Harmonizing Screening for Gambling Problems in Epidemiological Surveys – Development of the Rapid Screener for Problem Gambling (RSPG)

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Background and aims: The aim of this study was to test the screening properties of several combinations of items from gambling scales, in order to harmonize screening of gambling problems in epidemiological surveys. The objective was to propose two brief screening tools (three items or less) for a use in interviews and self-administered questionnaires. *Methods:* We tested the screening properties of combinations of items from several gambling scales, in a sample of 425 gamblers (301 non-problem gamblers and 124 disordered gamblers). Items tested included interview-based items (Pathological Gambling section of the DSM-IV, lifetime history of problem gambling, monthly expenses in gambling, and abstinence of 1 month or more) and self-report items (South Oaks Gambling Screen, Gambling Attitudes, and Beliefs Survey). The gold standard used was the diagnosis of a gambling disorder according to the DSM-5. *Results:* Two versions of the Rapid Screener for Problem Gambling (RSPG) were developed: the RSPG-Interview (RSPG-I), being composed of two interview items (increasing bets and loss of control), and the RSPG-Self-Assessment (RSPG-SA), being composed of three self-report items (chasing, guiltiness, and perceived inability to stop). *Discussion and conclusions:* We recommend using the RSPG-SA/I for screening problem gambling in epidemiological surveys, with the version adapted for each purpose (RSPG-I for interview-based surveys and RSPG-SA for self-administered surveys). This first triage of potential problem gamblers must be supplemented by further assessment, as it may overestimate the proportion of problem gamblers. However, a first triage has the great advantage of saving time and energy in large-scale screening for problem gambling.

Keywords: screening, problem gambling, epidemiological surveys, general population, RSPG

INTRODUCTION

Previously known as "Pathological Gambling," Gambling Disorder has recently been included in the "substance-related and addictive disorders" section of the DSM-5 (American Psychiatric Association, 2013). The prevalence of lifetime pathological gambling has been estimated at around 0.4–1.0% (American Psychiatric Association, 2013), depending on the country, the sample assessed, and particularly the assessment tool used. Indeed, one limitation when working on general population-based samples (like those used for prevalence surveys) is that long structured diagnostic interviews [like the Structured Clinical Interview for Pathological Gambling (SCI-PG) (Grant, Steinberg,

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Kim, Rounsaville, & Potenza, 2004) or the Diagnostic Interview for Gambling Severity (DIGS) (Winters, Specker, & Stinchfield, 2002)] are not feasible on a large scale, because they need significant and costly human resources. Thus, several self-report tools have been developed to enable rapid identification of gambling problems, which can be classified into three categories according to the Problem Gambling Research and Treatment Centre (PGRTC, 2011). Examples of long (>13 items) questionnaires are the South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987), the National Opinion Research Center DSM Screen for Gambling Problems (NODS) (Gerstein et al., 1999; Hodgins, 2004), and the Victorian Gambling Screen (VGS) (Tolchard & Battersby, 2010). An example of medium-sized (4–12 items) questionnaires is the Canadian Problem Gambling Inventory (CPGI) (Ferris & Wynne, 2001). Finally, examples of brief (1–3 items) screening tools are the one-item Screen for Problem Gambling (one-item SPG) (Thomas, Piterman, & Jackson, 2008), the Lie/Bet Questionnaire (Johnson et al., 1997), the Brief Biosocial Gambling Screen (BBGS) (Gebauer, LaBrie, & Shaffer, 2010), and the NODS-CLiP ("Control, Lying, and Preoccupation" version of the NODS – Toce-Gerstein, Gerstein, & Volberg, 2009). Because of their short duration, brief screening tools provide a good alternative for systematic screening of large samples of people who may have an elevated risk of gambling-related problems. They must be supplemented by further assessment in case of a positive screening (PGRTC, 2011) and should only be used as a first triage of people to be interviewed.

According to Stinchfield, McCready, and Turner (2012), the majority of the brief problem gambling screens have not been rigorously tested beyond their development. It is currently unknown what screen to be chosen for what kind of population, and whether a cross-use in clinical and community-based samples is possible without decreasing the psychometric properties. It is also still unknown if such tools are usable interchangeably in interview-based (like telephone-based surveys) or self-assessment-based (like internet-based surveys) epidemiological surveys, outside the context of their initial development.

For example, the Lie/Bet Questionnaire (Johnson et al., 1997) is often used in general population for a very quick screening of problem gambling, even though Stinchfield et al. (2012) rightly noted that this test is not as accurate in screening for problem gambling among the general population (because the authors did not take the low prevalence of problem gambling into account in the validation studies). Moreover, they emphasized that the Lie/Bet Questionnaire displays several limitations, especially the use of a lifetime timeframe (which is likely to increase false positive rate) and the lack of empirical evidence of classification accuracy from investigators other than the developers. Moreover, no recommendation is done about a use as a self-assessment questionnaire or an interview.

The NODS-CLiP is certainly the mostly used brief screening tool for PG. But it also displays some limitations, for example, the lifetime timeframe, the lack of independence of the gold standard used for the validation study (the full NODS), and the lower screening performance in a clinical sample (Stinchfield et al., 2012).

The BBGS is the more recently developed brief tool. It has the advantage of including a current timeframe (past 12 months). There is again a lack of independence of the gold standard used for the validation study (the full AUDADIS from which the BBGS is derived) (Stinchfield et al., 2012). Due to its recent development, the BBGS also requires further research to cross-validate its classification accuracy estimates (Stinchfield et al., 2012), because of the limited date available (PGRTC, 2011).

Finally, the one-item SPG is one of the least used brief screening tools. Critics about the one-item SPG are mainly about its important brevity (just one item), which yields high error rates, particularly false negative rates (Stinchfield et al., 2012).

The aim of our work is to perform a systematic search of the best combinations of items from several gambling scales, to develop two brief screening tools (three items or less) being suitable for interview-based epidemiological surveys on the one hand and self-rating-based epidemiological surveys on the other hand. Indeed, self-assessment and interviews are not strictly equivalent and the tools used must be adapted for each need. The objective is to harmonize screening of gambling problems in epidemiological surveys. Another objective is to compare the combinations tested to equivalents of the four major brief screening scales previously validated and widely used (one-item SPG, Lie/Bet, BBGS, and NODS-CLiP) within a single sample, with good representation of problem gamblers. Indeed, to our knowledge, those tools have so far neither been compared to each other in the same dataset, nor tested in samples combining problem gamblers and non-problem gamblers (NPG).

METHODS

Participants

This analysis was performed using baseline data from the JEU cohort study, collected between 2009 and 2011 (Challet-Bouju et al., 2014). The JEU study is a 5-year longitudinal cohort study performed at national level. The JEU cohort consists of 628 gamblers, divided into three groups, depending on whether they are problem or non-problem gamblers and on whether they had sought treatment or not. The main objective of this study is to identify the determinants of key state changes in the gambling practice. The proposed analysis is thus a secondary data analysis.

Initially based on the Pathological Gambling section of the DSM-IV, the diagnosis of a gambling disorder was reassessed for this analysis according to the current DSM-5 section for Gambling Disorders (i.e., removal of criterion 8 on illegal acts and use of a threshold of 4). With this re-categorization, the sample was composed of 301 NPG, 124 problem gamblers without treatment (PGWT), and 186 problem gamblers seeking treatment (PGST) (17 more gamblers were initially in the PGST group, but were reclassified as NPG with the DSM-5 classification; we decided to exclude them *a posteriori* from the NPG group because they had sought treatment).

NPG and PGWT were recruited in various gambling places and via the press, in order to cover the broadest

possible range of gambling activities. PGSTs were recruited in seven care centers, among patients who started treatment less than 6 months before. Only participants who reported gambling on at least one occasion during the previous year and who were between 18 and 65 years old were included in the study. For more information about the JEU cohort study, refer to the study protocol (Challet-Bouju et al., 2014).

Measures

Among other assessments, participants were interviewed throughout a past year – interview based on the 10 diagnostic criteria for Pathological Gambling in the DSM-IV (American Psychiatric Association, 2000), an interview designed to explore their gambling history and habits (lifetime subjective history of problem gambling, monthly expenses in gambling, and abstinence of 1 month or more), and two self-report questionnaires: the SOGS (Lejoyeux, 1999; Lesieur & Blume, 1987) and the Gambling Attitudes and Beliefs Scale (GABS) (Bouju et al., 2014; Breen & Zuckerman, 1999). The SOGS is a well-known measure of problem gambling severity, and the GABS measures cognitive biases, irrational beliefs, and positively valued attitudes to gambling (Breen & Zuckerman, 1999).

The formulations of the interview-based items are given in Table 1 [for the formulations of items from the SOGS and the GABS, see the validation papers of these scales (Breen & Zuckerman, 1999; Lesieur & Blume, 1987)]. The DSM-5 status was used as a gold standard to perform the screening properties analysis. All the scales were administered in French language.

For the secondary objective, we focused particularly on combinations which could correspond to equivalents of the four major brief screening scales (one-item SPG, Lie/Bet, BBGS, and NODS-CLiP). Indeed, even if these combinations are not strictly formulated in the same way as the original scales, we presume that they represent good equivalents that could be used for the comparison. The formulations of the originals and equivalents of the four brief screening tools are given in Table 2.

Statistical analysis

For the interview-based tool, we tested the screening properties of combinations of the 10 items from the Pathological Gambling section of the DSM-IV and the three questions from the gambling history and habits (lifetime history of problem gambling, monthly expenses in gambling, and abstinence of 1 month or more). For the self-report-based tool, we tested the screening properties of combinations of 25 items from the SOGS (items 2–16 k, excluding question 12 and including non-scoring items) and the 35 items from the GABS. Question 2 of the SOGS was rephrased in order to obtain the value of the maximum amount of money wagered in a day (instead of amounts grouped in classes). In order to obtain a binary response to this question, we determined a threshold of €180 to have a "yes" answer, calculated to maximize the Youden Index [(YI) which is a statistic that measures the performance of a diagnostic test, independently of the disorder's prevalence] (Youden, 1950). The same strategy was used for the interview question about

Table 1. Formulations of the interview-based items

Gambling history and habits (lifetime history of problem gambling):
"Has your gambling practice already become a problem for you?"

Gambling history and habits (monthly expenses in gambling):
"How much money do you bet on average per month in gambling?"

Gambling history and habits (abstinence of 1 month or more):
"Have you ever fully stopped gambling for at least one month?"

Item 1 from the DSM-IV (preoccupation):
"During the past 12 months, have you been constantly preoccupied with gambling (e.g., preoccupied with reliving past gambling experiences, planning the next venture, or thinking of ways to get money with which to gamble)?"

Item 2 from the DSM-IV (increasing bets):
"During the past 12 months, have you needed to gamble with increasing amounts of money in order to achieve the desired excitement?"

Item 3 from the DSM-IV (loss of control):
"During the past 12 months, have you made repeated unsuccessful efforts to control, cut back, or stop gambling?"

Item 4 from the DSM-IV (withdrawal):
"During the past 12 months, have you been restless or irritable when attempting to cut down or stop gambling?"

Item 5 from the DSM-IV (escapism):
"During the past 12 months, did you gamble as a way of escaping from the hardships of life or of relieving an undesirable mood (e.g., feelings of helplessness, guilt, anxiety, depression)?"

Item 6 from the DSM-IV (chasing):
"During the past 12 months, after having lost money in gambling, did you often return to gambling another day in order to get even, to recover your losses?"

Item 7 from the DSM-IV (lying):
"During the past 12 months, have you lied to family member, therapist, or others to conceal the extent of involvement with gambling?"

Item 8 from the DSM-IV (illegal acts):
"During the past 12 months, have you committed illegal acts, such as forgery, fraud, theft, or embezzlement, in order to finance gambling?"

Item 9 from the DSM-IV (jeopardizing of other activities):
"During the past 12 months, have you jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling?"

Item 10 from the DSM-IV (borrowing money):
"During the past 12 months, have you relied on others to provide money to relieve a desperate financial situation caused by gambling?"

the monthly expenses in gambling, with a threshold of €125. GABS responses (with four response modalities from "strongly agree" to "strongly disagree") were redefined as "yes" answers when "strongly agree" or "agree" were chosen for reversed items, and vice versa for direct items.

Table 2. Formulations of the original and equivalents four major brief screening tools tested

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One-item SPG (Rockloff, Ehrich, Themessl-Huber, & Evans, 2011)
Original item:
"In the past 12 months, have you ever had an issue with your gambling?"

Item used in the JEU cohort (= used as an equivalent of the one-item SPG):
"Do you feel you have ever had a problem with betting or money gambling in the past 12 months?" *(=item 6 from the SOGS)*

Lie/Bet Questionnaire (Johnson et al., 1997)
Original items:
Lie: "Have you ever had to lie to people important to you about how much you gambled?"
Bet: "Have you ever felt the need to bet more and more money?"

Items used in the JEU cohort (= used as an equivalent of the Lie/Bet Questionnaire):
Lie: "During the past 12 months, have you lied to family members, therapist, or others to conceal the extent of involvement with gambling?" *(=item 7 from the DSM-IV)*
Bet: "During the past 12 months, have you needed to gamble with increasing amounts of money in order to achieve the desired excitement?" *(=item 2 from the DSM-IV)*

BBGS (Gebauer et al., 2010)
Original items:
Withdrawal: "During the past 12 months, have you become restless, irritable, or anxious when trying to stop and/or cut down on gambling?"
Lying: "During the past 12 months, have you tried to keep your family or friends from knowing how much you gambled?"
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?"

Items used in the JEU cohort (= used as an equivalent of the BBGS):
Withdrawal: "During the past 12 months, have you been restless or irritable when attempting to cut down or stop gambling?" *(=item 4 from the DSM-IV)*
Lying: "During the past 12 months, have you lied to family members, therapist, or others to conceal the extent of involvement with gambling?" *(=item 7 from the DSM-IV)*
Borrowing money: "During the past 12 months, have you relied on others to provide money to relieve a desperate financial situation caused by gambling?" *(=item 10 from the DSM-IV)*

NODS-CLiP (Toce-Gerstein et al., 2009)
Original items:
Preoccupation: "Have there ever been periods lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets?"
Loss of control: "Have you ever tried to stop, cut down, or control your gambling?"
Lying: "Have you ever lied to family members, friends, or others about how much you gamble or how much money you lost on gambling?"

Items used in the JEU cohort (= used as an equivalent of the NODS-CLiP):
Preoccupation: "During the past 12 months, have you been constantly preoccupied with gambling (e.g., preoccupied with reliving past gambling experiences, planning the next venture, or thinking of ways to get money with which to gamble)?" *(=item 1 from the DSM-IV)*
Loss of control: "During the past 12 months, have you made repeated unsuccessful efforts to control, cut back or stop gambling?" *(=item 3 from the DSM-IV)*
Lying: "During the past 12 months, have you ever lied to family members, therapist, or others to conceal the extent of involvement with gambling?" *(=item 7 from the DSM-IV)*

All possible combinations of one to three items ($n = 377$ for interview combinations and $n = 34,279$ for self-report combinations) were tested. A combination was considered as having a positive screening when there was at least one "yes" answer. Screening properties (Sensitivity: Se, Specificity: Sp, Incorrect Classification Rate: ICR, Youden Index: YI, and Positive and Negative Predictive Values: PPV and NPV) were estimated in the JEU sample excluding PGSTs. We excluded PGSTs because the final brief screening tools are not intended to be used clinically for problem gamblers in treatment, so that their inclusion would not have been relevant.

In addition to providing the screening properties in our sample without the PGSTs, we then re-computed PPV, NPV, and ICR to take into account the French prevalence of problem gambling in the population of past-year gamblers, that is, 2.76% (Costes et al., 2011). The prevalence of problem gambling in past-year gamblers (Pr) was calculated as follows: prevalence of active gamblers in the general population (12.2%) × prevalence of problem gambling in active gamblers (10.8%)/prevalence of past-year gamblers in the general population (47.8%) (Costes et al., 2011). The adjusted PPV was calculated as follows: $Se \times Pr/[Se \times Pr + (1 - Sp)(1 - Pr)]$, the adjusted NPV as follows: $Sp(1 - Pr)/[Sp(1 - Pr) + (1 - Se)Pr]$, and the adjusted ICR as follows: $(1 - Sp)(1 - Pr) + (1 - Se)Pr$, where $Pr = 0.0276$. The objective, in adjusting the proportion of problem gamblers according to national prevalence, was to obtain a more

realistic sample (because the sample used in the JEU cohort study was constituted based on an approximate equality of size between problem and non-problem gamblers, it overestimates the prevalence of problem gambling).

As stated above, the aim of brief screening tools is to enable rapid identification of potential problem gamblers, in order to reduce the number of people to be interviewed. The objective is therefore to miss as few potential problem gamblers as possible. Consequently, we chose to retain only the combinations of items with the highest sensitivity for consideration (we set the threshold at 0.95). Of these, the final choice of the best combination for each modality (interview or self-report) and within each number of items was the one with the highest YI, which is a statistic that combines both Se and Sp, and thus gives a good compromise between true positive and true negative rates. Within the best retained combinations of each modality, we chose to favor the briefer ones if they had equivalent properties, in order to have the shortest duration. As argued by Volberg, Munck, and Petry (2011), although sensitivity is the key performance characteristic of a screening tool, diagnostic efficiency is also very important to determine the tool's accuracy. Thus, the equivalence of properties was determined as a difference in Se, Sp, or ICR of less than 5%.

Ethics

Participants were informed about the research and gave their written informed consent prior to their inclusion in the study. This study was approved by the French Research Ethics Committee (CPP) on January 8, 2009.

RESULTS

Combinations of interview-based items

There were 194 interview combinations with sensitivity greater or equal to 0.95, 15 of them being composed of two items, and 179 of three items (none with just one item). Among them, the top 10 combinations (regarding their YI) are presented in Table 3 (top 5 for 2-item combinations and top 5 for 3-item combinations), with their relative screening properties. We can notice that the combinations which were considered as equivalents to three of the four major brief screening tools (Lie/Bet, BBGS, and NODS-CLiP) were not in the top 10. The equivalent of the NODS-CLiP was the only one to be in the 194 combinations with sensitivity greater or equal to 0.95 (in the 49th position of 3-item combinations).

The best combinations were composed of items 2 (increasing bets) and 3 (loss of control) from the DSM for 2-item combinations, and items 1 (preoccupation), 4 (withdrawal), and 9 (jeopardizing of other activities) from the DSM for 3-item combinations.

Since both combinations exhibited equivalent properties (difference for Se of 3% and Sp and ICR of 2%), we chose to retain the briefer combination (i.e., DSM2–DSM3 combination) as the best one for interview-based brief screening tool. We named it the Rapid Screener for Problem Gambling – Interview (RSPG-I).

Combinations of self-assessment items

There were 7,465 self-assessment combinations with sensitivity greater or equal to 0.95, 100 of them being composed of two items and 7,365 of three items (none with just one item). Among them, the top 10 combinations (regarding their YI) are presented in Table 4 (top 5 for 2-item combinations and top 5 for 3-item combinations), with their relative screening properties. We can notice that the combination which was considered as equivalent to one of the major brief screening tools (one-item) was not in the top 10, and even not in the high-sensitivity combinations.

The best combinations were composed of item 6 from the SOGS (past 12 months history of PG) and item 5 from the GABS (losing track of time) for 2-item combinations, and items 4 (chasing), 9 (guiltiness), and 10 (perceived inability to stop) from the SOGS for 3-item combinations.

Since the two combinations exhibited very different properties (difference for Se of 1%, Sp of 13%, and ICR of 9%), we chose to retain the longer combination (that is SOGS4–SOGS9–SOGS10) as the best one for self-assessment brief screening tool. We named it the Rapid Screener for Problem Gambling – Self-Assessment (RSPG-SA).

Classification accuracy

Table 5 shows the concordance between DSM-5 diagnosis and RSPG-I and RSPG-SA classifications. The results show that the RSPG-I and the RSPG-SA captured the vast majority (95.2% and 95.0%, respectively) of participants with a gambling disorder according to the DSM-5. It means that less than 5% of disordered gamblers were not covered by the RSPG. Both RSPG versions captured a significant proportion of gamblers without a gambling disorder (21.9% for RSPG-I and 36.3% for RSPG-SA), which reflects the low specificity of the two questionnaires, particularly RSPG-SA. As specificity performance was not the priority for the selection of best combinations, this is not surprising. The objective was to miss as few disordered gamblers as possible. Concerning the severity assessed by the DSM-5 among the participants with a gambling disorder, all the severe disordered gamblers were captured by both questionnaires and almost all the moderate disordered gamblers were captured by RSPG-I (97.7%) and RSPG-SA (97.6%). For mild disordered gamblers, the capture rate was lower for both questionnaires, but still acceptable (91.2% and 91.1%).

DISCUSSION AND CONCLUSIONS

The objective of this work was to develop two brief screening tools (three items or less) being suitable for reducing the duration of problem gambling screening in interview-based and self-rating-based epidemiological surveys. The analyses have enabled us to propose two very brief screening tools (two or three items) for problem gambling: the RSPG-I and the RSPG-SA. The final RSPG-I and RSPG-SA are given in English language in Table 6 and in French language in Table 7 (note that the French version was the only one to be tested in this work, and that the English version corresponds to a translation which has not been validated).

Table 3. Screening properties of the top 10 best combinations of interview-based items, and comparison with three equivalents of Brief Screening Tools (Lie/Bet, BBGS, and NODS-CLiP)

	Within the sample without PGSTs ($n = 425$)						Re-computation with national prevalence		
	YI	Se	Sp	PPV	NPV	ICR	aPPV	aNPV	aICR
Top 10 combinations of interview-based items									
2-Item combinations									
DSM2 (increasing bets) and DSM3 (loss of control)	*0.732*	*0.952*	*0.781*	*0.642*	*0.975*	*16.9%*	*0.110*	*0.998*	*21.5%*
DSM1 (preoccupation) and DSM7 (lying)	0.724	0.960	0.764	0.627	0.979	17.9%	0.104	0.999	23.0%
DSM3 (loss of control) and lifetime history of PG	0.719	0.968	0.751	0.616	0.983	18.6%	0.099	0.999	24.3%
DSM1 (preoccupation) and DSM3 (loss of control)	0.711	0.960	0.751	0.614	0.978	18.8%	0.099	0.998	24.3%
DSM3 (loss of control) and DSM7 (lying)	0.706	0.952	0.754	0.615	0.974	18.8%	0.099	0.998	24.0%
3-Item combinations									
DSM1 (preoccupation), DSM4 (withdrawal), and DSM9 (jeopardizing of other activities)	0.773	0.976	0.797	0.665	0.988	15.1%	0.120	0.999	19.8%
DSM2 (increasing bets), DSM3 (loss of control), and DSM9 (jeopardizing of other activities)	0.745	0.984	0.761	0.629	0.991	17.4%	0.105	0.999	23.3%
DSM2 (increasing bets), DSM3 (loss of control), and DSM10 (borrowing money)	0.742	0.968	0.774	0.639	0.983	16.9%	0.108	0.999	22.1%
DSM2 (increasing bets), DSM3 (loss of control), and DSM8 (illegal acts)	0.742	0.968	0.774	0.639	0.983	16.9%	0.108	0.999	22.1%
DSM2 (increasing bets), DSM7 (lying), and DSM10 (borrowing money)	0.739	0.952	0.787	0.649	0.975	16.5%	0.113	0.998	20.8%
Equivalents of brief screening tools[a]									
DSM2 (increasing bets) and DSM7 (lying) = equivalent of the Lie/Bet Questionnaire (Johnson et al., 1997)	0.718	0.927	0.791	0.646	0.964	16.9%	0.112	0.997	20.6%
DSM1 (preoccupation), DSM3 (loss of control), and DSM7 (lying) = equivalent to the NODS-CLiP (Toce-Gerstein et al., 2009)	0.666	0.992	0.674	0.557	0.995	23.3%	0.080	1.000	31.7%
DSM4 (withdrawal), DSM7 (lying), and DSM10 (borrowing money) = equivalent of the BBGS (Gebauer et al., 2010)	0.731	0.927	0.804	0.661	0.964	16.0%	0.118	0.997	19.3%

Notes. Only combinations with the highest sensitivity (Se ≥ 0.95) were first selected, and the obtained list of combinations was then graded according to the highest Youden Index (YI). The retained combination is emphasized in italic font.

For all combinations, the screening of a gambling problem was based on at least one "yes" answer.

DSM#: DSM criterion number in the order of the DSM-IV.

YI: Youden Index = Sensitivity + Specificity − 1; performance of a diagnostic test, independently of the disorder's prevalence.

Se: Sensitivity; probability of screening a participant with a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5) as a problem gambler, using the screening tool tested.

Sp: Specificity; probability of screening a participant who does not have a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5), as a NPG with the screening tool tested.

PPV: Positive Predictive Value; probability of a participant who is screened as a problem gambler using the tested screening tool, having a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5).

NPV: Negative Predictive Value; probability of a participant who is screened as a NPG using the tested screening tool, not having a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5).

ICR: Incorrect Classification Rate: proportion of misclassified gamblers (problem gamblers according to the gold standard who are classified as NPG using the tested screening tool and NPG according to the gold standard who are classified as problem gamblers using the tested screening tool).

YI, Se, and Sp are estimated values of the Youden Index, sensitivity and specificity obtained from the JEU sample excluding PGSTs.

PPV, NPV, and ICR were approximated using estimated values of Se and Sp in the JEU sample excluding PGSTs, and then re-computed to take into account the French prevalence rate of Pathological Gambling in the population of past-year gamblers (aPPV: adjusted PPV; aNPV: adjusted NPV; and aICR: adjusted ICR), that is 2.76% of at risk or excessive gambling (Costes et al., 2011).

Lifetime history of PG = subjective evaluation by the gambler whether he had or not a lifetime history of problem gambling.

[a]Three equivalents of interview-based Brief Screening Tools (Lie/Bet, BBGS, and NODS-CLiP).

The RSPG-I is composed of two criteria from the gambling disorder section of the DSM: the increasing bets criterion and the loss of control criterion. This version exhibited good screening properties and was especially efficient for screening gamblers with a diagnosis of gambling disorder (sensitivity of 0.95). Even if we selected the best combinations first based on the best sensitivity, the other properties remained at good levels. In particular,

Table 4. Screening properties of the best combinations of self-report items, and comparison with one equivalent of Brief Screening Tool (one-item SPG)

	Within the sample without PGSTs ($n = 425$)						Re-computation with national prevalence		
	YI	Se	Sp	PPV	NPV	ICR	aPPV	aNPV	aICR
Top 10 combinations of self-report items									
2-Item combinations									
SOGS 6 (past 12 months history of PG) and GABS 5 (losing track of time)	0.471	0.959	0.512	0.448	0.968	35.8%	0.053	0.998	47.6%
SOGS 4 (chasing) and GABS 5 (losing track of time)	0.447	0.959	0.488	0.436	0.966	37.4%	0.050	0.998	49.9%
SOGS 2 (max. bet in 1 day > €180) and SOGS 7 (gamble more than intended)	0.437	0.959	0.478	0.431	0.966	38.2%	0.050	0.998	50.9%
SOGS 8 (criticisms from others) and GABS 5 (losing track of time)	0.428	0.950	0.478	0.429	0.959	38.4%	0.049	0.997	50.9%
SOGS 10 (perceived inability to stop) and GABS 5 (losing track of time)	0.425	0.950	0.475	0.427	0.959	38.6%	0.049	0.997	51.2%
3-Item combinations									
SOGS 4 (chasing), SOGS 9 (guiltiness), and SOGS 10 (perceived inability to stop)	*0.588*	*0.950*	*0.637*	*0.519*	*0.969*	*27.1%*	*0.069*	*0.998*	*35.4%*
SOGS 2 (max. bet in 1 day > €180), SOGS 5 (wrongly claim to have won), and SOGS 11 (hiding gambling evidences)	0.578	0.950	0.627	0.512	0.968	27.8%	0.067	0.998	36.4%
SOGS 2 (max. bet in 1 day > €180), SOGS 9 (guiltiness), and SOGS 13 (arguments)	0.567	0.950	0.617	0.506	0.968	28.6%	0.066	0.998	37.4%
SOGS 2 (max. bet in 1 day > €180), SOGS 9 (guiltiness), and SOGS 16e (credit cards)	0.567	0.950	0.617	0.506	0.968	28.6%	0.066	0.998	37.4%
SOGS 2 (max. bet in 1 day > €180), SOGS 9 (guiltiness), and SOGS 15 (losing time from work)	0.564	0.950	0.614	0.504	0.968	28.8%	0.065	0.998	37.7%
Equivalents of brief screening tools[a]									
Item 6 from the SOGS (past 12 months history of PG) = equivalent of the one-item SPG (Rockloff et al., 2011)	0.603	0.752	0.851	0.675	0.893	17.8%	0.125	0.992	15.2%

Notes. Only combinations with the highest sensitivity (Se ≥ 0.95) were first selected, and the obtained list of combinations was then graded according to the highest Youden Index (YI). The retained combination is emphasized in italic font.

For all combinations, the screening of a gambling problem was based on at least one "yes" answer.

SOGS# and GABS#: SOGS and GABS item number.

YI: Youden Index = Sensitivity + Specificity − 1; performance of a diagnostic test, independently of the disorder's prevalence.

Se: Sensitivity; probability of screening a participant with a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5) as a problem gambler, using the screening tool tested.

Sp: Specificity; probability of screening a participant who does not have a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5), as a NPG with the screening tool tested.

PPV: Positive Predictive Value; probability of a participant who is screened as a problem gambler using the tested screening tool, having a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5).

NPV: Negative Predictive Value; probability of a participant who is screened as a NPG using the tested screening tool, not having a diagnosis of gambling disorder according to the gold standard (full Pathological Gambling section of the DSM-5).

ICR: Incorrect Classification Rate: proportion of misclassified gamblers (problem gamblers according to the gold standard who are classified as NPG using the tested screening tool and NPG according to the gold standard who are classified as problem gamblers using the tested screening tool).

YI, Se, and Sp are estimated values of the Youden Index, sensitivity and specificity obtained from the JEU sample excluding PGSTs.

PPV, NPV, and ICR were approximated using estimated values of Se and Sp in the JEU sample excluding PGSTs and then re-computed to take into account the French prevalence rate of Pathological Gambling in the population of past-year gamblers (aPPV: adjusted PPV; aNPV: adjusted NPV; and aICR: adjusted ICR), that is 2.76% of at risk or excessive gambling (Costes et al., 2011).

[a]The equivalent of the self-report Brief Screening Tool (One-item SPG).

the RSPG-I showed good diagnosis efficiency (83.1%), in the same range as the NODS-CLiP (86.4% in the development study) (Volberg et al., 2011). The RSPG-I combines two crucial elements of addiction: tolerance and loss of control. For a long time, the definition of addiction emphasized tolerance and withdrawal as key components of drug dependence, which was only considered as a physical dependence (American Psychiatric Association, 1980). Since version IV of the DSM (American Psychiatric Association, 2000), symptoms of tolerance and withdrawal

Table 5. Classification accuracy of the Rapid Screener for Problem Gambling (RSPG) compared to gambling disorder DSM-5 diagnosis and severity, in the JEU cohort excluding PGSTs ($n = 425$)

	GD−	GD+	Current severity		
			Mild (4–5)	Moderate (6–7)	Severe (8–9)
Total *N*	301	124	57	44	23
% of sample	70.8%	29.2%	46.0%	35.5%	18.5%
N RSPG-I+	66	118	52	43	23
% RSPG-I+	21.9%	95.2%	91.2%	97.7%	100%
N RSPG-SA+	107	115	51	41	23
	(MD = 6)	(MD = 3)	(MD = 1)	(MD = 2)	(MD = 0)
% RSPG-SA+	36.3%	95.0%	91.1%	97.6%	100%

Note. GD = diagnosis of a gambling disorder according to DSM-5; GD−/GD+ = without a gambling disorder/with a gambling disorder; RSPG−I+ = positive screening of a gambling problem according to the Rapid Screener for Problem Gambling – Interview; RSPG−SA+ = positive screening of a gambling problem according to the Rapid Screener for Problem Gambling – Self-Assessment; MD = missing data.

Table 6. Final Rapid Screener for Problem Gambling (RSPG) – English version

RSPG-I – Interview version (for a use in telephone-based or in face-to-face surveys)
Have you had a gambling practice over the past 12 months?
  Yes   Continue the interview
  No   Stop the interview – 0 point
During the past 12 months, have you needed to gamble with increasing amounts of money in order to achieve the desired excitement?
  Yes   1 point
  No   0 point
During the past 12 months, have you made repeated unsuccessful efforts to control, cut back or stop gambling?
  Yes   1 point
  No   0 point
Scoring and interpretation:
  Score of 0: don't need a deeper interview ⇒ no gambling disorder
  Score greater or equal to 1: conduct a deeper interview to establish a final diagnosis of a gambling disorder

RSPG-SA – Self-assessment version (for a use in internet-based surveys)
Have you had a gambling practice over the past 12 months?
  Yes   Continue the questionnaire
  No   Stop the questionnaire – 0 point
When you gamble, how often do you go back another day to win back money you have lost?
  Never   0 point
  Some of the time (less than half the time I lose)   0 point
  Most of the time I lose   1 point
  Every time I lose   1 point
Have you ever felt guilty about the way you gamble, or what happens when you gamble?
  Yes   1 point
  No   0 point
Have you ever felt like you would like to stop betting money on gambling, but didn't think you could?
  Yes   1 point
  No   0 point
Scoring and interpretation:
  Score of 0: don't need a deeper interview ⇒ no gambling disorder
  Score greater or equal to 1: conduct a deeper interview to establish a final diagnosis of a gambling disorder

are no longer mandatory for a diagnosis of addiction, and behavioral symptoms (e.g., repeated but unsuccessful attempts to cut down or control the drug consumption or gambling practice, consuming drug or gambling more than intended, etc.) are now as important as the symptoms of physical dependence. The RSPG-I has thus the advantage of combining symptoms of both physical (tolerance) and behavioral (loss of control) dependence. Moreover, loss of control was one of the key elements of the definition of addictions proposed by Aviel Goodman (1990). This definition was especially well suited for behavioral addiction, and pathological gambling was mentioned as one of the disorders that corresponded very well to addiction criteria. Thus, the RSPG-I is fairly consistent with the reconciliation

Table 7. Final Rapid Screener for Problem Gambling (RSPG) – French version

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RSPG-I – version Interview (pour les enquêtes téléphoniques ou en face-à-face)

Avez-vous eu une pratique de jeu au cours des 12 derniers mois?

Oui	Continuer l'interview
Non	Arrêter l'interview – 0 point

Durant les 12 derniers mois, avez-vous eu besoin de jouer avec des sommes d'argent de plus en plus élevées pour atteindre l'état d'excitation désiré?

Oui	1 point
Non	0 point

Durant les 12 derniers mois, avez-vous fait des efforts répétés mais infructueux pour contrôler, réduire ou arrêter la pratique du jeu?

Oui	1 point
Non	0 point

Cotation et interprétation:

Score de 0: pas de besoin d'une interview plus poussée ⇒ pas de trouble lié au jeu

Score supérieur ou égal à 1: faire une interview plus poussée pour établir un diagnostic final de trouble lié au jeu

RSPG-SA – version Auto-Evaluation (pour les enquêtes par Internet)

Avez-vous eu une pratique de jeu au cours des 12 derniers mois?

Oui	Continuer le questionnaire
Non	Arrêter le questionnaire – 0 point

Lorsque vous avez joué au cours des 12 derniers mois, combien de fois êtes-vous retourné au jeu un autre jour pour vous refaire, c'est-à-dire pour regagner l'argent perdu auparavant?

Jamais	0 point
Quelquefois (moins de la moitié des fois où j'ai perdu)	0 point
La plupart des fois où je perds	1 point
A chaque fois que je perds	1 point

Au cours des 12 derniers mois, vous êtes-vous déjà senti coupable à cause de la façon dont vous jouez ou à cause de ce qui se produit lorsque vous jouez?

Oui	1 point
Non	0 point

Au cours des 12 derniers mois, avez-vous envisagé d'arrêter de jouer tout en pensant que vous en étiez incapable?

Oui	1 point
Non	0 point

Cotation et interprétation:

Score de 0: pas de besoin d'une interview plus poussée ⇒ pas de trouble lié au jeu

Score supérieur ou égal à 1: faire une interview plus poussée pour établir un diagnostic final de trouble lié au jeu

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of gambling disorder and substance use disorders made in the DSM-5 (American Psychiatric Association, 2013). Another element of consistency with the DSM-5 is the absence in the RSPG-I of the illegal acts criterion, which is no longer considered for the diagnosis. Although this criterion was taken into account alongside other criteria to test all possible combinations, it has not been retained in the final version of the rapid screener. Toce-Gerstein and colleagues (Toce-Gerstein, Gerstein, & Volberg, 2003) identified the items 2 and 3 of the DSM-IV as being more present in pathological gamblers (with 5–7 positive criteria in DSM-IV). These items could thus indicate a certain level of severity of the gambling practice beyond the mere excessive use, which seems relevant with their use for a rapid screening of problem gambling.

The RSPG-SA is composed of three items from the SOGS (Lesieur & Blume, 1987): the chasing item, the guiltiness item, and the perceived inability to stop item. Despite of its self-report design, it displayed good screening properties. The RSPG-SA provided relevant screening of gamblers with a diagnosis of gambling disorder (sensitivity of 0.95) and showed correct diagnosis efficiency (72.9%). The chasing behavior had been demonstrated to be one of the DSM criteria, which discriminates best between community gamblers and gamblers in treatment (Stinchfield, Govoni, & Frisch, 2005). Moreover, the chasing item from the SOGS was found to be present for almost only probable pathological gamblers (SOGS score ≥ 5) in a telephone-based community survey (Cox, Kwong, Michaud, & Enns, 2000). Even if it was not the most frequently endorsed item, it seemed to be able to discriminate well between non-problem and problem gamblers, which seems relevant with its inclusion in the RSPG-SA. In the same study, guiltiness and inability to stop belonged to the most endorsed items in probable pathological gamblers. Compared to the chasing item (which rather refers to an externalized component of addiction), guiltiness and perceived inability to stop gambling could refer to more internalized components of gambling addiction. The presence of the item "guiltiness" in the self-report rapid screener is especially very interesting, because this notion is often forgotten from other problem gambling scales, despite of its clinical relevance. As argued by Flanagan (2013), the life of the addict is a source of both guilt and shame. Guiltiness does reflect the reactive attitude to failure to control gambling, as an intra-personal feeling of being unsuccessful both to control the behavior and to achieve the expected life made impossible because of the addiction. As this is not a necessary element to diagnose gambling disorder, but rather a psychological state of mind,

it is rarely investigated in problem gambling screening scales. But the inclusion of this aspect of gambling addiction in the RSPG is not surprising for the self-report version (who can be better suited than the gambler himself to assess his own state of mind?). It is also an indication of more severe problems, because guiltiness often appears when damages are already here and noticeable by others. Finally, perceived inability to stop gambling is rarely explored in gambling-related scales. Yet this dimension is a major clinical element characterizing problem gambling. For example, in a study exploring gambling-related cognitions, the perceived inability to stop gambling accounted for the highest variance in SOGS score and displayed a high discriminant function for identifying probable problem gamblers (Raylu & Oei, 2004). This dimension is indeed another indirect way to explore the loss of control over gambling, which could lead to low self-efficacy and the conviction that it is impossible to change the behavior. For a self-report measure, the recognition of a certain powerlessness to control the behavior may identify precociously problem gamblers long before important damage (which are often a focus of gambling problems related scales) settle down. The RSPG-SA has thus the advantage of combining both externalized and internalized components of addiction, and behavioral (chasing), emotional (guiltiness), and cognitive (perceived inability to stop) aspects.

A secondary objective of this study was to compare the RSPG to equivalents of the four major brief screening scales previously validated and widely used (one-item SPG, Lie/Bet, BBGS, and NODS-CLiP), especially in a sample with a good representation of both problem and non-problem gamblers. The equivalents were each better than the two versions of the RSPG in at least one screening property, depending on the preliminary choice made by the authors at the time of development of these scales. However, our strategy to select the best combinations based on both sensitivity and YI had allowed us to obtain two measures that are good in almost all screening properties, with no deficient property. Moreover, comparing to equivalents, the RSPG-I does not include item 7 from the DSM (lying), while this item is included in the three main equivalents (NODS-CLiP, BBGS, and Lie/Bet). This item is probably more prone to denial, which is a major bias problem in screening measures in addictology. Moreover, when the gambler has no close relative to whom he can lie, what is the relevance of this item?

Both the two versions of the RSPG have the advantage of combining complementary aspects of addiction and thus of being relatively complete despite of their short duration.

This work is limited by some weaknesses. First, the final RSPG questionnaires were not validated alone, in a representative sample of gamblers. Second, the list of items tested was obviously not exhaustive, and CPGI (Ferris & Wynne, 2001) items could especially not be included, whereas it is currently the mostly used questionnaire for screening gambling problems (the SOGS was most commonly used during startup of this study in 2009). Third, this work was done in French only, so that it could be useful to confirm the interest of the RSPG in other languages (the proposed English-version had not been tested itself). Fourth, the diagnosis of a

gambling problem was made based on the 10 criteria from the DSM-IV, because the DSM-5 was not published at the time of recruitment and baseline assessment (2009–2011). DSM-5 changes include: reclassification, renaming, and changes in diagnostic criteria and lowering of threshold for a diagnosis (Reilly & Smith, 2013). All these changes could have led to underestimate the prevalence of addiction compared to the DSM-IV. However, a recent study of the impact of DSM-5-related changes on prevalence rates and classification accuracy concluded that the new criteria yielded equivalent or slightly better classification accuracy in all comparisons and across all samples (Petry, Blanco, Stinchfield, & Volberg, 2013). Fifth, the comparison with existing tools is not completely reliable because equivalents are not formulated strictly in the same way as the original tools so gamblers could have responded differently. Moreover, some items were passed in interview (DSM), while these tools are all used in self-report (NODS-CLiP, BBGS, Lie/Bet, and one-item, SPG). It is noteworthy that one of the strengths of our procedure was to differentiate the two modes of completion, while the existing screening tools are often used interchangeably in self-report (pen-and-paper or internet-based surveys) and interview (mostly telephone-based surveys) studies. Another great strength of this work was that all combinations of items from available gambling scales were tested in a systematic manner, with no *a priori*. Finally, to our knowledge, this is the first mini-screener for problem gambling based on DSM-5 categorization. Finally, and as expected, PPV were very low when being adjusted to national prevalence. However, the adjusted VPN remains very good even with low national prevalence, as this is desired for a screening tool.

To conclude, we recommend to use the RSPG-SA/I for screening problem gambling in epidemiological surveys, with the version adapted for each purpose (RSPG-I for telephone-based or face-to-face survey, and RSPG-SA for pen-and-paper or internet-based surveys). This first triage of potential problem gamblers using the RSPG-SA/I must be supplemented by further assessment (Problem Gambling Research and Treatment Centre (PGRTC), 2011; Toce-Gerstein et al., 2009), as it may overestimate the proportion of problem gamblers (specificity = 0.78 or 0.64). However, a first triage has the great advantage of saving time and energy in large-scale screening for problem gambling.

plan. BP and JBH conducted the statistical analysis. All other authors (including those mentioned in the JEU Group) contributed to include the participants in the study, to the development of the protocol, and to obtain funding sources. GCB wrote the first draft of the manuscript, and all authors gave feedback and approved the final manuscript.

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