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DSM-5 Gambling Disorder: Prevalence and Characteristics in a Substance Use Disorder Sample

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Abstract

Background—The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) replaced the DSM-IV diagnosis of Pathological Gambling (PG) with Gambling Disorder (GD). GD requires four rather than five criteria for the diagnosis and excludes the “Illegal Acts” criterion. We examined the prevalence of GD and its characteristics and validity in a substance use disorder (SUD) sample.

Methods—Participants (N=6,613) in genetic studies of substance dependence underwent a semi-structured psychiatric interview. Individuals who reported ever having gambled \$10 at least monthly (n = 1,507) were the focus of the analyses.

Results—Approximately one-third of acknowledged gamblers (n = 563; 8.5% of the total sample) received both PG (DSM-IV) and GD (DSM-5) diagnoses and 678 (10.3% of the total) received a DSM-5 diagnosis, representing an increase of 20.4% relative to DSM-IV. Although the three groups were comparable demographically, the DSM-5-Only group was intermediate between the other two groups on the prevalence of comorbid substance use disorders, the distribution of DSM-IV PG criteria endorsed, and the types of gambling reported. Multinomial logistic regression

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Contributors

Lior Rennert, Cécile Denis, Kyle Peer, Kevin G. Lynch, Joel Gelernter, and Henry R. Kranzler had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Henry R. Kranzler, Joel Gelernter, Kyle Peer. *Analysis and interpretation of data:* Cécile Denis, Lior Rennert, Kyle Peer, Kevin G. Lynch, Henry R. Kranzler. *Statistical analysis:* Lior Rennert, Kevin G. Lynch. *Obtained funding:* Joel Gelernter and Henry R. Kranzler. *Study supervision:* Henry R. Kranzler, Joel Gelernter. All authors contributed to and have approved the final manuscript.

Conflict of interest

Kyle Peer, Lior Rennert, Kevin G. Lynch, Cécile Denis, and Joel Gelernter have no disclosures to make. Henry Kranzler has consulting arrangements with Alkermes, Lilly, Lundbeck, Pfizer, and Roche. He has also received honoraria from the American Society of Clinical Psychopharmacology's Alcohol Clinical Trials Initiative, which is supported by Lilly, Lundbeck, Abbott, and Pfizer.

analysis showed that the DSM-5-Only group was more likely than the No-Diagnosis group and less likely than the Both-Diagnoses group to acknowledge a gambling problem.

Conclusion—There was a high prevalence of PG in this SUD sample. Analysis of non-DSM variables suggested that the increased sensitivity of the DSM-5 GD diagnosis successfully identifies a broader set of individuals with clinically significant gambling-related problems. Prospective studies of individuals with GD are needed to validate this finding.

Keywords

gambling disorder; DSM-IV; DSM-5; diagnosis; validity

Introduction

The fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) characterizes Pathological Gambling (PG) as persistent and recurrent maladaptive gambling behavior (American Psychiatric Association, 1994). In the fifth edition of the DSM (DSM-5), published in May 2013, the diagnosis of Pathological Gambling was renamed as Gambling Disorder (GD) (Petry et al., 2013). The disorder was reclassified from an “Impulse-Control Disorder Not Elsewhere Classified” to one of the “Substance-Related and Addictive Disorders” in an effort to clarify the diagnosis and treatment of GD, to increase its recognition, and to improve research efforts directed to the disorder (Petry et al., 2013; O'Brien, 2011). This change also reflects recognition of the similarities between pathological gambling behavior and addiction to substances (Grant et al. 2010). Changes made in DSM-5 to the gambling diagnosis included the removal of the “Illegal Acts” criterion in the diagnosis and the reduced number of criteria required for a diagnosis (i.e., four instead of five criteria) (American Psychiatric Association, 2012; Petry et al., 2013).

The revisions were informed by a growing body of literature on GD (Petry et al., 2013) and, along with the other changes in DSM-5, were approved by the American Psychiatric Association (Jeste, 2012). Although the intent was for DSM-5 to reflect the best scientific understanding of psychiatric illness, it has been controversial. Two important considerations in evaluating new diagnostic criteria are whether the changes significantly alter the prevalence rate of the disorder and whether the criteria are sensitive and valid. Proposed changes that result in substantial differences in prevalence or that occur at the cost of reduced validity could adversely affect the diagnosis and treatment of a disorder (Agrawal et al., 2011). Previous studies have consistently reported low endorsement rates of the Illegal Acts criterion in different samples and shown that it was never endorsed in the absence of other criteria (Strong et al., 2007; Jimenez-Murcia et al., 2009; Denis et al., 2012; Petry et al., 2013). Consistent with this view, endorsement of the Illegal Acts criterion by individuals at the diagnostic threshold occurs infrequently, so that a GD diagnosis is unlikely to be contingent upon this criterion (Zimmerman et al., 2006; Petry et al., 2013). In two studies, one in a small addiction treatment sample ($n = 161$) (Denis et al., 2012) and one in 3,710 randomly selected household residents in the United States, gambling patrons, and individuals in substance abuse treatment (Petry et al., 2013), the removal of this criterion resulted in a modest change in prevalence and had a minimal impact on diagnostic accuracy.

Thus, the key change in the DSM-5 diagnosis of GD is the reduction in the number of criteria required for the diagnosis.

Reducing the number of criteria required for the GD diagnosis in DSM-5 could result in false positive diagnoses (i.e., lower specificity) that could lead to imprudent treatment decisions and misallocation of scarce resources (Batstra et al., 2012). However, three studies of the concurrent validity of DSM-IV PG (Stinchfield, 2003; Stinchfield et al., 2005; Jimenez-Murcia et al., 2009) showed consistently better diagnostic accuracy with a cutoff of four diagnostic criteria than with five criteria. Consistent with expectations, in a small addiction treatment sample (n= 161), a reduction in the number of required criteria showed that the prevalence rate of GD increased by 19.6% [from 20.5% (DSM-IV) to 25.5% (DSM-5)] (Denis et al., 2012).

There are high rates of gambling problems in individuals with substance use disorders (SUDs) (Oleski et al., 2011) and of SUDs in pathological gamblers (Lorains et al., 2011). However, few data are available to examine the impact of changes in the DSM-5 diagnosis of GD among individuals with substance use disorders (SUDs), as only two studies with a cumulative total of fewer than 400 participants have addressed this question (Denis et al., 2012; Petry et al., 2013). Thus, the present study's objectives were (1) to assess the impact of the proposed changes in DSM-5 on the prevalence rate of GD and (2) to characterize participants who received a DSM-5 GD diagnosis but not a DSM-IV PG diagnosis in a large sample of current gamblers recruited from among substance-dependent and screened control subjects. That is, we asked the question: are the additional individuals identified by DSM5 who were not diagnosed according to DSM-IV affected with a gambling syndrome that is (a) clinically important, and (b) qualitatively similar to that of the subjects who were already identified?

1. Methods

1.1 Sample

A total of 6,613 subjects were aggregated from family-based and case-control genetic studies of substance dependence. Eligible affected subjects met DSM-IV criteria for a lifetime diagnosis of cocaine, alcohol or opioid dependence. Excluded from this number were individuals with a clinical diagnosis of bipolar disorder or schizophrenia or any other condition with a high likelihood to impair symptom reporting (e.g., traumatic brain injury).

We limited the analyses to subjects who reported gambling at least once a month and spending at least \$10 during the period during which they gambled the most. This yielded a sample of 1,507 subjects for analysis. The subjects were recruited at five U.S. sites: Yale University School of Medicine (n=798), the University of Connecticut Health Center (n=446), the University of Pennsylvania School of Medicine (n=176), the Medical University of South Carolina (n=53), and McLean Hospital (n=34). The institutional review board at each site approved the protocol and informed consent forms. The National Institute on Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism each provided a Certificate of Confidentiality to protect study participants.

1.2 Assessments

Subjects were interviewed with the Semi-Structured Assessment for Drug Dependence and Alcoholism (SSADDA), a computer-assisted interview that yields demographic data and lifetime DSM-IV diagnoses of PG, SUDs, and other psychiatric disorders (Pierucci-Lagha et al., 2005; Pierucci-Lagha et al., 2007). The proposed changes to the DSM-5 diagnosis of GD (i.e., omitting the Illegal Acts criterion and lowering the diagnostic threshold to four criteria) were readily accommodated by the data available from the SSADDA. In addition, the SSADDA Gambling section includes a variety of non-DSM questions that cover the kinds and frequency of gambling behaviors, and problems associated with gambling that, because they do not overlap directly with the diagnostic criteria, make them useful to validate the diagnosis of GD in DSM-5.

1.3 Analyses

1.3.1. Definition of Gambling Disorder (GD)—To meet criteria for a DSM-IV Pathological Gambling (PG) diagnosis, subjects had to endorse at least five of the 10 criteria. In the DSM-5 Gambling Disorder (GD), nine of the criteria are the same as for DSM-IV PG, but the Illegal Acts criterion was removed and only four criteria out of nine are required for a diagnosis. Using these definitions, we defined three groups: subjects who did not meet criteria for either DSM-IV PG or DSM-5 GD (referred to below as the "No-Diagnosis" group), subjects that did not meet DSM-IV PG criteria but met DSM-5 criteria for GD (referred to below as the "DSM-5-Only" group), and subjects that met both DSM-IV criteria for PG and DSM-5 criteria for GD (referred to below as the "Both-Diagnoses" group). Thus, any subject meeting DSM-IV criteria meets DSM-5 criteria as well.

1.3.2 Data analysis—We first determined the extent to which the prevalence of GD increased by implementation of the proposed changes under DSM-5 (an increase was obligate). We then compared the three diagnosis groups on a series of measures that included socio-demographic variables, DSM-IV SUD diagnoses, and the specific DSM-IV PG criteria met. Comparisons used ANOVA for continuous variables (with the *post hoc* Tukey-Kramer test) and the chi-square test for categorical variables. Next, we used multinomial logistic regression models (described below in detail) to examine whether the probabilities of membership in the three diagnosis groups were related to the distributions of a set of gambling measures. The queries regarding these measures focused on the period during which the respondent was gambling the most. The measures included types of gambling (betting on sports, gambling in a casino, playing a lottery or bingo, playing sports for money, buying high-risk stocks or commodities, and internet gambling), gambling characteristics (age started gambling, amount of money gambled, frequency of gambling), and whether gambling caused problems and other people objected to the individual's gambling.

As required by the nature of the changes embodied in the DSM-5 diagnosis of GD, we anticipated that the three groups would be ordered in severity, with least severe group being the No-Diagnosis group, the DSM-5-Only group of intermediate severity, and the Both-Diagnoses group being most severe. Thus, the key question addressed in the analyses was

whether the greater sensitivity of the DSM-5 GD diagnosis identifies a group of individuals for whom gambling is problematic enough to warrant the diagnosis.

2. Results

2.1 Sample characteristics

As shown in Table 1, the sample consisted primarily of middle-aged men, slightly more than half of whom were African American (AA). The most common SUD was alcohol use disorder, followed by cocaine, cannabis, and opioid use disorders.

2.2 Prevalence of Gambling Disorder (GD)

Based on DSM-IV (i.e., 5 criteria out of 10), 563 individuals (8.5%) met a diagnosis of PG. Based on DSM-5 (i.e., 4 of 9 criteria), 678 individuals (10.3%) met a diagnosis of GD. This represents an increase of 20.4% in the prevalence of a gambling diagnosis. We divided the subsample that gambled \$10 at least monthly ($n=1,507$) into 3 groups: the No-Diagnosis group ($n=829$, 55.0%), meeting criteria for neither a DSM-IV PG diagnosis nor a DSM-5 GD diagnosis; a DSM-5-Only group ($n=115$, 7.6%), meeting criteria for a DSM-5 GD diagnosis but not a DSM-IV PG diagnosis; and a Both-Diagnoses group ($n=563$, 37.4%), meeting criteria for both a DSM-IV PG diagnosis and a DSM-5 GD diagnosis.

2.3 Group Comparisons

2.3.1 Socio-demographics and Prevalence of Substance Use Disorders—As shown in Table 1, the three groups differed significantly on gender, race/ethnicity, and years of education. The differences largely reflected the greater number of men and AAs and fewer years of education in the Both-Diagnoses group. The only significant difference between the DSM-5-Only and the No-Diagnosis groups was that the former included a lower percentage of European-Americans (EAs) than the latter. There was no difference on socio-demographic variables between the DSM-5-Only group and the Both-Diagnoses group (Table 1).

Among men ($n=1,150$), the application of DSM-5 gambling criteria led to an increase of 18.9% in the prevalence of a gambling diagnosis (39.6% met DSM-IV PG diagnosis and 47.0% met DSM-5 GD diagnosis). There was a larger increase in prevalence among women ($n=357$): 26.9% (i.e., 30.3% met DSM-IV PG and 38.4% met DSM-5 GD). AAs ($n=771$) had an increase of 19.2% in the prevalence of gambling disorder using DSM-5 GD criteria compared to DSM-IV PG criteria (i.e., 42.5% and 50.7%, respectively). The comparable increase in EAs was 21.6% (i.e., 30.6% and 37.2%, respectively).

The prevalence of an SUD diagnosis for the four specific substances assessed in the DSM-5-Only group was intermediate that of the No-Diagnosis and the Both-Diagnoses groups. The prevalence of a cocaine use disorder was significantly higher in the DSM-5-Only group than in the No-Diagnosis group and the prevalence of an alcohol use disorder was significantly lower in the DSM-5-Only group than in the Both-Diagnoses group (Table 1).

2.3.2 Endorsement of DSM-IV Pathological Gambling Criteria—Table 2 displays the rates of endorsement for each DSM-IV PG criterion. In the DSM-5-Only group, the most frequently endorsed criteria were Preoccupation with gambling (90.4%), Chasing losses (82.6%), Need to increase the amount of money gambled (65.2%), and Reliance on others for money (54.8%). These 4 criteria were the most frequently endorsed in the other groups as well. For each criterion, the endorsement rate in the DSM-5-Only group was intermediate to the rates of the No-Diagnosis and Both-Diagnoses groups.

2.3.3 Types and Characteristics of Gambling and Gambling-Related Problems

—Table 3 displays the prevalence of each type of gambling that participants endorsed on at least a monthly basis. We used multinomial logistic regression models to examine the association of group membership with various measures of gambling, including the type and severity of gambling behaviors. We adjusted the model for gender, race/ethnicity, level of education (<12 years vs. 12 years), and presence of an SUD. We excluded variables that had an overall prevalence of less than 5%, which removed Internet gambling (4%) and gambling on the stock market (2%), leaving four gambling type variables and six variables reflecting gambling characteristics or problems. Initial analyses examining the individual contributions of these variables, summarized in Table 4, showed significant effects for all but “age at gambling onset”. Endorsements of some (but not all) of the gambling variables (or higher scores on them) were associated with increased odds of being in the DSM-5-Only group vs. the No-Diagnosis group or the Both-Diagnoses group vs. the No-Diagnosis group.

The relative differences between unadjusted and adjusted odds ratio for Both-Diagnoses vs. DSM-5-Only and for DSM-5-Only vs. No-Diagnosis (ranging from 1.5–5.0%) were far below the 10% relative difference for confounding. This is consistent with the absence of an interactive effect of age, gender and race/ethnicity on diagnosis (data not shown).

Then, we included the 10 non-DSM gambling variables in the same multinomial logistic regression model, using a forward stepwise selection rule based on changes in the likelihood ratio goodness of fit test, with entry and exit thresholds of $p=0.05$ [in fact, the results were not sensitive to this choice of threshold—significant entries had p -values well below 0.05 (with the exception of gambling via lottery), while non-significant p -values were well above 0.05]. The variables were selected for entry in an order that agreed almost exactly with their individual significance. We note that, for each variable in the multinomial model, the entry statistics are much smaller than in the individual models (Table 4), reflecting considerable overlap in their relations with diagnosis group. Table 5 summarizes these analyses with only significant entries presented.

This overall model fit the data well. The AUC statistics for the two logits embedded in the multinomial model fell into acceptable ranges: 0.75 for Both Diagnoses vs. DSM-5 Only, and 0.70 for DSM-5 Only vs. No Diagnosis. The Hosmer-Lemeshow goodness of fit test was not significant for either logit ($\chi^2_{(8)}=7.47$, $p=0.49$ for Both Diagnoses vs. DSM-5 Only, and $\chi^2_{(8)}=14.1$, $p=0.08$ for DSM-5 Only vs. No-Diagnosis).

Subjects who acknowledged having a gambling problem had significantly higher odds of being in the DSM-5-Only group vs. the No-Diagnosis group [OR=2.36 (95% CI=1.39–

4.03)] and of being in the Both-Diagnoses group vs. the DSM-5-Only group [OR=3.89 (95% CI=2.32–6.53)]. Subjects who reported that others objected to their gambling also had significantly higher odds of being in the Both-Diagnoses group vs. the DSM-5-Only group [OR=2.06 (95% CI=1.23–3.44)], and of being in the DSM-5-Only group vs. the No-Diagnosis group [OR=1.81 (95% CI=1.08–3.06)]. Being a casino gambler increased the odds of being in the DSM-5-Only group vs. the No-Diagnosis group [OR=1.79 (95% CI=1.09, 2.94)], but not the odds of being in the Both-Diagnoses group vs. the DSM-5-Only group. Although it was included in the model, daily gambling, the amount of money gambled, and lottery gambling did not differentiate the DSM-5-Only group from the Both-Diagnoses group.

3. Discussion

This study, which compared the prevalence of the DSM-IV diagnosis of PG with its sanctioned replacement, the DSM-5 diagnosis of GD, showed a substantial increase in prevalence, as necessitated by the nested structure of the two criterion sets. Because DSM diagnoses are often used to decide which individuals are eligible for treatment, the increased prevalence of DSM-5 GD has important implications for the availability of treatment resources.

The prevalence of DSM-IV PG (8.5%) was substantially lower than that seen in previous studies of individuals with SUDs: 20.5% in the study by Denis et al. (2012) and 55.0% in the study of Petry et al. (2013). Our subjects were recruited to participate in studies of the genetics of substance dependence, and are probably not representative of a clinical population, in which co-occurring GD is more prevalent. The 20.4% greater prevalence that we observed for GD is, however, consistent with previous findings showing an increase in prevalence of 11–24% attributable to the application of DSM-5 criteria (Denis et al., 2012; Petry et al., 2013). Although the Illegal Acts criterion was endorsed by 53.3% of individuals that met the DSM-IV criteria for PG, the other criteria were endorsed by 51.7% to 98.6% of that group. We found that, as shown previously (Strong et al., 2007; Petry et al., 2013), elimination of the Illegal Acts criterion had little impact on the prevalence of the DSM-5 diagnosis of GD.

Participants that met criteria for only a DSM-5 GD diagnosis differed on a variety of measures from those with no gambling diagnosis and in some cases from those who met criteria for both the DSM-IV and DSM-5 gambling diagnoses. The socio-demographic differences among the diagnosis groups are consistent with findings from previous studies, which showed that male gender, African-American race and the presence of an alcohol use disorder were associated with a greater risk of problem gambling (McBride et al., 2010; Carragher et al., 2011). In our sample, the DSM-5-Only group was intermediate to the No-Diagnosis and Both-Diagnoses groups on all three of these measures. The rate of endorsement of the individual gambling criteria in the DSM-5-Only group was also intermediate to those of the other two groups.

In the multivariate analysis, the percentage of group members that acknowledged that gambling caused them problems clearly differentiated the DSM-5-Only group from both the

No-Diagnosis and the Both-Diagnoses groups (Table 5). This does not permit a clear determination of whether the changes in the DSM-5 diagnosis of GD are warranted, but the findings from other studies support the greater sensitivity and attendant increase in prevalence of the DSM-5 diagnosis. McBride et al (2010) conducted a latent class analysis of DSM-IV criteria in a nationally representative British sample of 5,644 individuals. They found that nearly 10% of the sample reported a preoccupation with gambling and chasing losses (i.e., a “preoccupied chaser” group). Although clearly less severe than the 1.4% of gamblers who were classified as “antisocial impulsive gamblers,” the preoccupied chaser group generally met one to four DSM-IV PG criteria and, despite not receiving a diagnosis of PG, showed evidence of gambling-related impairment (McBride et al., 2010). Our findings are consistent with those of McBride et al. (2010), insofar as the preoccupation and chasing criteria were the ones endorsed most often by the DSM-5-Only group. Similarly, Toce-Gerstein et al. (2003) identified two groups of pathological gamblers, the less severe of which they called “problem gamblers,” comprised of individuals that did not meet DSM-IV PG criteria. This group was similar to those in our sample who met only DSM-5 GD criteria, one-third of whom reported that gambling caused problems for them compared to only 10% in the No-Diagnosis group and 70% in the Both-Diagnoses group (Toce-Gerstein et al., 2003). Overall, although the individuals meeting criteria only for a DSM-5 GD manifest a lower severity of gambling problems, as with the DSM-5 revision of SUDs that captures a less-severe form of SUD [i.e., “diagnostic orphans” (Harford et al., 2010; Moss et al., 2010; Peer et al. 2013)], the DSM-5 GD criteria appear to capture a group of less-severe problem gamblers whose disordered behavior may warrant treatment.

To ensure that the increased sensitivity inherent in the DSM-5 diagnosis justifies the decreased specificity (i.e., greater number of false positives) that may accompany it, additional research, including prospective follow up and examination of the natural history of individuals diagnosed with DSM-5 GD, is warranted. Our cross-sectional approach provides a limited perspective on the question, as prediction of subsequent course is one of the key characteristics of accurate diagnosis. Our study has other limitations. First, our sample was not recruited specifically for an analysis of gambling disorder; rather, it comprised individuals recruited for genetic studies of substance dependence, which appears to have led to the low prevalence of a gambling disorder. Although epidemiological studies have estimated the rate of PG to be 0.4% to 4.0% (Petry, 2007), the prevalence is higher in individuals with an SUD (Welte et al., 2001; Petry, 2007; Kessler et al., 2008; Rush et al., 2008). A second limitation of our study is the lack of a validated measure of gambling problems against which to evaluate the DSM-5 diagnosis. Although the validity of the SSADDA as a method by which to diagnose gambling disorder is unknown, most of the SSADDA items are similar to those included in the National Opinion Research Center DSM Screen for Gambling Problems (NODS), a validated and commonly used measure of gambling disorder (Wickwire et al. 2008). Future studies should employ a standard measure, such as the NODS, which together with measures of personality (e.g., impulsivity) could provide a more comprehensive evaluation of the validity of the DSM-5 diagnosis of GD (Steel and Blaszczyński, 1998).

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Table 1

Characteristics of the sample by diagnosis group

	All Gamblers (n=1,507)	No Diagnosis (n=829)	DSM-5 Only (n=115)	Both Diagnoses (n=563)	Test Statistic [*]	p-value
Gender [males: n (%)]	1,150 (76.3)	609 (73.5) ^a	86 (74.8) ^{a, b}	455 (80.8) ^b	10.19	0.006
Race/Ethnicity [n (%)]					21.36	<0.0001
African American	771 (51.2)	380 (45.8) ^a	63 (54.8) ^{a, b}	328 (58.3) ^b		
European American	543 (36.0)	341 (41.1) ^a	36 (31.3) ^b	166 (29.5) ^b		
Hispanic	98 (6.5)	62 (7.5)	5 (4.3)	31 (5.5)		
Other	95 (6.3)	46 (5.5)	11 (9.6)	38 (6.7)		
Age (yr) [M (SD)]	41.3 (10.2)	41.0 (10.6)	41.3 (10.5)	41.7 (9.58)	1.48	0.478
Range (Min – Max)	18–70	19–70	18–70	18–66		
Education (yr) [M (SD)]	12.0 (1.96)	12.2 (2.04) ^a	11.9 (1.78) ^{a, b}	11.8 (1.86) ^b	17.51	<0.0001
SUDs (DSM-IV)						
Alcohol [n (%)]	1,306 (86.7)	703 (84.8) ^a	95 (82.6) ^a	508 (90.2) ^b	10.32	0.006
Cocaine [n (%)]	1,219 (80.9)	636 (76.7) ^a	99 (86.1) ^b	484 (86.0) ^b	20.73	<0.0001
Opioids [n (%)]	647 (42.9)	325 (39.2) ^a	48 (41.7) ^{a, b}	274 (48.7) ^b	12.33	0.002
Cannabis [n (%)]	906 (60.1)	445 (53.7) ^a	70 (60.9) ^{a, b}	391 (69.4) ^b	34.81	<0.0001

Test value: Results from ANOVA for continuous data and Chi-square analysis for categorical data. When ANOVA showed a significant difference ($p < 0.05$), the *post-hoc* Tukey–Kramer test was used to specify the group differences. Superscript labels with different letters reflect significant group differences. SUD= substance use disorder

Table 2

Rates of endorsement of each DSM-IV Pathological Gambling criterion for the whole sample and by diagnosis group

Criteria	All Gamblers (n=1,507)	No Diagnosis (n=829)	DSM-5 Only (n=115)	Both Diagnoses (n=563)
Preoccupation with gambling	1197 (79.8%)	538 (65.5%)	104 (90.4%)	555 (98.6%)
Need to gamble more	713 (47.3%)	170 (20.5%)	75 (65.2%)	468 (83.1%)
Unsuccessful efforts to control gambling	350 (23.2%)	18 (2.2%)	18 (15.7%)	314 (55.8%)
Restlessness when cutting down	366 (24.3%)	18 (2.2%)	20 (17.4%)	328 (58.3%)
Gambling as a way to escape	351 (23.3%)	38 (4.6%)	22 (19.1%)	291 (51.7%)
Chasing losses	903 (59.9%)	305 (36.8%)	95 (82.6%)	503 (89.3%)
Lied about gambling	570 (37.8%)	80 (9.7%)	47 (40.9%)	443 (78.7%)
Committed illegal acts	352 (23.4%)	52 (6.3%)	N/A *	300 (53.3%)
Jeopardized/lost a relationship/job	382 (25.3%)	11 (1.3%)	16 (13.9%)	355 (63.1%)
Reliance on others for money	665 (44.1%)	120 (14.5%)	63 (54.8%)	482 (85.6%)

* The "Illegal Acts" criterion is not included in the DSM-5 Gambling Disorder diagnosis.

Table 3

Gambling-related variables by diagnosis group

	No Diagnosis (n=829)	DSM-5 Only (n=115)	Both Diagnoses (n=563)	Test value**	p-value
Type of Gambling [n (%)]					
Gambled on sports	274 (33.1) ^a	49 (42.6) ^b	271 (48.1) ^b	32.47	<0.0001
Gambled in casino	532 (64.2) ^a	89 (77.4) ^b	469 (83.3) ^b	62.90	<0.0001
Played lottery	529 (63.8)	82 (71.3)	397 (70.5)	7.90	0.019
Played sports for money	86 (10.4) ^a	19 (16.5) ^b	137 (24.3) ^b	48.49	<0.0001
Bought stocks/commodities	10 (1.2)	5 (4.3)	12 (2.1)	6.25	0.044
Gambled on Internet	21 (2.5) ^a	7 (6.1) ^b	30 (5.3) ^b	8.77	0.013
Gambling Characteristics*					
Amount gambled (\$)					
[M (SD)]	501 (1330) ^a	883 (1783) ^b	1446 (2410) ^c	168.17	<0.0001
Age at onset (yr)					
[M (SD)]	28.2 (9.97)	27.9 (9.67)	28.2 (9.75)	0.08	0.96
Months gambled					
[M (SD)]	33.6 (66.3) ^a	33.5 (51.1) ^{a, b}	37.3 (75.2) ^b	25.21	<0.0001
Frequency of gambling					
[n (%)]					
Daily	297 (35.8) ^a	60 (52.2) ^b	373 (66.3) ^c	124.97	<0.0001
Weekly or monthly	532 (64.2) ^a	55 (47.8) ^b	190 (33.7) ^c		
Gambling problems					
[n (%)]					
Gambling caused problems	97 (11.5) ^a	42 (29.6) ^b	417 (71.0) ^c	523.00	<0.0001
People objected to gambling	130 (13.9) ^a	40 (32.2) ^b	389 (66.1) ^c	402.08	<0.0001

* During the period when subjects gambled the most.

** Test value: Results from ANOVA for continuous data and Chi-square analysis for categorical data. When ANOVA showed a significant difference ($p < 0.05$), the Tukey-Kramer test was used *a posteriori* to specify the group differences. Superscript labels with different letters reflect significant group differences.

Table 4

Odds ratios (95% Confidence Intervals) for gambling type and severity measures

Variable	Both Diagnoses vs. DSM-5 Only	DSM-5 Only vs. No Diagnosis	Test Statistic	P-value
Gambled on sports monthly (%)	1.19 (0.77, 1.85)	1.60 (1.03, 2.47)	28.74	<0.0001
Gambled in casino monthly (%)	1.44 (0.87, 2.39)	1.73 (1.07, 2.79)	45.47	<0.0001
Played lottery monthly (%)	1.10 (0.69, 1.75)	1.36 (0.87, 2.13)	10.92	0.004
Played sports for money monthly (%)	1.86 (1.03, 3.37)	1.38 (0.75, 2.52)	37.37	<0.0001
Gambled daily	1.84 (1.21, 2.80)	1.77 (1.18, 2.67)	103.00	<0.0001
Amount of gambled (\$)	1.15 (1.02, 1.30)	1.22 (1.06, 1.40)	81.51	<0.0001
Gambling caused problems (%)	5.83 (3.69, 9.20)	3.35 (2.09, 5.38)	489.44	<0.0001
People objected to gambling	4.22 (2.70, 6.59)	2.93 (1.85, 4.63)	379.59	<0.0001
Age of onset of gambling (yr)	1.00 (0.98, 1.03)	1.00 (0.98, 1.02)	0.45	0.800
Months gambled	1.00 (1.00, 1.00)	1.00 (1.00, 1.00)	0.24	0.889

* The increase in the odds of being in a higher response category associated with a one unit increase in a gambling variable. Test Statistic refers to the change in likelihood ratio goodness of fit statistic when the gambling variable is included in a model that already contains variables for race, gender, years of education, and substance use disorder diagnoses.

Table 5

Results of multivariate analysis of gambling variables as predictors of diagnosis group membership

Predictor Variable	OR DSM-5 Only vs. No Diagnosis	OR Both Diagnoses vs. DSM-5 Only	Order of Entry	χ^2	Final p-value
Gambling caused problems	2.36 (1.39, 4.03)	3.89 (2.32, 6.53)	4	489.44	<0.0001
People objected to gambling	1.81 (1.08, 3.06)	2.06 (1.23, 3.44)	5	95.12	<0.0001
Gambled daily	1.47 (0.96, 2.24)	1.41 (0.90, 2.22)	6	32.39	<0.0001
Gambler in casino	1.79 (1.09, 2.94)	1.34 (0.78, 2.30)	7	27.10	<0.0001
Amount gambled (\$)	1.07 (0.93, 1.22)	1.08 (0.95, 1.22)	8	9.39	0.0070
Lottery gambler	1.43 (0.90, 2.28)	1.02 (0.63, 1.67)	9	6.12	0.0469

OR= Odds Ratio (95% confidence interval)