Rethinking cutoff values for the South Oaks Gambling Screen: Sex-specific insights and DSM-5 severity adjustments in Gambling Disorder assessment

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ABSTRACT

Background and aims: The South Oaks Gambling Screen (SOGS) is a commonly used tool for screening potential gambling problems. The SOGS score has been found to be correlated with the DSM-5 criteria for Gambling Disorder (GD). However, one of its main limitations is the high rate of false positives. The objective of this study was to establish more accurate cutoff points for the SOGS based on the DSM-5 criteria and severity levels, taking into account sex-specific samples. Additionally, we aimed to validate these cutoff points using external measures. *Methods:* The study sample comprised 4.516 patients (398 women and 4,118 men) who sought treatment for GD. Of these patients, 4.203 met the DSM-5 criteria for GD, while 313 did not meet the threshold for GD diagnosis. *Results:* The recommended cutoff value for the SOGS is eight for men (Sensitivity (Se): 82.9%, Specificity (Sp): 86.2%) and seven for women (Se: 85.6%, Sp: 77.4%). For moderate severity of GD, the cutoff points are nine for men (Se: 82.1%, Sp: 82.0%) and eight for women (Se: 86.3%, Sp: 73.3%), while for severe cases of GD, the cutoff point is ten for both sexes (Se: 83.0%, Sp: 56.7% for men; Se: 80.0%, Sp: 77.4% for women). These cutoff values are validated by evidence of worse psychopathological states, more dysfunctional personality traits, and risky behaviours commonly associated with GD. *Discussion and Conclusions:* These findings support adjusting the reference values for the SOGS to eight in males and seven in females to enhance the classification of individuals potentially experiencing GD. The use of higher cutoff values has significant implications for clinical and research purposes, enabling a more precise assessment of the diagnosis and severity of GD.

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INTRODUCTION

The South Oaks Gambling Screen (SOGS) (Lesieur & Blume, 1987) is a widely used in-strument designed for screening the possible presence of gambling problems in clinical,

epidemiological and research contexts (Petry, 2005). Its structure is based on the third edition of the Diagnostic and Statistical Manual of Mental Disorders III (DSM-III) criteria for pathological gambling, the former version of current gambling disorder (GD) diagnosis of the DSM-5 and DSM-5-TR (American Psychiatric Association, 2013, 2022). Despite being designed based on DSM-III criteria, the SOGS has a similar etiological structure of later versions of the manual (Slutske, Zhu, Meier, & Martin, 2011) and demonstrated to be a rapid and reliable instrument to evaluate the presence of gambling related problems (Esparza-Reig, Guillén-Riquelme, Martí-Vilar, & González-Sala, 2021; Stinchfield, 2002). The scale is composed of 20 items with multiple choice, assessing a single dimension. The score ranges from 0 to 20, and its original cutoff point is 5, therefore a score from 5 to 20 is considered as an indicator of the possible presence of gambling related problems. The SOGS allows its administration by professionals, non-professionals not specialized in psychological assessment, administration by computer or even self-administration, and has been adapted and validated to several languages and cultures, showing good psychometric properties (de Oliveira, Silva, & da Silveira, 2002; Duvarci, Varan, Coşkunol, & Ersoy, 1997; Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994; Gyollai et al., 2011; Haddad, Roukoz, Akel, & Hallit, 2022; Kido & Shimazaki, 2007; Petry, Armentano, Kuoch, Norinth, & Smith, 2003; Tang, Wu, Tang, & Yan, 2010).

In clinical settings, screening instruments are very useful, as they provide reliable, valid information about the possible presence of a disorder and are frequently the first step towards the solution of a serious problem. In this line, easy to administer screening instruments are crucial in order to optimize public health resources providing the adequate assistance to each patient considering its individual characterization (precision medicine). Nevertheless, like almost all brief assessment instruments, the SOGS has some limitations and, hence, has not been exempt of criticism. For instance, half of the SOGS items pertain to the criterion of borrowing money to gamble. As a result, the mere presence of this particular criterion could lead to a positive screening score (Stinchfield, 2002). Additionally, other studies suggest that the SOGS may be assessing two distinctive dimensions related to gambling issues (Orford, Sproston, & Erens, 2003; Salonen et al., 2017). Furthermore, one of the primary critiques of the SOGS is the high presence of false positives, i.e. many patients surpassing the threshold but not presenting the condition (Battersby, Thomas, Tolchard, & Esterman, 2002; Otto et al., 2020; Stinchfield, 2002; Tang et al., 2010).

Goodie et al. (2013) examined the utility of the SOGS to predict the presence of gambling disorder in a sample of community individuals who presented frequent gambling behaviours. Their results yielded a high number of false positives of GD for the original cutoff value of five. However, the authors proposed that if the cutoff was elevated to eight, the number of false positives was reduced drastically while it has almost no impact in the false negative rates. In the same line, previous validity studies also reported that the SOGS cutoff value should be elevated to eight (de Oliveira et al., 2009; Duvarci & Varan, 2001; Tang et al., 2010). Moreover, the SOGS scores range up to 20, and these cutoff points consider the same risk for all patients who scored above them. Hence, these proposals aim solely at providing a cutoff point to assess the possible presence of a gambling problem. The fifth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) introduced three different severity levels to the diagnosis of GD. These three severity levels are determined by the number of fulfilled criteria: mild (4–5 criteria), moderate (6–7 criteria) and severe (8–9 criteria) and were established mirroring those proposed for substance use disorders (SUD). To specify the severity of the disorder is a useful feature to predict the prognosis of the disorder and, therefore, to adapt the treatment to the necessities of each patient. The SOGS scores correlate with the number of DSM criteria for GD (Cox, Enns, & Michaud, 2004; de Oliveira et al., 2009; Goodie et al., 2013; Stinchfield, 2002; Tang et al., 2010), with other measures of gambling frequency and severity (Barbaranelli, Vecchione, Fida, & Podio-Guidugli, 2013; Petry, 2003), and with more impulsive choices in a delay discounting paradigm (Alessi & Petry, 2003). Therefore, the SOGS have been widely used as a measure of severity of GD (Aloi et al., 2022; Chase & Clark, 2010; Ciccarelli, Cosenza, Nigro, & D'Olimpio, 2022; Jiménez-Murcia et al., 2019; Mathieu, Barrault, Brunault, & Varescon, 2020; Muela, Ventura-Lucena, Navas, & Perales, 2023; Nigro et al., 2022; Panayiotou, Artemi, Theodorou, Theodorou, & Neophytou, 2023; Rogier, Picci, & Velotti, 2019), even though it was not initially designed for this purpose (Lesieur & Blume, 1987). Other widely used screening tools for addiction problems, like the Alcohol Use Disorders Identification Test (AUDIT) (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993) and the Drug Use Disorders Identification Test (DUDIT) (Berman, Bergman, Palmstierna, & Schlyter, 2005) have different cutoff points for different risk levels.

Moreover, the AUDIT and the DUDIT also have different cutoff scores depending on sex, being slightly lower for women than for men (Babor, Higgins-Biddle, Saunders, Monteiro, & World Health Organization (WHO), 2001; Berman et al., 2005; Hildebrand, 2015; Reinert & Allen, 2007). Nevertheless, the SOGS do not have different scores by sex although men and women tend to exhibit different profiles of GD. Women are more prone to engage in non-strategic forms of gambling (e.g. bingo, lotteries), while men are more likely to conduct strategic gambling (e.g. poker, sports betting) (Gartner, Bickl, Härtl, Loy, & Häffner, 2022; Grant, Chamberlain, Schreiber, & Odlaug, 2012; Jiménez-Murcia, Granero, Fernández-Aranda, & Menchón, 2020; Zakiniaeiz & Potenza, 2018). Additionally, women present higher comorbidity with depression and anxiety symptomatology (Gartner et al., 2022; Grant, Chamberlain, et al., 2012). In contrast, men have less previous comorbidity with depression and anxiety problems but higher comorbid alcohol and substance use (Gartner et al., 2022; Grant, Chamberlain, et al., 2012). In addition, women usually have a later onset, but a more rapid evolution of the disorder (i.e. telescoping phenomenon) (Grant, Odlaug, &

Mooney, 2012; Lucas et al., 2023; Zakiniaeiz, Cosgrove, Mazure, & Potenza, 2017), as well as higher rates in autolytic ideation and behaviour (Valenciano-Mendoza et al., 2021). Unlike physiological conditions where gender differences are clear-cut, the behavioural context of gambling presents a more complex scenario. However, the sex-specific differences in gambling behaviour, preferences, and clinical outcomes suggest that separate cutoffs may improve the sensitivity and specificity of the SOGS.

Therefore, the objectives of this study are, first, to establish cutoff values for the SOGS that align with the diagnostic criteria and the severity levels for GD outlined in the DSM-5, while accounting for variations in these cutoff values based on the sex of the assessed individuals. Second, we aim to assess the discriminant validity of the proposed cutoff values in relation to psychopathological variables and gambling behaviour.

METHODS

Participants

The sample consisted of 4.516 patients (398 women and 4.118 men) who sought treatment in the Behavioural Addictions Unit of the University Hospital of Bellvitge, a public hospital in Spain certified as a tertiary care centre for the treatment of GD. All of them were assessed by experienced clinical psychologists in two sessions before the treatment. During the first session, the clinical psychologist conducted a semi-structured interview to assess the presence of GD and to explore various aspects of gambling behaviour and socio-demographic data. During this first session, they also signed the informed consent to participate in the study. During the second assessment session, participants completed a battery of validated psychometric instruments, including the Diagnostic Questionnaire for Pathological Gambling (Jiménez-Murcia et al., 2009; Stinchfield, 2003). Both the semi-structured interview and the Diagnostic Questionnaire for Pathological Gambling were used to ensure diagnostic accuracy. 4.203 patients met the threshold for GD (≥4 criteria of the DSM-5), while 313 of them did not reach the threshold for GD diagnosis and, accordingly, their condition was considered as problematic gambling. The recruitment took place between January-2005 and March-2023.

Instruments

Semi-structured clinical interview. The aim of this interview was to assess clinical and sociodemographic variables (Jiménez-Murcia, Aymamí-Sanromà, Gómez-Pena, Álvarez-Moya, & Vallejo, 2006), including the age at which problematic gambling behaviour began, the presence of accumulated debts related to gambling, the occurrence of illegal acts related to gambling disorder, gambling preferences (non-strategic, strategic, or mixed), type of gambling (offline, online, or mixed) (Jiménez-Murcia et al., 2020), substance use, autolytic behaviour, suicidal ideation, age, marital status, highest level of education attained,

employment status, personal income, and family income. Social position was calculated using Hollingshead's index (Hollingshead, 2011).

South Oaks Gambling Screen. As described in the introduction, the SOGS is a widely used screening instrument for assessing the possibility of a gambling problem (Lesieur & Blume, 1987). It consists of 20 items that assess gambling symptoms and possible negative consequences. SOGS scores have showed correlation with DSM criteria for GD (Cox et al., 2004; de Oliveira et al., 2009; Goodie et al., 2013; Stinchfield, 2002; Tang et al., 2010) and other measures of gambling severity (Barbaranelli et al., 2013; Petry, 2003). The Spanish version of the SOGS was used in this study (Echeburúa et al., 1994) and the measured internal consistency was in the adequate range, with a Chronbach's alpha of 0.703.

Symptom Checklist-Revised. The Symptom Checklist-Revised (SCL-90-R) (Derogatis, 1994) is a self-report instrument designed to assess psychopathological symptoms. The instrument uses a 5-point Likert scale and consists of 90 items. It provides dimensions of somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychotic symptomatology. In addition, the instrument provides three global measures: Global Severity Index (GSI), Positive Symptom Total (PST) and Positive Symptom Distress Index (PSDI). The Spanish version used in this study (Derogatis, 2002) showed good internal consistency, with Chronbach's alphas ranging from 0.783 to 0.980 for all dimensions.

Temperament and Character Inventory-Revised. The Temperament and Character Inventory-Revised (TCI-R) (Cloninger, 1999) is a self-report instrument designed for the evaluation of temperament and character traits. The instrument uses a 5-point Likert scale and consists of 240 items. The temperament dimensions include harm avoidance, novelty seeking, reward dependence and persistence, while the character dimensions include self-directedness, cooperativeness and self-transcendence. The Spanish version used in this study (Gutiérrez-Zotes et al., 2004) had a Cronbach's alpha between 0.703 and 0.859 for all dimensions.

DSM-5 criteria for gambling disorder. Diagnostic criteria for GD were assessed using the Spanish adaptation of the Diagnostic Questionnaire for Pathological Gambling (Jiménez-Murcia et al., 2009; Stinchfield, 2003). This self-report measure consists of 19 items coded on a binary scale (Yes/No). This instrument is a valid and reliable instrument to evaluate the presence of DSM-IV criteria for pathological gambling. The results were re-evaluated and recoded post hoc according to the DSM-5 criteria for GD. The internal consistency for this study was adequate, with a Chronbach's alpha of 0.761.

Statistical analysis

The statistical analysis was done with Stata18 for Windows (Stata-Corp, 2023). The analysis of the global accuracy of the

SOGS as a screening measure to discriminate the GD severity level (as defined by DSM-5 criteria, defined as the external reference gold standard in this work) was done with Receiver Operating Characteristics (ROC) methodology. The area under the ROC curve (AUC) measured the global accuracy of the SOGS across all the potential cutoff points. The optimal cutoff point for the SOGS was selected considering the usual indexes: sensitivity (Se), specificity (Sp), false alarm rate (FAR, the complement of Sp), predictive negative value (PNV), predictive positive value (PPV), and false discovery rate (FDR, the complement of PPV). Since the primary aim of the screening tools is to maximize the accuracy to identify at-high-risk individuals (with the assumption that the costs of false negative classifications are higher than false positive ones), the selection of the optimal cutoff point was based on Se indexes no lower than 0.80 (Zhou, Obuchowski, & McClish, 2002).

Next, two groups based on the SOGS optimal cutoff point were compared (low screening score *versus* high screening score), using chi-square tests (χ^2) for categorical variables and analysis of variance (ANOVA) for quantitative variables. These procedures included the calculation of the effect size for the differences, with the standardized indexes Cramer's-V and partial eta-square (η_p^2) (mild-moderate effect size was considered for $V > 0.15$ and $\eta_p^2 > 0.10$, and high-large effect for $V > 0.30$ and $\eta_p^2 > 0.25$) (Levine & Hullett, 2002). In addition, Finner's procedure was used for controlling the increase in Type-I error due to multiple significance tests (Finner & Gontscharuk, 2009).

Ethics

This study was conducted in accordance with the Declaration of Helsinki. The study was approved by the Ethics Committee for Clinical Research of the University Hospital of Bellvitge (ref. 34/05, 307/06).

RESULTS

Description of the sample

Mean age was 42.4 years-old (SD = 13.8). Most participants in the study were married (44.2%), with low education levels (58.2% primary or less), employed (56.2%), and pertained to low social position index (51.6%). A detailed description of the sociodemographic variables of the sample is displayed in Table 1, which includes the frequency distribution by sex.

Severity distribution

Based on the DSM-5 criteria, $n = 4,203$ patients (93.1%) met clinical criteria for GD and $n = 313$ were within the problematic gambling condition (<4 criteria). No difference by sex was observed for this classification ($\chi^2 = 0.50$, $p = 0.480$, $V = 0.01$).

Figure 1 shows the bar-chart with the distribution of the gambling severity based on the DSM-5 criteria. The highest severity level achieved the prevalence in the study, with no differences between sexes (GD: $\chi^2 = 2.99$, $p = 0.225$, $V = 0.03$; problematic gambling: $\chi^2 = 0.40$, $p = 0.821$, $V = 0.04$).

Cutoff points

Figure 2 displays the results of the ROC analysis aimed at the selection of the optimal cutoff points of the SOGS for discriminating between the GD severity levels (each plot shows the impact of the different SOGS cutoff points on the Se, Sp, PPV, PNV, FDR and FAR). Among the women subsample, the best SOGS divisions were 7 (for mild GD), 8 (for moderate GD) and 10 (for severe GD). Among men subsamples, the best divisions were 8, 9 and 10 (for mild, moderate and severe GD). Table 2 displays the complete

Table 1. Sociodemographic descriptive of the sample

| | | Total | | Women | | Men | | |
		N = 4,516		N = 398		N = 4,118		p
[1]*Quantitative variables*		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Age (years-old)		42.37	13.82	49.98	12.81	41.64	13.70	**0.001**[*]
[1]*Categorical variables*		*n*	*%*	*n*	*%*	*n*	*%*	
Marital status	Single	1,904	42.2%	170	42.7%	1,734	42.1%	**0.001**[*]
	Married - in couple	1,997	44.2%	149	37.4%	1,848	44.9%	
	Divorced - separated	615	13.6%	79	19.8%	536	13.0%	
Education	Primary/less	2,629	58.2%	245	61.6%	2,384	57.9%	0.188
	Secondary	1,593	35.3%	124	31.2%	1,469	35.7%	
	University	294	6.5%	29	7.3%	265	6.4%	
Employment	Unemployed	1,978	43.8%	215	54.0%	1,763	42.8%	**0.001**[*]
	Employed	2,538	56.2%	183	46.0%	2,355	57.2%	
Social position index	High	67	1.5%	3	0.8%	64	1.6%	**0.001**[*]
	Mean-high	216	4.8%	15	3.8%	201	4.9%	
	Mean	467	10.3%	44	11.1%	423	10.3%	
	Mean-low	1,436	31.8%	77	19.3%	1,359	33.0%	
	Low	2,330	51.6%	259	65.1%	2,071	50.3%	

Note. [1]Comparisons of means with analysis of variance (ANOVA). [2]Comparison of proportions with chi-square tests (χ^2). SD: standard deviation. Bold: *p < 0.05*.
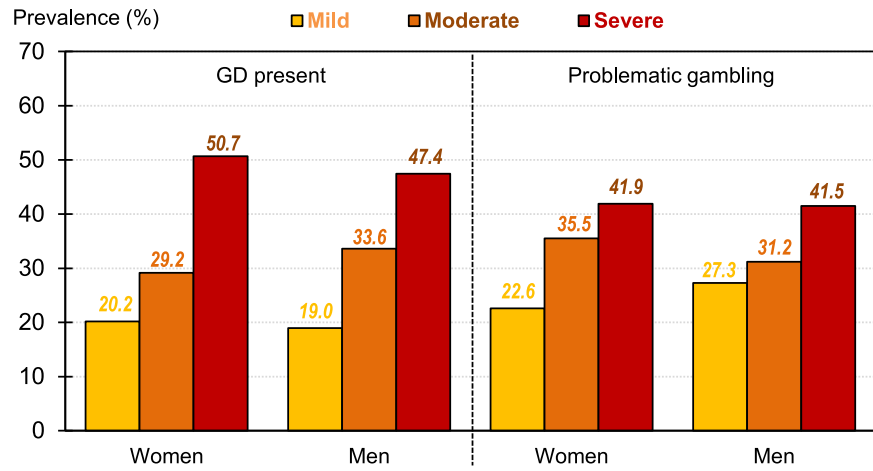
Fig. 1. Severity distribution based on DSM-5 criteria
Note. GD present: mild (4–5 criteria), moderate (6–7 criteria), severe (8–9 criteria).
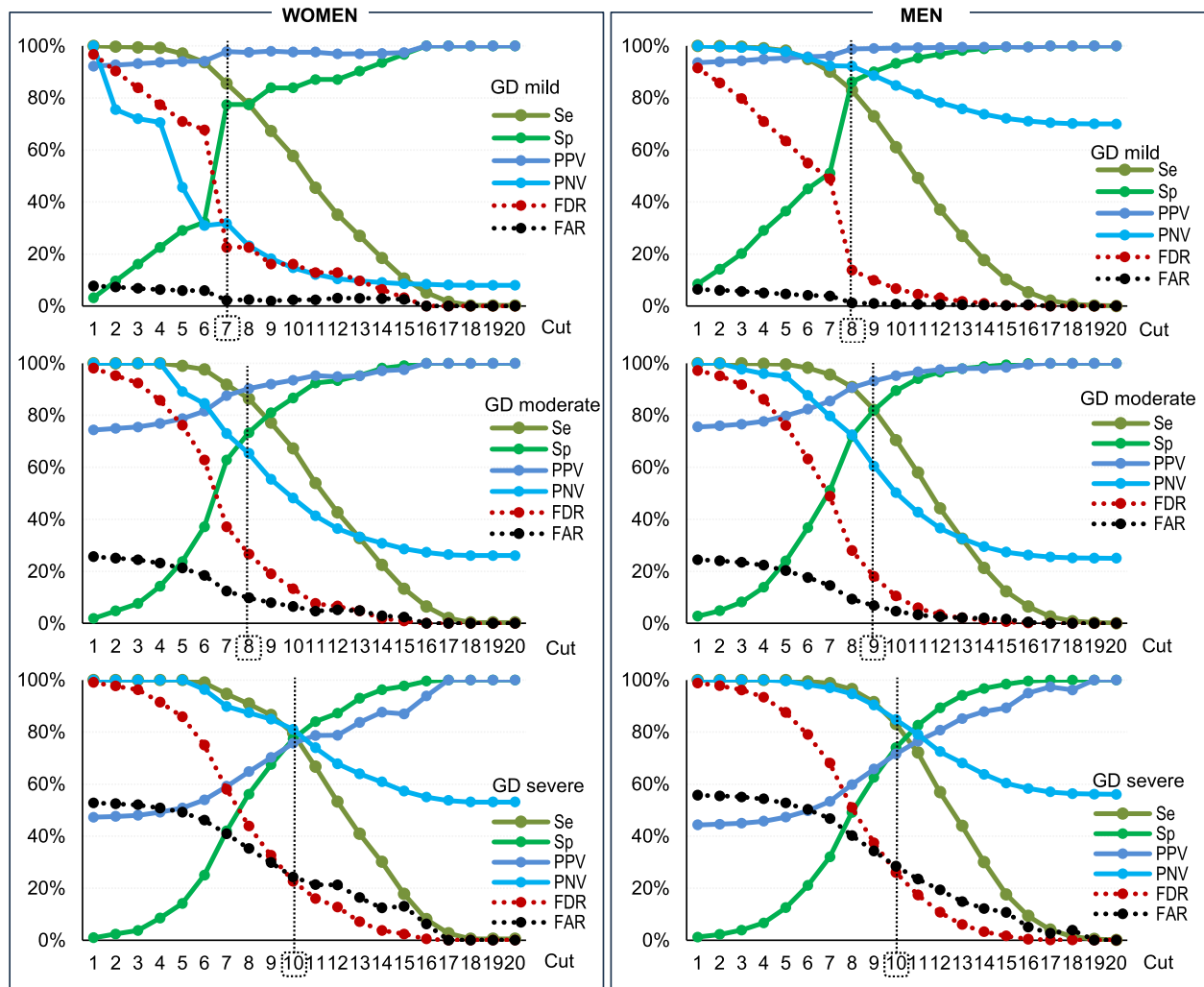Problematic gambling: mild (1 criteria), moderate (2 criteria), severe (3 criteria).

Fig. 2. Identification of the optimal cutoff for the SOGS: ROC analysis for women (left) and men (right)
Note. Se: sensitivity. Sp: specificity. PPV: predictive value for a positive. PNV: predictive value for a negative. FDR: False discovery rate. FAR: false alarm rate.

Table 2. Identification of the optimal cutoff for the SOGS: ROC analysis

Subsample	DSM-5	Cutoff	Se	Sp	PPV	PNV	FDR	FAR	AUC	95% CI AUC	
					Optimal cutoff for the SOGS: ROC analysis						
Women (n = 398)	GD mild	7	85.6%	77.4%	97.8%	31.8%	22.6%	2.2%	0.752	0.652	0.851
	GD moderate	8	86.3%	73.3%	90.2%	65.4%	26.7%	9.8%	0.810	0.760	0.859
	GD Severe	10	80.0%	77.4%	75.7%	81.0%	22.6%	24.3%	0.782	0.736	0.827
Men (n = 4,118)	GD mild	8	82.9%	86.2%	98.8%	92.2%	13.8%	1.2%	0.828	0.804	0.851
	GD moderate	9	82.1%	82.0%	93.2%	60.4%	18.0%	6.8%	0.840	0.826	0.854
	GD Severe	10	83.0%	56.7%	60.1%	81.0%	43.3%	39.9%	0.799	0.786	0.813

Subsample	DSM-5	Cutoff	Se	Sp	PPV	PNV	FDR	FAR	AUC	95% CI AUC	
					Validity for the cutoff = 5						
Women (n = 398)	GD mild	5	97.0%	29.0%	94.0%	45.7%	71.0%	6.0%	0.752	0.652	0.851
	GD moderate	5	99.0%	23.8%	78.7%	89.1%	76.2%	21.3%	0.810	0.760	0.859
	GD Severe	5	100.0%	14.2%	50.8%	100.0%	85.8%	49.2%	0.782	0.736	0.827
Men (n = 4,118)	GD mild	5	98.1%	36.5%	95.4%	97.9%	63.5%	4.6%	0.828	0.804	0.851
	GD moderate	5	99.6%	24.0%	79.7%	95.0%	76.0%	20.3%	0.840	0.826	0.854
	GD Severe	5	99.9%	12.5%	47.3%	99.7%	87.5%	52.7%	0.799	0.786	0.813

Note. Se: sensitivity. Sp: specificity. PPV: predictive value for a positive screening score. PNV: predictive value for a negative screening score. FDR: false discovery rate. FAR: false alarm rate. AUC: area under the ROC curve. 95% CI: 95% confidence interval.

assessment of these selected thresholds for the SOGS. This table also includes the validity-accuracy indexes for a cutoff equal to 5, which provide unacceptable results in specificity, regardless of the severity of the gambling disorder and the sex of the patient.

Discriminant validity of the optimal cutoff points

The patients were classified in two groups based on the cutoff point which discriminated at least mild GD severity level (SOGS = 7 for women and SOGS = 8 for men). The results of the comparisons between the individuals with low versus high score is displayed in Table 3. Among women, those with high SOGS screening score reported a younger onset of the GD, higher number of DSM-5 criteria for GD, worse psychopathology state (higher mean scores in the SCL90-R), higher scores in the novelty seeking and harm avoidance traits, lower score in the self-directedness, higher likelihood of alcohol consumption and higher risk of illegal behaviour related with the gambling activity. Among men, those with a high SOGS screening score reported a younger onset of the GD, longer duration of the GD, higher number of DSM-5 criteria for GD, worse psychopathology state, more dysfunctional personality traits, higher likelihood of impulsivity behaviours (autolytic and suicidal behaviour, as well as substance use), and a higher risk of debts due to the gambling activity.

DISCUSSION

The findings of this research agree with raising the cutoff score of the SOGS from five to eight in order to determine the probable presence of gambling disorder in men who show gambling activity. The precise threshold of eight has previously been suggested as the optimal cutoff value for the

SOGS (de Oliveira et al., 2009; Duvarci & Varan, 2001; Goodie et al., 2013; Tang et al., 2010). However, this cutoff value had still not been validated with a large sample of treatment-seeking patients in any prior study. Additionally, this study assessed if different cutoff values could be recommended for men and women, as proposed in other screening instruments for addictive disorders (Babor et al., 2001; Berman et al., 2005; Hildebrand, 2015; Reinert & Allen, 2007). According to these results, the ideal cutoff value for women should be seven, one point less than for men. The literature that explored sex differences in GD has identified different profiles of GD for men and women (Gartner et al., 2022; Grant, Chamberlain, et al., 2012; Jiménez-Murcia et al., 2020; Zakiniaeiz & Potenza, 2018). The lower cutoff value for women is consistent with these differential profiles, as women exhibit a more rapid evolution of the disorder and, thus, may be prompt to present GD with fewer symptoms as assessed by the SOGS (Grant, Odlaug, & Mooney, 2012; Lucas et al., 2023; Zakiniaeiz et al., 2017).

Moreover, these results propose different scores depending on the level of severity of GD. For men, the cutoff value for assessing moderate severity would be nine, while for women this cutoff value would be eight, in line with the different cutoff scores for possible GD. However, according to these results, no different cutoff values either for men or women should be considered for severe GD. A SOGS score equal or greater than ten may represent a high risk of presenting severe GD for both men and women. A cutoff of ten in the SOGS had already been proposed to precisely identify severe gambling problems (Battersby et al., 2002; Dickerson, Baron, Hong, & Cottrell, 1996). These results support the use of the SOGS to assess GD severity from a dimensional perspective (Barbaranelli et al., 2013; Goodie et al., 2013; Petry, 2003; Stinchfield, 2002; Tang et al., 2010).

Table 3. Discriminant validity of the proposed cutoff points

SOGS →	[1]Women						[2]Men					
	Low; *n* = 63		High.; *n* = 335				Low; *n* = 799		High.; *n* = 3,319			
	Mean	*SD*	*Mean*	*SD*	*p*	η_p^2	*Mean*	*SD*	*Mean*	*SD*	*p*	η_p^2
Onset GD (yrs-old)	41.62	14.31	36.98	11.89	**0.006**[*]	0.019	33.50	14.26	28.50	11.08	**0.001**[*]	0.027
Duration GD (yrs)	5.62	5.45	6.06	6.07	0.592	0.001	5.45	6.14	6.27	6.09	**0.001**[*]	0.003
DSM-5 total	5.03	2.02	7.12	1.90	**0.001**[*]	**0.137**	4.84	1.81	7.23	1.75	**0.001**[*]	**0.223**[†]
SCL: Somatization	1.31	0.90	1.71	0.91	**0.002**[*]	0.025	0.60	0.59	0.97	0.78	**0.001**[*]	0.038
SCL: Obss/compulsive	1.13	0.84	1.62	0.87	**0.001**[*]	0.042	0.74	0.66	1.21	0.80	**0.001**[*]	0.056
SCL: Interp. sensitive	0.96	0.82	1.53	0.87	**0.001**[*]	0.054	0.65	0.65	1.09	0.82	**0.001**[*]	0.045
SCL: Depressive	1.61	0.98	2.21	0.89	**0.001**[*]	0.056	0.98	0.74	1.56	0.88	**0.001**[*]	0.069
SCL: Anxiety	1.03	0.86	1.62	0.89	**0.001**[*]	0.055	0.59	0.59	1.07	0.79	**0.001**[*]	0.058
SCL: Hostility	0.65	0.66	1.17	0.86	**0.001**[*]	0.050	0.58	0.63	0.99	0.84	**0.001**[*]	0.039
SCL: Phobic anxiety	0.63	0.77	0.91	0.88	**0.020**[*]	0.014	0.27	0.45	0.50	0.66	**0.001**[*]	0.021
SCL: Paranoid id.	0.94	0.83	1.33	0.83	**0.001**[*]	0.029	0.61	0.63	0.98	0.78	**0.001**[*]	0.036
SCL: Psychotic	0.77	0.70	1.25	0.79	**0.001**[*]	0.051	0.53	0.57	0.97	0.76	**0.001**[*]	0.054
SCL: PST score	1.09	0.75	1.59	0.74	**0.001**[*]	0.058	0.67	0.54	1.11	0.69	**0.001**[*]	0.066
SCL: GSI score	42.73	21.58	58.11	17.52	**0.001**[*]	0.087	32.97	19.65	48.48	20.47	**0.001**[*]	0.084
SCL: PSDI score	2.03	0.57	2.32	0.62	**0.001**[*]	0.029	1.65	0.50	1.92	0.57	**0.001**[*]	0.035
TCI: Novelty seeking	102.51	12.97	111.15	11.68	**0.001**[*]	0.066	102.50	13.13	110.70	12.77	**0.001**[*]	0.060
TCI: Harm avoidance	104.86	16.90	110.09	15.40	**0.015**[*]	0.015	96.97	14.35	100.58	16.12	**0.001**[*]	0.008
TCI: Reward-Depend.	101.84	14.14	102.15	12.38	0.858	0.000	99.01	14.02	97.39	13.55	**0.003**[*]	0.002
TCI: Persistence	103.46	16.99	104.01	16.80	0.811	0.000	107.58	18.25	108.85	18.62	0.081	0.001
TCI: Self-directedness	129.90	20.14	118.80	17.59	**0.001**[*]	0.048	138.16	19.61	126.01	19.50	**0.001**[*]	0.057
TCI: Cooperative.	135.75	13.17	134.12	13.45	0.378	0.002	133.51	14.66	128.87	15.40	**0.001**[*]	0.014
TCI: Self-Transcend.	68.03	14.23	68.31	14.15	0.887	0.000	60.65	13.85	63.41	13.94	**0.001**[*]	0.006
	n	%	*n*	%	*p*	*V*	*n*	%	*n*	%	*p*	*V*
Autolytic behaviour	9	14.3%	50	14.9%	0.896	0.007	31	3.9%	211	6.4%	**0.008**[*]	0.042
Suicidal ideation	11	17.5%	84	25.1%	0.193	0.065	86	10.8%	677	20.4%	**0.001**[*]	0.098
Tobacco	28	44.4%	184	54.9%	0.126	0.077	432	54.1%	2,078	62.6%	**0.001**[*]	0.069
Alcohol	1	1.6%	32	9.6%	**0.035**	0.105	90	11.3%	584	17.6%	**0.001**[*]	0.068
Drugs	1	1.6%	17	5.1%	0.222	0.061	50	6.3%	406	12.2%	**0.001**[*]	0.075
Debts due to gambling	22	34.9%	155	46.3%	0.096	0.083	243	30.4%	1,821	54.9%	**0.001**[*]	**0.193**[†]
Illegal acts	6	9.5%	71	21.2%	**0.031**[*]	0.108	87	10.9%	937	28.2%	**0.001**[*]	**0.159**[†]

Note. [1]High score: SOGS≥7. [2]High score: High score: SOGS≥8. SD: standard deviation. Effect size (η_p^2 for ANOVA and Cramer-V for χ^2 test). [*]Bold: significant comparison. [†]Effect size: mild/moderate to high/large ($\eta_p^2 > 0.10$ or $V > 0.15$).

The second objective of this study was to validate the heightened cutoff points by using external measures related to the GD. The discriminant validity of these cutoff values is proven by the higher general psychopathological symptomatology, dysfunctional personality traits, sooner gambling behaviour onset, more alcohol use and more illegal acts in those individuals with a SOGS value higher than eight (for men) and seven (for women). Moreover, in men there are also differences in gambling duration, autolytic behaviours and suicidal ideations, tobacco and drug use and debts. For women, the lack of differences in the GD duration may be associated to the telescoping effect (Grant, Odlaug, & Mooney, 2012; Lucas et al., 2023; Zakiniaeiz et al., 2017). Furthermore, the absence of differences in the rates of suicidal ideation and self-harming behaviour in women could be explained as being independent of the level of severity (Valenciano-Mendoza et al., 2021). Moreover, while substance-related disorders correlate with GD in men, this association is not observed in women (Gartner et al., 2022). Also, the presence of higher debt rates in males with a SOGS

score higher than eight may be associated with the preference for online based strategic forms of gambling (Baenas et al., 2024), associated with a rapid increase in debt levels (Jiménez-Murcia et al., 2020). These differences support the investigation of sex-specific cutoffs to enhance diagnostic accuracy. However, it is essential to exercise caution when interpreting these cutoffs, particularly to prevent the potential stigmatisation of women. Overall, these results provide discriminant validity for these cutoff points, as more severe gambling profile is present in those individuals who score above the proposed thresholds.

Objective identification of potential issues of the instrument is crucial for both clinical and research purposes. In clinical settings, false positives may be considered less severe errors than false negatives (Goodie et al., 2013; Stinchfield, 2002, 2003). This is because untreated medical conditions may have greater adverse effects than the side effects, expenses or other consequences that may result from a false positive diagnosis. Therefore, in clinical settings aiming to identify potential gambling problems, a score of five may

be convenient, but the elevated rates of false positives have to be considered. On the other hand, for epidemiological and research purposes where SOGS is employed as a tool to assess possible gambling severity, it would be recommended to raise the cutoff points to decrease the occurrence of false positives and provide a more accurate depiction of gambling disorder. In line with this and prior research (de Oliveira et al., 2009; Duvarci & Varan, 2001; Goodie et al., 2013; Tang et al., 2010), a fitting SOGS score to differentiate possible positive cases of gambling disorder would be eight for males and, according to these results, seven for females. The findings of this research can assist not only to endorse the increase of the cutoff values in upcoming studies but also to accurately interpret prior research that applied the SOGS to measure the severity of GD in samples with gambling behaviours. Those studies with individuals with gambling behaviour but low SOGS scores ought to contemplate that their sample may exhibit noteworthy differences with clinically diagnosed patients (Otto et al., 2020; Stinchfield, 2002; Tang et al., 2010). Moreover, when categorizing the severity of the GD using the SOGS, the proposed cutoff values for the different severity levels may serve as a reference of the scores of a large clinical sample of patients diagnosed with GD with different severity gradients (Barbaranelli et al., 2013; Goodie et al., 2013; Petry, 2003; Stinchfield, 2002; Tang et al., 2010). In addition, for clinical purposes, a screening score corresponding to a higher severity level could prove beneficial in determining treatment urgency, serving as a form of triage, providing a more personalized intervention and, thus, optimizing the time and resources applied to evaluate possible cases of GD.

Limitations

The findings of this study have to be interpreted in light of its limitations. Firstly, sex differences have been considered in this study, however, other individual features could have an impact on the optimal cutoff values, such as age (Granero et al., 2020) or cultural context (Battersby et al., 2002; Hayano, Dong, Miyata, & Kasuga, 2021). Secondly, obtained cutoff values for women may be tentative due to sample size limitations. Future research should continue to refine these cutoffs with larger and more diverse samples in the context of gambling behaviour. Thirdly, the severity levels are useful to determine which patients would require a more rapid or a specific intervention, but DSM-5 severity levels for GD are not exempt from criticism, as they have not been proven to be as effective for GD as they have for SUD and not all symptoms may be equivalent or interchangeable (Grant, Odlaug, & Chamberlain, 2017; Hasin et al., 2013; Mestre-Bach et al., 2019). While this study adheres to the current standard, future work should explore alternative approaches to severity assessment that may offer a more refined understanding of GD. Lastly, the entire sample included in this study exhibited at least one DSM-5 symptom, thereby suggesting that investigating this phenomenon including non-problem gamblers could be an interesting possibility for future research, providing a more comprehensive validation of the SOGS cutoffs.

CONCLUSIONS

This study is the first to validate the cutoff values for the SOGS both for males and females, also adding cutoff values for the different severity gradients of GD proposed in the DSM-5. Moreover, consistent with previous studies, these results support the dimensional use of the SOGS as a measure to assess the severity of GD, but, at the same time, suggest that the reference values of the SOGS should be increased to eight in males and seven in females in order to optimize the categorization of individuals with a potential GD. The rise in cutoff values has significant implications for both clinical practice and research purposes, as it allows for a more precise assessment of GD diagnosis and severity levels.

Data availability: The datasets generated during and/or analysed during the current study are not publicly available due to ethical restrictions in order to protect the confidentiality of the participants, but are available from the corresponding author on reasonable request.

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