

Optimizing DSM–IV–TR Classification Accuracy: A Brief Biosocial Screen for Detecting Current Gambling Disorders Among Gamblers in the General Household Population

Line Gebauer, BA¹; Richard LaBrie, EdD²; Howard J Shaffer, PhD, CAS³

Objective: To develop a pathological gambling (PG) screen for efficient application to the household population and for clinicians to use with treatment seekers.

Method: We applied a series of multivariate discriminant functions to past-12-month Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR)–based, gambling-related problems; the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) measured and collected this data. The NESARC conducted computer-assisted personal interviews with 43 093 households and identified the largest sample of pathological gamblers drawn from the general household population.

Results: We created a 3-item, brief biosocial gambling screen (BBGS) with high sensitivity (Sensitivity = 0.96; 76 of 79 pathological gamblers correctly identified) and high specificity (Specificity = 0.99; 10 892 of 11 027 nonpathological gamblers correctly identified).

Conclusions: Major US studies reveal extensive comorbidity of PG with other mental illnesses. The BBGS features psychometric advantages for health care providers that should encourage clinicians and epidemiologists to consider current PG along with other problems. The BBGS is practical for clinical application because it uses only 3 items and they are easy to ask, answer, and include in all modes of interviewing, including self-administered surveys. The BBGS has a strong theoretical foundation because it includes 1 item from each of the addiction syndrome 3 domains: neuroadaptation (for example, withdrawal); psychosocial characteristics (for example, lying); and adverse social consequences of gambling (for example, obtaining money from others).

Can J Psychiatry. 2010;55(2):82–90.

Clinical Implications

- Expansion of land-based and Internet gambling opportunities may alert clinicians to the need for increased screening for PG.
- The presence of comorbidity among disordered gamblers has major implications for treatment planning, relapse, and recovery.
- Expanding the clinical care of patients with a co-occurring gambling disorder could result in improved treatment for various associated behavioural health problems.

Limitations

- The BBGS is based on self-reported endorsement of DSM-IV-TR–based criteria; screens using an expanded set of criteria or actual behaviours might yield different clinical tools.
- The BBGS is specific to screening for a current gambling disorder; other criteria might be more sensitive to PG measured over a longer time frame than the past-year.
- The DSM-IV-TR–based criteria have been used successfully in non-US populations; however, the BBGS remains to be tested using these other populations.

Key Words: *gambling, pathological gambling, measurement, screening, assessment, addiction, psychometrics, public health*

The growing public health interest and concern focused on gambling behaviour^{1,2} stimulated increased research interest about the epidemiology of gambling and gambling-related disorders, and generated a need for gambling-related screening instruments appropriate to more widespread use within large populations. Our report describes a public health resource developed in response to that need: a psychometrically sound and brief screen for disordered gambling that various interests can employ within the general population.

National prevalence studies focusing on PG provide evidence that PG is a relatively low base-rate phenomenon, with rates of past-year PG ranging from 0.2% to 2.1% worldwide: Norway, 0.2%³; New Zealand, 0.5%⁴; Sweden, 0.6%⁵; South Africa, 1.4%⁶; and, Australia, 2.1%⁷. There is evidence that these prevalence estimates are stable across both research studies and methods. Three studies⁸⁻¹⁰ conducted in the United Kingdom during 2000, 2005, and 2007 estimated the prevalence of current PG to be 0.7%, 0.5%, and 0.7%, respectively. There also is evidence of stability over time. In 1979, the first national US survey¹¹ estimated the prevalence of serious gambling problems to be 0.7%. After several decades of gambling expansion, the recent NESARC¹² reported that respondents meeting criteria for past-year PG were too few to analyze. Analysis of the publicly available NESARC database yielded an estimated prevalence of 0.16%. The stability of gambling disorder prevalence over time appears unaffected by increased gambling access. Similar to the US experience, a Swiss survey¹³ conducted before the introduction of casinos estimated past-year PG at 0.8%. A survey by the same researchers about 10 years after the legalization of casinos¹⁴ estimated past-year PG prevalence at 0.2%.

As public health interest in gambling has accelerated, more large-scale US surveys of various mental health disorders, notably the NESARC¹² and NCS-R,¹⁵ included DSM-IV-TR¹⁶ measures of PG. The NESARC survey of household residents ($n = 43\ 093$) revealed a significant overlap between the diagnosis of PG and other psychiatric diagnoses. Participants with a lifetime PG diagnosis (that is,

prevalence = 0.4%, $n = 195$) were likely to report experiencing other psychiatric disorders: 73% reported an alcohol use disorder; 60% reported nicotine dependence; 50% a mood disorder; 43% an anxiety disorder; and 61% a PD.¹² The NCS-R reported similar overlap between lifetime PG and psychiatric disorders: 76% of the identified lifetime pathological gamblers (prevalence = 0.6%, $n = 24$) evidenced a substance use disorder; 56% a mood disorder; 60% an anxiety disorder; and 42% an impulse-control disorder.¹⁵ In addition, the NCS-R was the first scientific study to obtain onset data, revealing that among pathological gamblers who had any comorbid disorder, the other disorder preceded PG 74% of the time and followed it 23% of the time.

PG Among the General Population

Previously, we noted in our meta-analysis of the prevalence of disordered gambling¹⁷ that there were 27 instruments for identifying disordered gambling at that time; more measures have been developed since then. The motivation of the developers, the social context at origin, and the inherent strengths and weaknesses associated with these instruments have influenced an array of multidimensional characteristics.¹⁸ The proliferation of PG-related instruments reflects the ambition of researchers to achieve a gold standard that accurately classifies disorders. A review of the extant screening instruments is beyond the scope of our study. We chose to investigate the DSM-IV-TR formulation for identifying PG because: the DSM-IV-TR is the putative choice for assessing eligibility for the treatment of behavioural disorders; DSM-IV-TR criteria were used in recent national household surveys of behavioural disorders; and, the analyses leading to an improved, brief PG screen can contribute to an improved understanding of the fundamental features of PG and contribute to the ongoing construction of DSM-V.

One DSM-based brief screen for gambling disorders is the Lie/Bet Questionnaire.¹⁹ The Lie/Bet scale classifies respondents as potential pathological gamblers if they endorse either the DSM criterion question, "Have you ever had to lie to people important to you about how much you gambled?" or the question, "Have you ever felt the need to bet more and more money?" In the initial field test, the screen correctly identified all but one of the GA members (Sensitivity = 0.99; 190/191) and incorrectly identified 9% of the control group of Department of Veterans Affairs employees as GA members (Specificity = 0.91; 155/171). A follow-up study by the same researchers using the same design correctly identified all of the GA members ($n = 146$) but incorrectly identified 15% of the employees as GA members (that is, false positives) (Specificity = 0.85; 235/277).²⁰ A Norwegian study²¹ applied the Lie/Bet Questionnaire to a general population sample of adults and classified a target group who satisfied the DSM-IV criteria both for PG and for at-risk gambling (that is, those who endorsed 3 or more DSM-IV criteria). This study reported sensitivity as 0.92 (11/12) and specificity as 0.97 (1328/1371).²¹ This study of the general

Abbreviations used in this article

AUDADIS	Alcohol Use Disorder and Associated Disabilities Interview Schedule
BBGS	brief biosocial gambling screen
DSM	Diagnostic and Statistical Manual of Mental Disorders
GA	Gamblers Anonymous
NCS-R	National Comorbidity Survey Replication
NESARC	National Epidemiologic Survey on Alcohol and Related Conditions
PD	personality disorder
PG	pathological gambling
PPV	positive predictive value

population underscores the difficulty of investigating low base-rate diseases. The authors failed to report the number of pathological gamblers perhaps because there were too few for confident analysis.²¹

Objectives

The objective of our study was to develop a brief PG screen for the general population; ideally this screen should have strong psychometric properties that would promote broad clinical application. To date, the NESARC survey,¹² which collected information about DSM-IV-TR-based PG criteria from the general household population, has produced the largest sample of pathological gamblers drawn from the general household population. This information base provided an ideal opportunity to develop and demonstrate a new general population gambling screen, constrained to the least number of DSM-IV-TR criteria, sufficiently sensitive to identify PG correctly, and specific enough to exclude nonpathological gamblers from being incorrectly classified as having PG (that is, false positives).

NESARC used the AUDADIS-IV,²² a measure that assesses lifetime and past-year symptoms of mental disorders using DSM-IV-TR criteria. As part of the interview, all participants who had ever gambled 5 or more times during a year answered questions about PG symptoms. Table 1 summarizes the DSM-IV-TR diagnostic criteria for PG, presents the NESARC survey questions associated with each criteria, and provides the criterion's brief title used in this report. A PG diagnosis requires 5 or more positive endorsements of DSM-IV-TR symptoms or signs. (From this point on, we will use the single term symptoms to refer to both symptoms [that is, self-reported experiences] and signs [that is, observable circumstances]).

The best candidate items for a BBGS would correctly identify the largest proportion of pathological gamblers with the fewest false positives. Operationally, the most effective screening items would be those with: high sensitivity, the proportion of true positives correctly identified; and, the lowest proportion of false positives, the proportion of positives incorrectly identified as cases. Sensitive public health screens will maximize recognizing true positives. Consequently, it becomes very important for such screens to limit the number of false positives; this feature optimizes clinical utility.

The findings of Strong and Kahler²³ and Toce-Gerstein et al.,²⁴ among others, indicate that the 10 DSM-IV-TR criteria for PG vary in their ability to discriminate PG from non-PG. The syndrome model of addiction²⁵ predicts that criteria reflecting symptoms common both to substance and to nonsubstance addiction (for example, neuroadaptation as measured by DSM criterion 2, tolerance, and DSM criterion 4, withdrawal) will be effective diagnostic classifiers of PG. Similarly, research focusing on other objects of addiction (for example, cocaine) has shown that physical symptoms are associated with increased risk for developing a more severe disorder, compared with behavioural and social symptoms.²⁶ Likewise,

research demonstrates that symptoms of physical dependence are effective discriminators and (or) gates for alcohol dependence.²⁷ Consequently, we expect that the physical symptoms associated with gambling will be powerful discriminators between PG and non-PG. We also expect that social symptoms will discriminate PG from non-PG. The Lie component of the Lie/Bet Questionnaire evidences the discriminative ability of a social symptom. Concealing the extent of involvement with the object of addiction is a social symptom common both to substance and to nonsubstance addiction. The financial problems typically associated with gambling seemingly are more specific, but addiction to substances also can include severe financial demands to acquire the substance. Consequently, we expect that the social symptom of turning to others for money to alleviate financial problems also will be a strong predictor of PG.

Methods

Subjects

Data for our study were drawn from a recent survey—now in the public domain—of a nationally representative US sample, the NESARC. The Cambridge Health Alliance Institutional Review Board approved the secondary analysis of the NESARC data. The NESARC obtained data using a structured, Computer-Assisted Personal Interview system from a US representative sample of adults ($n = 43\,093$) aged 18 years and older among a civilian noninstitutional population residing in households and group quarters. The investigators provided participants with written information about the survey and obtained their consent before conducting interviews. The survey, conducted during a 2-year period, 2001–2002, had a response rate of 81%. The NESARC investigators obtained information about nicotine, alcohol, and other specific drug use disorders for 10 drug classes. The mood and anxiety assessments evaluated major depressive episode, dysthymic disorder, manic episode, hypomanic episode, panic disorder, social phobia, specific phobia, and generalized anxiety disorder. NESARC assessed 7 of the 10 DSM-IV-TR PDs: dependent, avoidant, histrionic, obsessive-compulsive, schizoid, paranoid, and antisocial.

The NESARC used the rate of gambling participation to screen for gambling problems; that is, the participants ($n = 11\,153$) who confirmed having gambled 5 or more times during any 1 year screened into the gambling module. The AUDADIS-IV assessed other DSM-IV-TR symptoms. Participants reported their lifetime gambling symptoms in response to questions posed as “Did you ever . . . ?” Subsequent questions identified whether the endorsed symptoms occurred during the last 12 months or before 12 months ago.

An important application of a brief screening procedure is to identify people who would benefit from further evaluation. Consistent with this strategy, we sought to discriminate NESARC participants with current (that is, past 12 months) PG. The scoring of past-year symptoms identified 79 participants (that is, 0.2% of the total sample and 0.7% of

Table 1 AUDADIS-IV symptoms and criteria for DSM-IV-TR PG

DSM-IV-TR criterion for PG	Corresponding AUDADIS-IV symptom	Abbreviation for current study
Are restless or irritable when attempting to cut down or stop gambling	Ever find that you became restless, irritable, or anxious when trying to quit or cut down on your gambling	Withdrawal
Lie to family members, therapist, or others to conceal the extent of involvement with gambling	Ever try to keep your family or friends from knowing how much you gambled	Lying
Rely on others to provide money to relieve a desperate financial situation caused by gambling	Ever have such financial trouble as a result of your gambling that you had to get help with living expenses from family, friends, or welfare	Money from others
Have repeated unsuccessful efforts to control, cut back, or stop gambling	Ever more than once try to quit or cut down on your gambling, but found you could not do it	Loss of control
Need to gamble with increasing amounts of money in order to achieve the desired excitement	Ever find that you had to increase the amount of money you would gamble to keep it exciting	Tolerance
Have jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling	Ever have job or school trouble because of your gambling—such as missing too much work, being demoted at work, losing your job, or dropping out of school Ever break up or come close to breaking up with anyone who was important to you because of your gambling	Relations
Gamble as a way of escaping from problems or of relieving a dysphoric mood (for example, feelings of helplessness, guilt, anxiety, depression)	Ever gamble to get out of a bad mood—such as feeling nervous, sad, or down Ever gamble to forget your problems	Escape
After losing money gambling, often return another day in order to get even (chasing one's losses)	Ever find you had to gamble again as soon as possible after losing in order to win back your losses Ever find you had to gamble again as soon as possible after winning in order to win more	Chasing
Have committed illegal acts, such as forgery, fraud, theft, or embezzlement, in order to finance gambling	Ever raise gambling money by writing a bad check, signing someone else's name to a check, stealing, cashing someone else's check, or in some other illegal way	Illegal acts
Preoccupied with gambling (for example, preoccupied with reliving past gambling experiences, handicapping or planning the next venture, or thinking of ways to get money with which to gamble)	Ever spend a lot of time gambling, planning your bets, or studying the odds Ever spend a lot of time thinking about ways to get money together so you could gamble Ever spend a lot of time thinking about the times when you won or lost	Preoccupation

^a For criteria with more than one corresponding NESARC item, endorsement of any of those items counts as endorsing that criterion, but endorsing more than one does not add to one's score (for example, if I claim to have job or school trouble, and I have broken up as a result of gambling, I still receive only one point toward my criteria count).

participants who screened into the gambling module) who reported experiencing 5 or more DSM criterion problems; this group met DSM-IV-TR diagnostic criteria for current PG. We retained 2 participants who were missing responses to a single item but who met criteria for current PG. Given the small number of people with current PG, we decided not to eliminate these people and scored the missing responses as negative. There were 11 074 non-PG participants. We eliminated non-PG participants ($n = 47$) who lacked a complete set of responses to DSM-IV-TR items; reducing the DSM analysis to 11 027 non-PG participants.

Measures

To provide a reference standard for the properties of an effective screen, we applied the Lie/Bet Questionnaire procedure

to the NESARC questions that parallel those of the Lie/Bet Questionnaire. To illustrate, we accepted a positive response to the Lie/Bet question, “Have you ever had to lie to people important to you about how much you gambled?” when respondents endorsed the NESARC Lie item, “Did you ever try to keep your family or friends from knowing how much you gambled?” We similarly accepted a positive response to the Lie/Bet question, “Have you felt the need to bet more and more money?” when participants endorsed the NESARC Tolerance item, “Did you ever find that you had to increase the amount of money you would gamble to keep it exciting?” Finally, we classified participants as having PG or not if a participant endorsed at least one of the Lie or Tolerance items. We refer to this reference measure as the Mapped Lie/Bet scale.

We classified the PG status of participants who endorsed 5 or more DSM-IV-TR criteria as occurring during the past 12 months as current PG; we defined the other participants as non-PG.

Data Analysis

We used SPSS (version 16.0 for Windows) chi-square tests to evaluate the significance of the differences in the distribution of demographic characteristics between research groups. We compared the NESARC participants eligible for the gambling module of the survey with those ineligible; within the eligible group, we compared current PGs to those with too few endorsed criteria to meet diagnosis. We generated contingency tables for the endorsement distribution of the 10 DSM-IV-TR criteria by the participants' PG status. Then, we computed critical predictive properties for each diagnostic criterion: sensitivity, the proportion of PGs successfully estimated as PGs; and, PPV, the proportion of participants estimated as current PG who currently had PG. PG is a low base-rate disorder and most study participants are overwhelmingly non-PG. Parameters of contingency tables that involve the non-PG such as specificity (that is, the proportion of actual nonpathological gamblers who are estimated as nonpathological gamblers) and negative predictive value (that is, the proportion of estimated nonpathological gamblers who are actually nonpathological gamblers), can vary only slightly across sample characteristics. The optimal screening instrument for an infrequently occurring phenomena (that is, PG) would be one that correctly identifies the largest proportion of current pathological gamblers (that is, highest sensitivity) and incorrectly identifies as pathological gamblers the fewest non-PG (that is, highest PPV). To develop a brief and efficient screen for PG, we conducted a stepwise discriminant function analysis (SPSS version 16.0) using the individual DSM-IV-TR criteria as predictors to discriminate the group of participants who met DSM-IV-TR criteria for current PG from the group that did not meet criteria. At each step, the stepwise procedure selected the DSM-IV-TR criterion that, in combination with any previously selected criteria, resulted in the largest multivariate difference between groups as measured by Wilks lambda (λ). To avoid a trivial outcome owing to the low rate of PG, we defined the a priori probability of group membership for classifying participants as equal. We selected as the most parsimonious and effective set of discriminators, the stepwise selection that yielded the best classification measures of sensitivity and PPV.

Results

Demographics

Table 2 presents the demographic characteristics of the NESARC sample. The characteristics of the participants (74%) who did not gamble sufficiently to warrant administration of the gambling questions were significantly different (chi-square test results ranged from 73 to 728, and associated

probabilities were statistically significant, $P < 0.001$) from participants who screened into the gambling module on all demographic characteristics except urbanicity (Table 2). The participants who screened into the gambling module were more likely to be: male, Caucasian, married, exposed to higher education, of higher family income, and from the US northeastern and midwestern states.

The comparison of the demographic characteristics of gambling module respondents categorized with current PG (0.7%) or non-PG indicated that people with current PG were younger ($\chi^2 = 13$, $df = 3$, $P < 0.01$) and more likely to have never married ($\chi^2 = 14$, $df = 2$, $P < 0.01$). The small size of the current PG sample precluded testing the differences among the 5 ethnoracial groups. We combined the smaller groups of Native Americans, Asians, and Hispanics into a single group. The test of the 3 ethnoracial groups, Caucasian, African American, and other, indicated that the increased prevalence of African Americans among the current PG sample was statistically significant ($\chi^2 = 9$, $df = 2$, $P < 0.05$).

PG Status and DSM-IV-TR Criterion Endorsement: Sensitivity and PPV

Table 3 presents the distribution of endorsements for each DSM-IV-TR criterion by PG status. In addition, Table 3 provides the sensitivity and PPV parameters for each criterion. The order of criteria in Table 2 reflects the relative strength of the estimation parameters. The last row of Table 2 also provides the characteristics of the Mapped Lie/Bet items.

Discriminant Function Analysis

The stepwise discriminant function analysis selected 4 criteria that made statistically significant contributions to the discrimination between current PG and non-PG. This discriminant model identified, in order of contribution to discrimination, Withdrawal, Lying, Borrowing Money, and Loss of Control ($\lambda = 0.40$, $df = 4$, $P < 0.001$). The classification of participants using this model had a high sensitivity of 0.99: only one of the 79 people with PG was misclassified. However, this model incorrectly classified 226 people with non-PG as PG (that is, false positives). The 4-variable model satisfied the study criterion of high sensitivity but the large number of false positives and a relatively low PPV of 0.26 (Table 4) reduced our enthusiasm for this model. Consequently, we considered earlier steps in the model, using just 2 or 3 predictors, because these models were less sensitive but had markedly fewer false positives. We considered this circumstance more desirable for clinical application.

Screen Development

We tested a BBGS for current PG using the first 2 items selected by the stepwise procedure, Withdrawal and Lying. The Withdrawal–Lying screen correctly identified fewer people with PG (73/79, Sensitivity = 0.92) but this screen yielded many fewer false positives (125, PPV = 0.37). By

Table 2 NESARC demographic characteristics: total sample, by eligibility for gambling module and current PG status

Characteristic, %	NESAR sample	Gamble ≥ 5 times in 1 year		Current PG status	
	Total <i>n</i> = 43 093	No <i>n</i> = 31 940	Yes <i>n</i> = 11 153	Non-PG <i>n</i> = 11 074	PG <i>n</i> = 79
Sex		$\chi^2 = 728, df = 1, P < 0.001$		$\chi^2 = 0.3, df = 1, ns$	
Male	43	39	54	54	57
Female	57	61	46	46	43
Ethnoracial group		$\chi^2 = 291, df = 4, P < 0.001$		$\chi^2 = 9, df = 2, P < 0.05^a$	
Caucasian	57	55	62	62	48
African American	19	19	19	19	32
Native American	2	2	2	2	3
Asian	3	3	3	3	1
Hispanic	19	21	14	14	16
Age, years		$\chi^2 = 351, df = 3, P < 0.001$		$\chi^2 = 13, df = 3, P < 0.01$	
18–29	20	22	16	15	24
30–44	31	32	29	29	30
45–64	30	28	36	36	41
≥ 65	19	19	20	20	5
Marital status		$\chi^2 = 73, df = 2, P < 0.001$		$\chi^2 = 14, df = 2, P < 0.01$	
Married or living as married	51	50	53	53	35
Widowed, separated, or divorced	26	26	27	27	29
Never married	23	24	20	20	35
Education		$\chi^2 = 88, df = 2, P < 0.001$		$\chi^2 = 3, df = 5, ns$	
<High school	18	19	15	15	20
High school	29	29	31	31	38
\geq Some college	53	52	54	54	42
Income, \$		$\chi^2 = 217, df = 3, P < 0.001$		$\chi^2 = 3, df = 3, ns$	
$\leq 19\ 999$	28	30	23	23	30
20 000–34 999	22	22	21	22	18
35 000–69 999	31	30	34	34	34
$\geq 70\ 000$	19	19	22	22	18
Urbanicity		$\chi^2 = 0.4, df = 1, ns$		$\chi^2 = 0.3, df = 1, ns$	
Urban	82	82	82	82	90
Rural	18	18	18	18	20
Region		$\chi^2 = 216, df = 3, P < 0.001$		$\chi^2 = 2, df = 3, ns$	
Northeast	19	18	21	21	15
Midwest	21	20	23	23	28
South	38	40	32	32	30
West	22	22	24	24	27

^a After combining Native American, Asian, and Hispanic into a single group
 ns = not statistically significant

Table 3 Characteristics of DSM-IV-TR criteria discriminating people with PG from non-PG others

Criterion	PG	Non-PG	SE	PPV
Withdrawal			0.57	0.74
Yes	45	16		
No	34	11 011		
Lying			0.85	0.37
Yes	67	113		
No	12	10 914		
Money from others			0.42	0.69
Yes	33	15		
No	46	11 012		
Loss of control			0.72	0.35
Yes	57	108		
No	22	10 919		
Tolerance			0.77	0.17
Yes	61	301		
No	18	10 726		
Relations			0.37	0.25
Yes	29	87		
No	50	10 940		
Escape			0.85	0.10
Yes	67	595		
No	12	10 432		
Chasing			0.94	0.09
Yes	74	711		
No	5	10 316		
Illegal acts			0.10	0.73
Yes	8	3		
No	71	11 024		
Preoccupation			0.96	0.06
Yes	76	1268		
No	3	9759		
Mapped Lie/Bet			0.96	0.17
Yes	76	377		
No	3	10 650		

SE = sensitivity

adding our third best discriminator, Borrowing Money, to the screen, the sensitivity increased (Sensitivity = 0.96; 76/79) at the cost of adding only 10 false positives (PPV = 0.36). Table 4 presents these outcomes along with the parameters achieved using the Mapped Lie/Bet scale for comparison. The Mapped Lie/Bet scale had the same sensitivity as the selected brief screen but a much lower PPV of 0.17 (377 false positives.)

Discussion

The proliferation of land-based and Internet gambling has elevated awareness and concern about the prevalence of PG. This increased interest resulted in the addition of PG modules to recent US national household studies of psychological health (for example, NESARC and NCS-R). Although PG is evidence of a relatively low prevalence disorder among the general population, it is more common among people in the general population who have experienced mental health and substance use problems. Both major US studies reveal an extensive comorbidity of PG with other mental illnesses. This circumstance should alert clinicians to screen for current PG along with other problems to develop and implement treatment plans that respond to the full range of patient needs. However, comprehensive assessments are counterbalanced by the practical considerations of interview length and diagnostic verification. Our study described the development of a BBGS that is responsive to practical clinical requirements by using only 3 items, and they are easy to ask, easy to answer, and easy to include in all modes of interviewing, including office-based screening instruments that can be self-administered. Because the BBGS restricts the rate of false positives, compared with other screening instruments, it has the benefit of reducing the number of people who unnecessarily need further evaluation. All of these features encourage routine application of the BBGS in various settings. The BBGS advances gambling studies and public health screening by offering an alternative to the Lie/Bet Questionnaire¹⁹ that provides important psychometric advantages for health care providers, making it better suited to clinical applications in various settings.

Limitations

The NESARC is unique as the first study of the US national household population to report information about DSM-IV-TR PG criteria that clustered during the previous 12 months. To uncover the significance of the screening items identified in this study, future research must retest the BBGS using different data. The development of the BBGS is further limited because the items available for discriminant function modelling were only those currently available from DSM-IV-TR. The DSM-IV-TR criteria do not represent an exhaustive list of consequences associated with PG. In fact, there is no empirical evidence that the DSM-IV-TR criteria include the most valid 10 diagnostic criteria. Other criteria might do a better job of identifying pathological gamblers and discriminating them from nonpathological gamblers.

Finally, the BBGS is limited by data obtained exclusively from self-report. Future studies should seek to develop a diagnostic system independent of self-report, or at least a set of measures complemented by actual behaviour and outcomes. Self-report is vulnerable because of inadvertent problems with memory and deliberate conditions such as presenting more socially acceptable responses. In addition, optimal PG-related diagnostic signs and symptoms should be capable of: yielding accurate diagnostic classification, post

Table 4 Estimation parameters of competitive DSM-IV-TR brief screening models for PG					
	PG	Non-PG	SE	PPV	λ (df)
Model 1: Withdrawal, Lying, Borrowing Money, Loss of Control					
Yes	78	226	0.99	0.26	0.40 (4) ^a
No	1	10 801			
Model 2: Withdrawal, Lying					
Yes	73	125	0.92	0.37	0.48 (2) ^a
No	6	10 902			
Model 3: Withdrawal, Lying, Borrowing Money					
Yes	76	135	0.96	0.36	0.43 (3) ^a
No	3	10 892			
Mapped Lie/Bet					
Yes	76	377	0.96	0.17	0.66 (2) ^a
No	3	10 650			
BBGS Model Questionnaire					
Withdrawal: During the past 12 months, have you become restless, irritable, or anxious when trying to stop and (or) cut down on gambling?					
Responses:					
I do not gamble → Exit, not a gambler					
Yes → Exit, consider as a person with PG pending clinical evaluation					
No → Continue					
Lying: During the past 12 months, have you tried to keep your family or friends from knowing how much you gambled?					
Responses:					
Yes → Exit, consider as a person with PG pending clinical evaluation					
No → Continue					
Borrowing Money: During the past 12 months, did you have such financial trouble as a result of gambling that you had to get help with living expenses from family, friends, or welfare?					
Responses:					
Yes → Exit, consider as a person with PG pending clinical evaluation					
No → Exit, is not a person with PG					
^a $P < 0.001$					
SE = sensitivity					

facto; distinguishing at-risk populations; and, predicting the development of the disorder, a priori. To illuminate the construct of PG, research will need to clarify the relation between gambling problems and co-occurring disorders, with special emphasis on the relation between PG and other expressions of addiction.

Conclusion

The 3-item BBGS satisfies our requirements for brevity, while maintaining sensitivity and the important practical need to limit the number of false positives. In addition, despite the intervention of researcher heuristics, the 3 BBGS items yield an instrument conceptually consistent with a syndrome model of addiction.²⁵ The 3-factor screen includes 1 item from each of 3 syndrome model domains: neuroadaptation by the withdrawal item; psychosocial characteristics by the question

about lying; and, an adverse social consequence of gambling, obtaining money from others.

Acknowledgements

The National Center for Responsible Gaming provided primary funding for this project. The Division on Addictions also receives funding from the National Institute of Mental Health, the National Institute of Alcohol Abuse and Alcoholism, the National Institute on Drug Abuse, bwin Interactive Entertainment, Aktiengesellschaft [Ltd], University of Nevada at Las Vegas, University of Michigan, Robert Wood Johnson Foundation, Port Authority of Kansas City, St Francis House, Las Vegas Sands Corporation, Massachusetts Council on Compulsive Gambling, and others.

We thank Christine Thurmond at the Division on Addictions for her supervisory help with this project and Ingrid Maurice for her help in preparing this manuscript for publication.

References

- Korn DA. Expansion of gambling in Canada: implications for health and social policy. *CMAJ*. 2000;163(1):61–64.
- Shaffer HJ, Korn DA. Gambling and related mental disorders: a public health analysis. *Annu Rev Public Health*. 2002;23:171–212.
- Götestam KG, Johansson A. Characteristics of gambling and problematic gambling in the Norwegian context: a DSM-IV-based telephone interview study. *Addict Behav*. 2003;28(1):189–197.
- Abbott MW. Problem and non-problem gamblers in New Zealand: a report on phase two of the 1999 National Prevalence Survey. Report number six of the New Zealand Gaming Survey. Wellington (NZ): New Zealand Department of Internal Affairs; 2001.
- Volberg RA, Abbott MW, Roenning S, et al. Prevalence and risks of pathological gambling in Sweden. *Acta Psychiatr Scand*. 2001;104(4):250–256.
- Collins P, Barr G. Gambling and problem gambling in South Africa: a national study. Cape Town (SA): National Center for the Study of Gambling; 2001.
- Productivity Commission. Australia's gambling industries: final report (no 10). Canberra (AU): AusInfo; 1999.
- Sproston K, Erens B, Orford J. Gambling behaviour in Britain: results from the British gambling prevalence survey. London (GB): National Centre for Social Research; 2000 Jun.
- Orford J, Sproston K, Erens B, et al. Gambling and problem gambling in Britain. New York (NY): Brunner-Routledge; 2003.
- Wardle H, Sproston K, Orford J, et al. British Gambling Prevalence Survey 2007. London (GB): National Centre for Social Research; 2007 Sep.
- Kallick M, Suits D, Dielman T, et al. A survey of American gambling attitudes and behavior. Ann Arbor (MI): University of Michigan Press; 1979.
- Petry NM, Stinson FS, Grant BF. Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry*. 2005;66(5):564–574.
- Bondolfi G, Osiek C, Ferrero F. Prevalence estimates of pathological gambling in Switzerland. *Acta Psychiatr Scand*. 2000;101(6):473–475.
- Bondolfi G, Jemann F, Ferrero F, et al. Prevalence of pathological gambling in Switzerland after the opening of casinos and the introduction of new preventive legislation. *Acta Psychiatr Scand*. 2008;117(3):236–239.
- Kessler RC, Hwang I, LaBrie RA, et al. DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychol Med*. 2008;38(9):1351–1360.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Text revision. Washington (DC): APA; 2000.
- Shaffer HJ, Hall MN, Vander Bilt J. Estimating the prevalence of disordered gambling behavior in the United States and Canada: a meta-analysis. Boston (MA): Presidents and Fellows of Harvard College; 1997. p 122.
- Shaffer HJ, LaBrie RA, LaPlante DA, et al. The road less travelled: moving from distribution to determinants in the study of gambling epidemiology. *Can J Psychiatry*. 2004;49(8):504–516.
- Johnson EE, Hamer R, Nora RM, et al. The Lie/Bet Questionnaire for screening pathological gamblers. *Psychol Rep*. 1997;80:83–88.
- Johnson EE, Hamer RM, Nora RM. The Lie/Bet Questionnaire for screening pathological gamblers: a follow-up study. *Psychol Rep*. 1998;83(3):1219–1224.
- Götestam KG, Johansson A, Wenzel HG, et al. Validation of the lie/bet screen for pathological gambling on two normal population data sets. *Psychol Rep*. 2004;95(3 Pt 1):1009–1013.
- Grant BF, Dawson DA, Stinson FS, et al. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug Alcohol Depend*. 2003;71:7–16.
- Strong DR, Kahler CW. Evaluation of the continuum of gambling problems using the DSM-IV. *Addiction*. 2007;102(5):713–721.
- Toce-Gerstein M, Gerstein D, Volberg RA. A hierarchy of gambling disorders in the community. *Addiction*. 2003;98:1661–1672.
- Shaffer HJ, LaPlante DA, LaBrie RA, et al. Toward a syndrome model of addiction: multiple expressions, common etiology. *Harv Rev Psychiatry*. 2004;12:367–374.
- Shaffer HJ, Eber GB. Temporal progression of cocaine dependence symptoms in the US National Co-morbidity Survey. *Addiction*. 2002;97(5):543–554.
- Langenbucher JW, Martin CS, Labouvie E, et al. Toward the DSM-V: the Withdrawal-Gate Model versus the DSM-IV in the diagnosis of alcohol abuse and dependence. *J Consult Clin Psychol*. 2000;68(5):799–809.

Manuscript received December 2008, revised, and accepted April 2009.

¹ Research Associate, Centre of Functionally Integrative Neuroscience, University of Aarhus, Denmark; Research Associate, Division on Addictions, Cambridge Health Alliance, Medford, Massachusetts.

² Associate Director of Research and Data Analysis, Division on Addictions, Cambridge Health Alliance, Medford, Massachusetts; Instructor in Psychiatry, Harvard Medical School, Boston, Massachusetts.

³ Director, Division on Addictions, Cambridge Health Alliance, Medford, Massachusetts; Associate Professor of Psychiatry, Harvard Medical School, Boston, Massachusetts.

Address for correspondence: Dr RA LaBrie, Division on Addictions, 101 Station Landing, 2nd Floor, Medford, MA 02155; rlabrie@hms.harvard.edu

Résumé : Optimiser l'exactitude de la classification du DSM-IV-TR : une échelle biosociale abrégée pour détecter les troubles de jeu pathologique actuels chez les joueurs de la population générale

Objectif : Élaborer une échelle du jeu pathologique (JP) pour une application efficace à la population générale des à l'usage des cliniciens auprès des personnes en traitement.

Méthode : Nous avons appliqué une série de fonctions discriminantes multivariées aux problèmes liés au jeu des 12 derniers mois selon le Manuel diagnostique et statistique des troubles mentaux, 4^e édition, texte révisé (DSM-IV-TR); l'enquête épidémiologique nationale sur l'alcool et les troubles connexes (NESARC) a mesuré et recueilli ces données. La NESARC a mené des entrevues personnelles assistées par ordinateur auprès de 43 093 ménages et a identifié le plus grand échantillon de joueurs pathologiques tiré de la population générale des ménages.

Résultats : Nous avons créé une échelle abrégée de jeu biosocial en 3 items (EAJB) avec sensibilité élevée (sensibilité = 0,96; 76 joueurs pathologiques sur 79 correctement identifiés) et spécificité élevée (spécificité = 0,99; 10 892 joueurs non pathologiques sur 11 027 correctement identifiés).

Conclusions : Les grandes études américaines révèlent une comorbidité répandue du JP avec d'autres maladies mentales. L'EAJB présente des avantages psychométriques pour les prestataires de soins de santé qui devraient inciter les cliniciens et les épidémiologistes à envisager un JP actuel avec d'autres problèmes. L'EAJB est pratique pour une utilisation clinique parce qu'elle ne comporte que 3 items qui sont faciles à poser et à y répondre, et qu'elle contient tous les modes d'entrevue, notamment les questionnaires auto-administrés. L'EAJB a une solide fondation théorique parce qu'elle inclut 1 item pour chacun des 3 domaines du syndrome de dépendance : la neuroadaptation (par exemple, le sevrage); les caractéristiques psychosociales (par exemple, mentir); et les conséquences sociales indésirables du jeu (par exemple, obtenir de l'argent des autres).