-demographic and socio-economic variables

	No disorder	Either PG or anx./depr. but no comorbidity	PG comorbid with anx./depr.	χ^2
Sex				
Male	1,169 (78.3 %)	232 (14.9 %)	99 (6.8 %)	0.02
Female	1,143 (78.1 %)	242 (15.1 %)	115 (6.8 %)	
Race				
Black	1,309 (68.4 %)	409 (21.6 %)	188 (9.9 %)	18.42**
Coloured	303 (85.5 %)	39 (10.9 %)	13 (3.7 %)	
Indian	138 (90.4 %)	9 (8.1 %)	2 (1.4 %)	
White	562 (94.4 %)	17 (3.4 %)	11 (2.3 %)	
Age				
18–29	753 (77.1 %)	185 (16.3 %)	74 (6.6 %)	0.66
30–44	745 (78.3 %)	155 (14.9 %)	76 (6.8 %)	
45–64	590 (78.1 %)	103 (14.2 %)	53 (7.7 %)	
65+	224 (81.6 %)	31 (13.9 %)	11 (4.5 %)	
Education				
No schooling	40 (69.2 %)	11 (17.7 %)	7 (13.1 %)	12.42**
Less than high school	1,067 (72.1 %)	282 (18.4 %)	140 (9.5 %)	
High school	830 (82.7 %)	144 (12.9 %)	54 (4.4 %)	
Some college or higher	357 (89.4 %)	35 (8.1 %)	12 (2.5 %)	
Employment status				
Full-time	1,039 (84.0 %)	160 (12.0 %)	61 (4.0 %)	9.72**
Part-time/occasional	194 (67.4 %)	64 (22.8 %)	29 (9.8 %)	
Unemployed	644 (70.5 %)	185 (18.8 %)	99 (10.7 %)	
Student	150 (81.9 %)	33 (14.2 %)	8 (3.9 %)	
Retired	285 (83.7 %)	32 (10.5 %)	17 (5.9 %)	

** Represents significance at the 1 % level, * represents significance at the 5 % level

Conversely, full-time employment and some college or higher education were associated with no disorder status. Gender was not associated with increased risk of comorbidity with anxiety/depression.

To investigate the association between comorbid status (problem gambling with any substance use disorder) and socio-demographic and socio-economic variables, we created three groups: (1) no disorder, (2) either substance use disorder or problem gambling but no comorbidity, and (3) comorbid for substance use disorder and problem gambling. Of the full sample, 43 (1.2 %) were comorbid for substance use disorder and problem gambling, 11.9 % had either substance use disorder or problem gambling but were not comorbid, and 86.9 % had no disorder. Table 5 summarizes the descriptive statistics on differences between these three groups on socio-demographic and socio-economic variables.

Inspection of the standardized residuals in the Chi square analyses suggested that male gender, Black racial status, and young adulthood were associated with comorbidity between problem gambling and substance use disorder. Conversely, full-time employment and some college or higher education were associated with no disorder status.

Table 5 Association between comorbid status (no disorder; or either SUD or problem gambling but no comorbidity; or comorbid for SUD and problem problem gambling) and socio-demographic and socio-economic variables

	No disorder	Either PG or SUD but no comorbidity	PG comorbid with SUD	χ^2
Sex				
Male	1,239 (83.9 %)	225 (14.1 %)	36 (2.0 %)	17.71**
Female	1,336 (90.1 %)	157 (9.5 %)	7 (0.4 %)	
Race				
Black	1,550 (81.7 %)	322 (16.7 %)	34 (1.6 %)	10.16**
Coloured	320 (90.9 %)	28 (7.5 %)	7 (1.6 %)	
Indian	139 (93.8 %)	10 (6.2 %)	0 (0 %)	
White	566 (95.5 %)	22 (4.2 %)	2 (0.3 %)	
Age				
18–29	820 (82.9 %)	162 (14.4 %)	30 (2.6 %)	6.33**
30–44	826 (86.2 %)	138 (12.7 %)	12 (1.2 %)	
45–64	676 (90.0 %)	69 (9.9 %)	1 (0.1 %)	
65+	253 (93.3 %)	13 (6.7 %)	0 (0 %)	
Education				
No schooling	50 (84.4 %)	8 (15.6 %)	0 (0 %)	5.74**
Less than high school	1,245 (84.1 %)	217 (14.3 %)	27 (1.7 %)	
High school	884 (87.7 %)	133 (11.4 %)	11 (0.9 %)	
Some college or higher	377 (94.8 %)	23 (4.6 %)	4 (0.6 %)	
Employment status				
Full-time	1,106 (89.6 %)	140 (9.6 %)	14 (0.9 %)	7.42**
Part-time/occasional	233 (82.1 %)	49 (16.2 %)	5 (1.7 %)	
Unemployed	751 (81.2 %)	156 (16.9 %)	21 (1.9 %)	
Student	164 (88.6 %)	25 (10.5 %)	2 (0.9 %)	
Retired	321 (95.1 %)	12 (4.6 %)	1 (0.2 %)	

** Represents significance at the 1 % level, * represents significance at the 5 % level

Discussion

The aim of the current study was to examine patterns of comorbidity for problem gambling (moderate-to-high risk for PG including actual PG), anxiety, depression and substance use disorder in a national representative (urban) sample in Africa. We expected similar patterns of comorbidity as had been observed elsewhere to emerge, but also anticipated indications of unique socio-economic and socio-demographic factors more characteristic of a developing country. In line with previous prevalence studies of problem gambling we find that the sub-populations who are male, young, relatively uneducated, unemployed and single are over-represented in the problem gambling group. Also echoing international findings, the prevalence of depression, anxiety, alcohol and substance use were clearly higher among the sample at risk for PG, with alcohol problems being particularly strongly associated. These results held when controlling for socio-demographic and socio-economic factors in multivariate analyses, and were true also when depression, anxiety and SUD were examined dimensionally. As special aspects of urban South Africa, we also found that

Black racial status and living in Johannesburg or the East Rand were associated with increased risk of problem gambling. The second characteristic merits attention and contextualization. Among the urban centers from which our data are drawn, Johannesburg and the East Rand are the areas that are economically dominated by the mining industry. The majority of mineworkers are Black males, many of whom have migrated to their sites of employment from other parts of the country and have partners and children living in their areas of origin. Social life in the mining areas often revolves around shebeens (unlicensed taverns) in which illegal gambling is common.

These results have implications for hypotheses about the universality of patterns of comorbidity among psychiatric disorders. Questions about the extent to which psychiatric disorders are culture-specific, and about whether their diagnosis in non-Western environments involves ethnocentric projection, have been warmly contested in cross-cultural psychology and popular discussion (Watters 2010). The most common view among professional researchers and clinicians, influenced by the increasing understanding of the biological basis of psychiatric disorders, is that cultural differences lead to variations in symptoms and frequency among universally occurring major forms of psychopathology (Ilechukwu 1988). For instance, it has been argued that depression was either nonexistent or at the very least uncommon in Africa (Perez and Junod 1998). Recent careful reviews of evidence, however, indicate that depression and anxiety are not only common in Africa but demonstrate similar clinical presentation patterns as in the West (Swartz 1998). In the current study, we show in a national representative (urban) African sample that patterns of comorbidity for problem gambling, depression, anxiety and SUD mirror those found in wealthy western countries. These patterns of comorbidity, especially with alcohol and drug abuse suggest the concept of "cross-addiction"—that is, that there may be common etiological factors that contribute to co-occurrence of more than one addictive disorder (Shaffer et al. 2004).

At the same time, our findings point to the kinds of contextual factors that specifically influence patterns of mental health stress in poorer countries. We noted that Black males living in Johannesburg and the East Rand, the centers most characterized by company residences for mine employees often living far from their families, were found to be at higher risk for problem gambling and for comorbid disorders. Environments of this kind are no longer common in wealthy countries,[5] so the special dynamics of mental health impairment with which they are associated may be neglected by clinical diagnostics and epidemiology that fails to include evidence from a global range of populations.

South African policy makers might draw some guidance from our findings. Because the group most at risk for problem gambling do most of their gambling outside legal venues, approaches to mitigation most common in wealthy countries—requirements on casino and track operators to monitor and screen clients for signs of problem gambling, and mandated redirection of some of the operators' profits to fund public awareness and easily accessible helplines and clinics—should be expected to have more limited effects in South Africa. On the other hand, our evidence concerning comorbidity might lead clinicians examining patients who present with symptoms of depression or anxiety to also probe patterns of gambling behavior. There are at present few resources dedicated to reducing alcohol and other substance abuse and dependence at the clinical level in townships. However, both government and mining companies fund public health interventions aimed at reducing

[5] Remote sites for energy extraction in, for example, Canada and Norway differ from the South African mining concentrations in at least two important ways relevant to the present discussion: the predominantly male employee groups are much smaller, better educated, and frequently rotated home at company expense.

prevalence. Our results suggest that these might usefully be accompanied by measures that reflect the contribution of problem gambling to the general nexus of compromised behavior-related health in, particularly, the younger Black population.

Limitations and Conclusion

The findings reported are subject to a number of limitations. First, the sample does not include rural South Africans, whose patterns of thought, behavior and mental health stress may be interestingly different from those of their urban compatriots. Second, given the low prevalence of full-blown PG we were forced, given our sample size, to focus attention on the somewhat 'watered down' construct of 'problem gambling'. The group of problem gamblers likely includes a higher proportion of false positive identifications than would be the case if, in a larger total sample, we could concentrate on PGSI category-4 gamblers without losing power.

These limitations notwithstanding, our results and analysis extend investigation of the co-occurrence of gambling problems with other mental health disorders beyond the confines of wealthy countries, to which such investigation has hitherto been almost exclusively restricted. We find that South African problem gamblers show patterns of comorbidity similar to those that have been observed elsewhere, but that rates of occurrence may be exacerbated by environmental factors not typically found in the developed world.

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