

# Towards DSM-V: considering other withdrawal-like symptoms of pathological gambling disorder

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## Key words

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## Abstract

Despite clinical reports of other withdrawal-like symptoms, the DSM-IV considers only restlessness/irritability as a withdrawal-like criterion comprising pathological gambling disorder (PGD). We explored whether this criterion should be broadened to include other gambling withdrawal-like symptoms.

Community-recruited adult gamblers ( $n = 312$ ) participated in telephone interviews about gambling and related behaviors as a part of a larger psychometric study. Frequency and chi-square analyses described the association of gambling withdrawal-like symptoms by gambling disorder status. Multinomial forward selection logistic regression obtained a multivariate model describing the simultaneous relationship between these symptoms and gambling disorder status.

One-quarter of the sample experienced the DSM-IV PGD criterion of restlessness/irritability. However, 41% experienced additional gambling withdrawal-like symptoms when attempting to quit or control gambling. A model including restlessness/irritability and three additional non-DSM-IV withdrawal-like symptoms (i.e. feelings of anger, guilt, and disappointment) is a stronger model of gambling disorder ( $\chi^2 = 217.488$ ;  $df = 8$ ,  $p < 0.0001$ ;  $R^2 = 0.5428$ ;  $p < 0.0001$ ) than restlessness/irritability alone ( $\chi^2 = 151.278$ ;  $df = 2$ ,  $p < 0.0001$ ;  $R^2 = 0.4133$ ). The overlap of gambling withdrawal-like symptoms with substance use withdrawal (11%) and depressive symptoms (34%) failed to fully account for these associations with gambling disorder status.

Future PGD conceptualization and potential criteria revisions for DSM-V may warrant a broader inclusion of gambling withdrawal-like symptoms.  
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## Introduction

Currently, the only withdrawal-like symptom codified in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV: American Psychiatric Association, 1994) for pathological gambling

disorder (PGD) is restlessness/irritability when attempting to control or stop gambling. Yet for decades, clinicians have reported about the presentation of gambling withdrawal-like symptoms in addition to restlessness/irritability. For example, Custer (1982) reported that staff at the Brecksville Treatment Program, the first US treatment

program for PGD, revealed several physiological symptoms attributable possibly to gambling withdrawal, namely, 'headache, abdominal pain, diarrhea, cold sweats, tremor and nightmares to appear for a few days after admission. . . .' In fact, about that same time nearly 30 years ago, Wray and Dickerson (1981) documented evidence of withdrawal-like symptoms relating to high frequency gambling. They found that 30–40% of high frequency US gamblers reported significant disturbance of mood or behavior similar to withdrawal symptoms experienced by high frequency drinkers upon cessation (e.g. restlessness/irritability, depressed mood, poor concentration and obsessive thoughts). Relative to somatic disturbances, the sample less frequently reported anxiety and sleep problems. However, that study failed to control for co-occurring depression and substance use as potential alternative explanations.

In a study conducted in Germany, researchers reported the presence of psychological and some physiological withdrawal-like symptoms from gambling (Meyer, 1989), yet that study was nearly all male gamblers and was limited to machine gamblers and roulette players. Similarly, in a Swedish study, Bergh and Kühlhorn (1994) found two or more gambling withdrawal-like symptoms (e.g. restlessness, irritation, sweating and trembling) among a third (33%) of problem gamblers, leading researchers to conclude that such symptoms were more common than previously reported.

Rosenthal and Lesieur (1992) conducted a study of 222 Gambler's Anonymous members and patients in eight states in the US. That study controlled for co-occurring substance use by using both a treatment and substance using control group, with about one-fourth of each being female) and included PGD criteria prior to their finalization in the DSM-IV. Nearly 90% of pathological gamblers reported experiencing restlessness/irritability when attempting to cut down or control gambling and 65% of pathological gamblers reported at least one of 10 withdrawal-like symptoms (e.g. insomnia, headaches, stomach upset/diarrhea, loss of appetite, etc.) compared to only 2% of control patients. Experiencing these symptoms were unrelated to type of gambling, age of onset of gambling problems, extent of alcohol or drug use while gambling, or self-identified problem substance use status. Withdrawal-like symptoms were also unrelated to socio-demographics other than income, and number of hours and longest hours spent gambling at any one time. Other than the Wray and Dickerson (1981) study, the Rosenthal and Lesieur (1992) study is the only other US study published on this topic to our knowledge. While it significantly adds to the dearth of research in this area,

limitations of that study include its exclusive reliance on a treatment sample and the sample's unclear racial/ethnic composition.

An examination of withdrawal-like symptoms (e.g. mood disturbances and somatic complaints) from alcohol and various classes of drugs may facilitate efforts to understand gambling withdrawal (West and Gossop, 1994). For example, there is evidence supporting the arrangement of alcohol withdrawal symptoms along a severity continuum (Stockwell, 1994), as well as the clinical importance of physical withdrawal symptoms for less severe drug classes like marijuana (Hall, 2002; Martin, 2002; Smith, 2002; Budney *et al.*, 2001). As reviewed by Moreyra *et al.* (2004), pathological gambling and these substances may share commonalities in terms of withdrawal-like symptoms, molecular genetics, comorbidity, and responses to treatment.

The current report aims to add to the limited literature on gambling withdrawal-like symptoms. It focuses on gambling withdrawal-like symptoms because their precise identification may contribute to a clearer understanding of PGD symptomatology and focused symptom reduction and abatement. Furthermore, as we approach the DSM-V publication, expected in 2010, it may be timely to consider the possible inclusion of additional gambling withdrawal-like symptoms in the operationalization of this disorder.

Thus, we explored the presence of gambling withdrawal-like symptoms to test the assumption that restlessness/irritability is by itself, a sufficiently contributory withdrawal-like criterion to our understanding of PGD. We also explored, for the first time, aspects of the symptom misattribution hypothesis (Ensalda, 2000; Thornicroft *et al.*, 2007) by statistically considering the extent of gambling withdrawal-like symptom overlap with depression and substance use withdrawal symptoms in a diverse, community-recruited sample of gamblers.

## Methods

### Sample and study description

Using media advertisements, we enrolled St Louis-area gamblers meeting eligibility criteria ( $\geq$ age 15; gambled or bet > five times lifetime) for a psychometric study of the Computerized-Gambling Assessment Module (C-GAM<sup>®</sup>: Cunningham-Williams *et al.*, 2003b). Two different, trained non-clinicians interviewed gamblers ( $n = 312$ ) twice, one week apart, via telephone about their gambling history, current DSM-IV disorder, additional clinically relevant data about gambling symptoms and treatment. We also interviewed key informants identified by a random subsample of the larger sample for purposes

of establishing clinician/non-clinician diagnostic concordance of the C-GAM instrument.

The C-GAM includes not only PGD criteria from all PGD-inclusive versions of DSM (i.e. DSM-III, -III-R, and -IV) and criteria from the International Classification of Diseases-10th Revision (ICD-10: World Health Organization, 1992), but clinically meaningful symptoms not currently included in published taxonomies. Although we collected information for the purposes of establishing C-GAM reliability and validity across various diagnostic systems, for this report, we focused only on DSM-IV PGD criteria and withdrawal-like symptoms to potentially inform future DSM revisions. We also included in the C-GAM a list of client and literature-supported reports of gambling withdrawal-like symptoms: feeling depressed or hopeless, disappointed in one's self, angry, guilty, or out of control, and an opportunity for respondent verbatim disclosure of any other symptoms that we had not included in the predetermined list of withdrawal-like symptoms. Furthermore, we assessed DSM-IV substance abuse/dependence and withdrawal (C-GAM-Drug and Alcohol modules; C-GAM-DA<sup>®</sup>: Cunningham-Williams *et al.*, 2003a); as well as depressive symptomatology using the Center for Epidemiological Studies Depression Scale (CES-D: Radloff, 1977). We obtained telephone consent after complete description of the study to participants. The University Institutional Review Board approved all methods with federal Certificate of Confidentiality assurances. A detailed description of the overall study methodology is reported elsewhere (Cunningham-Williams *et al.*, 2007; Cunningham-Williams and Hong, 2007).

### Statistical analysis

Using SAS<sup>®</sup> Version 9.1 (SAS Institute Inc., 2004), we categorized gamblers by their endorsement of DSM-IV symptoms as operationalized by the C-GAM. The three mutually exclusive categories are DSM-IV PGD (PGD; 5–10 criteria;  $n = 76$ ); those with fewer DSM-IV symptoms indicating their subthreshold status for the disorder (Subthreshold; 1–4 criteria;  $n = 117$ ), and the remaining gamblers without any DSM-IV PGD criteria (No Criteria; zero criteria;  $n = 119$ ). Bivariate frequency and chi-square analyses described the occurrence of gambling withdrawal-like symptoms by the three levels of gambling. Multinomial forward selection logistic regression obtained a multivariate model describing the simultaneous relationship between four symptoms and the three levels of gambling. Using chi-square and analysis of variance tests, we also described the presence of depression, co-occurring substance use disorders, and substance use

disorder withdrawal by gambling disorder status and also by the presence or absence of gambling withdrawal.

## Results

### Socio-demographic and gambling characteristics

Table 1 describes the socio-demographic characteristics of this sample by their endorsement of DSM-IV gambling criteria (i.e. gambling disorder status). Gamblers ranged in age from 15 to 85 years (mean age = 46.8 years) and were socio-demographically diverse (i.e. 56% female; 28% African-American/others; 35% never married, 36% currently married; 45% some college or higher education; 65% employed; 28% with annual household income <\$25,000).

Table 2 further describes this sample in terms of their gambling behaviors and history. All gamblers in the sample reported gambling on at least one of 11 different types of gambling activities within the past 12 months. Their average age of onset for gambling was 19.2 years [standard deviation (SD) = 10.0]. Gamblers in the Subthreshold and PGD categories were significantly younger on average than gamblers without any reported gambling problems ( $F = 3.79$ ;  $df = 2$ ,  $p = 0.02$ ).

Among those experiencing at least one gambling problem ( $n = 191$ ), the average onset age for experiencing problems was 29.8 years (SD = 13.0). Compared to Subthreshold gamblers on average, the most severe gamblers experienced problems at a significantly younger age (Subthreshold mean = 31.1; SD = 15.6; PGD = 28.0; SD = 14.1) and for a significantly longer period of time (Subthreshold mean = 11.2; SD = 12.0; PGD = 17.6; SD = 13.7;  $F = 11.79$ ;  $df = 1$ ,  $p = 0.0007$ ). The majority of them reported gambling problems within the past 12 months (91.7%), with the recency of experiencing gambling symptoms being statistically unrelated to gambling severity.

### Gambling withdrawal-like symptoms

About one in four gamblers in this sample experienced the DSM-IV PGD criterion of restlessness/irritability (24.7%;  $n = 77$ ). Other than restlessness/irritability, additional gambling withdrawal-like symptoms were endorsed by 40.9% of the sample ( $n = 125$ ). Individual item endorsement was as high as 32% for feelings of disappointment in oneself (32.5%;  $n = 100$ ) and guilt (32.0%;  $n = 98$ ) when trying to quit or control gambling behaviors (Table 3). Other prevalent symptoms were feelings of anger (28.9%;  $n = 89$ ), loss of control (24.0%;  $n = 74$ ), depression/hopelessness (20.1%;  $n = 62$ ), and other symptoms such as somatic complaints, anxiety/panic, shame (8.1%;

**Table 1** Socio-demographic characteristics of community-recruited gamblers by gambling disorder status<sup>a</sup> (*n* = 312)

Characteristics	Total sample ( <i>n</i> = 312)		No Criteria ( <i>n</i> = 119)		Subthreshold ( <i>n</i> = 117)		DSM-IV PGD ( <i>n</i> = 76)		$\chi^2$ (df) <i>p</i> -value
	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	
Gender									
Male	138	44.2	44	40.0	60	51.3	34	44.7	4.92 (df = 2) <i>p</i> = 0.09
Female	174	55.8	75	60.0	57	48.3	42	55.3	
Race/ethnicity									
White	225	72.1	99	83.2	78	66.7	48	63.2	13.5 (df = 4) <i>p</i> = 0.01
Black	72	23.1	16	13.5	31	26.5	25	32.9	
Others <sup>b</sup>	15	4.8	4	3.4	8	6.8	3	3.9	
Current marital status									
Married	113	36.3	50	42.0	34	29.3	29	38.2	5.15 (df = 6) <i>p</i> = 0.52
Never married	108	34.7	38	31.9	47	40.5	23	30.3	
Separated or divorced	70	22.5	24	20.2	27	23.3	19	25.0	
Widowed	20	6.4	7	5.9	8	6.9	5	6.6	
Educational attainment									
<GED/HS <sup>c</sup>	18	5.8	3	2.5	8	6.8	7	9.2	13.6 (df = 4) <i>p</i> = 0.009
High School Graduate	154	49.4	48	40.3	65	55.6	41	54.0	
College/College Graduate	140	44.9	68	57.1	44	37.6	28	36.8	
Current employment status									
Employed <sup>d</sup>	203	65.1	74	62.2	81	69.2	48	63.2	22.3 (df = 4) <i>p</i> < 0.001
Unemployed	52	16.7	10	8.4	23	19.7	19	25.0	
Retired	57	18.3	35	29.4	13	11.1	9	11.8	
Income									
<\$25,000	86	28.2	26	22.2	37	32.5	23	31.1	6.5 (df = 6) <i>p</i> = 0.37
\$25,000–\$50,000	93	30.5	39	33.3	28	24.6	26	35.1	
\$50,000–\$75,000	61	20.0	27	23.1	22	19.3	12	16.2	
≥\$75,000	65	21.3	25	21.4	27	23.7	13	17.6	
Mean age (standard deviation)	46.8 (17.0)		50.1 (18.3)		43.3 (17.0)		46.8 (13.5)		<i>F</i> = 4.88 (df = 2) <i>p</i> = 0.01

<sup>a</sup> Gambling disorder status is defined by three mutually exclusive groups by the number of DSM IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup> Others are gamblers who self-identify as Asian (*n* = 10), Latino (*n* = 2) or bi/multiracial, American Indian or Middle Easterner (*n* = 3).

<sup>c</sup> Did not graduate from high school/Did not complete a high school equivalency program.

<sup>d</sup> The employed category includes full- and part-time workers and students.

**Table 2** Gambling and gambling symptom onset, recency, and duration of community-recruited gamblers by gambling disorder status<sup>a</sup> (*n* = 312)

Characteristics	Total sample ( <i>n</i> = 312)		No Criteria ( <i>n</i> = 119)		Subthreshold ( <i>n</i> = 117)		DSM-IV PGD ( <i>n</i> = 76)		Statistic (df; <i>p</i> -value)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
<i>Among all gamblers (in years)</i>									
Gambling mean onset age	19.2	10.0	21.0	10.2	18.8	10.0	17.1	9.3	<i>F</i> = 3.79 (df = 2; <i>p</i> = 0.02)
Gambling duration	26.0	15.1	26.9	15.9	23.4	14.9	28.8	13.8	<i>F</i> = 3.27 (df = 2; <i>p</i> = 0.04)
<i>Among gamblers with symptoms (in years)</i>									
Mean onset age	29.8	13.0	–	–	31.1	15.6	28.0	14.1	<i>F</i> = 1.97 (df = 1; <i>p</i> = 0.16)
Symptom duration	13.8	15.1	–	–	11.2	12.0	17.6	13.7	<i>F</i> = 11.79 (df = 1; <i>p</i> = 0.0007)
<i>Recency of gambling</i>									
Within past 12 months	<i>n</i> = 176	91.7%	–	–	106	91.4%	70	92.1%	$\chi^2$ = 0.0317 (df = 1; <i>p</i> = 0.86)
More than 12 months ago	<i>n</i> = 16	8.3%	–	–	10	8.6%	6	7.9%	

<sup>a</sup>Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

**Table 3** Lifetime prevalence and bivariate association of gambling withdrawal-like symptoms among community-recruited gamblers by gambling disorder status<sup>a</sup> (*n* = 312)

Gambling withdrawal-like symptoms	Total sample ( <i>n</i> = 312)		No Criteria ( <i>n</i> = 119)		Subthreshold ( <i>n</i> = 117)		DSM-IV PGD ( <i>n</i> = 76)		$\chi^2$ <sup>b</sup> (df)
	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	
From DSM-IV:									
Restlessness/irritability	77	24.7	0	0.0	16	13.7	61	80.3	172.9 (df = 2)
Not from DSM-IV:									
Depressed/hopeless	62	20.1	0	0.0	8	6.9	54	71.1	164.4 (df = 2)
Disappointed in self	100	32.5	6	5.2	29	25.0	65	85.5	139.9 (df = 2)
Angry	89	28.9	4	3.5	21	18.1	64	84.2	156.3 (df = 2)
Guilty	98	31.8	6	5.2	28	24.1	64	84.2	137.3 (df = 2)
Out of control	75	24.3	4	3.4	16	13.8	55	72.4	129.7 (df = 2)
Other symptoms <sup>c</sup>	25	8.1	2	1.7	6	5.2	17	22.4	28.4 (df = 2)
>one withdrawal-like symptom	107	35.0	6	5.2	33	28.9	68	89.5	146.0 (df = 2)

<sup>a</sup>Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup>All significant at *p* < 0.0001.

<sup>c</sup>Other symptoms include the verbatim disclosure of somatic complaints, anxiety/panic, and shame when attempting to cut-back, control or stop gambling.

**Table 4** Multivariate association of gambling 'withdrawal-like' symptoms among community-recruited gamblers by gambling disorder status<sup>a</sup> (*n* = 312)

Gambling 'withdrawal-like' symptoms	Gambling disorder status							
	Cumulative				Incremental			
	df	$\chi^2$	<i>R</i> <sup>2</sup>	<i>p</i> -Value	df	$\chi^2$	<i>R</i> <sup>2</sup>	<i>p</i> -Value
From DSM-IV:								
Restlessness/irritability	2	151.2776	0.4133	<0.0001	2	151.2776	0.4133	<0.0001
Not from DSM-IV: <sup>b</sup>								
Angry	4	188.3437	0.4890	<0.0001	2	37.0661	0.0757	<0.0001
Guilty	6	205.4953	0.5212	<0.0001	2	17.1516	0.0322	0.00019
Depressed/hopeless	8	217.4877	0.5428	<0.0001	2	11.99245	0.0216	0.0025

<sup>a</sup>Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup>Withdrawal-like symptoms not from DSM-IV namely, feeling out of control and other withdrawal-like symptoms (i.e. somatic complaints, anxiety/panic, shame) were not significant for entry at *p* < 0.05. Other symptoms are listed in the order of forward selection.

*n* = 26). Each of the gambling withdrawal-like symptoms were bivariate and significantly related to gambling disorder status (each at *p* < 0.0001).

Table 4 shows the multinomial forward selection logistic regression results. Four symptoms were selected and are presented in their order of entry. The first symptom to enter was restlessness/irritability ( $\chi^2 = 151.278$ ; *df* = 2; *R*<sup>2</sup> = 0.4133). This is the only gambling withdrawal symptom recognized by DSM-IV. Three additional symptoms were added due to their statistical significance (*p* ≤ 0.05) after controlling for symptoms already included. This four-variable model included, in order of entry, restlessness/irritability, feelings of anger, of guilt, and of depression/hopelessness ( $\chi^2 = 217.488$ ; *df* = 8; *R*<sup>2</sup> = 0.543). Furthermore, Table 5 shows the associated odds ratios indicating that each additional symptom (not included in DSM-IV) is both uniquely and significantly related to gambling disorder status.

When assessing associations by gambling disorder status, those experiencing restlessness/irritability were more often in the PGD group (79.22%, *n* = 61) compared to their counterparts (Subthreshold: 20.78%, *n* = 16; No Criteria: 0%, *n* = zero;  $\chi^2 = 172.93$ ; *df* = 2; *p* < 0.0001). This association was similar to those endorsing at least one other gambling withdrawal-like symptom (PGD: 57.6%, *n* = 72; Subthreshold: 32%, *n* = 40; No Criteria: 10.4%, *n* = 13;  $\chi^2 = 134.63$ ; *df* = 2; *p* < 0.0001). Furthermore, there was no significant variation in the occurrence of such DSM-IV and non-DSM-IV withdrawal-like symptoms by gender, household income, and education, with

the exception of a borderline significant association for race/ethnicity and feelings of anger after quitting or cutting down ( $\chi^2 = 4.0$ ; *df* = 1; *p* = 0.045).

For those experiencing restlessness/irritability, there was a significant effect by age group ( $\chi^2 = 18.06$ ; *df* = 3; *p* = 0.0004). The majority was 25–44 years (30.6%, *n* = 26) and 45–64 years (32.0%, *n* = 41) compared to their youngest (≤24 years: 4.4%, *n* = 2) and oldest counterparts (≥65 years: 14.8%, *n* = 8). Age differences were also significant ( $\chi^2 = 8.74$ ; *df* = 3; *p* = 0.03) for those experiencing other withdrawal-like symptoms (25–44 years: 45.2%, *n* = 38; 45–64 years: 46.8%, *n* = 59; <24 years: 24.44%, *n* = 11; ≥ 65 years: 33.3%, *n* = 17). We also explored whether these age-related findings can be explained by an association of age with gambling disorder status ( $\chi^2 = 31.1$ ; *df* = 6; *p* < 0.0001). The majority of those with PGD were also 25–44 years (30.6%, *n* = 26) and 45–64 years (30.5%, *n* = 39) followed by their older (≥ 65 years: 13.0%, *n* = 7) and younger counterparts (<24 years: 8.9%, *n* = 4).

#### Gambling disorder status, depression and substance use disorder withdrawal

We were also interested in the co-occurrence of depression, alcohol abuse/dependence, and drug abuse/dependence with gambling disorder status. We found a statistically significant overlap among these conditions, with higher rates being more prevalent among those with gambling problems (Table 6). Specifically, nearly one in five gamblers met criteria for depression in the past week,

**Table 5** Multinomial logistic regression predicting gambling disorder status<sup>a</sup> by gambling withdrawal-like symptoms ( $n = 312$ )

Gambling withdrawal-like symptoms	Gambling disorder status			
	Subthreshold gambler (versus Recreational gambler)		Pathological gambler (versus Recreational gambler)	
	Odds ratio	95%CI	Odds ratio	95%CI
From DSM-IV:				
Restlessness/irritability	3.26	0.99, 10.76	14.22	3.99, 50.63
Not From DSM-IV: <sup>b</sup>				
Angry	1.16	0.92, 1.48	1.53	1.15, 2.03
Guilty	1.27	1.03, 1.56	1.59	1.22, 2.07
Depressed/hopeless	1.01	0.73, 1.41	1.47	1.06, 2.07

<sup>a</sup>Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup>Withdrawal-like symptoms not from DSM-IV namely, feeling out of control and other withdrawal-like symptoms (i.e. somatic complaints, anxiety/panic, shame) were not significant for entry at  $p < 0.05$ . Other symptoms are listed in the order of forward selection.

with over 40% of those in the PGD group being currently depressed. Gambling disorder status was similarly associated with substance use disorder status ( $\chi^2 = 28.9$ ;  $df = 6$ ;  $p < 0.0001$ ). Nearly 45% of the sample endorsed abuse/dependence criteria for alcohol, drugs, or both. The highest proportions of gamblers with substance use disorder comorbidity were among gamblers in the Subthreshold and PGD categories.

Table 6 also shows the prevalence of physiological, physical health, and emotional withdrawal symptoms from alcohol and drugs. Alcohol and drug withdrawal symptom types were each statistically associated with gambling disorder status (each at  $p < 0.0001$ ). Irrespective of withdrawal symptom type or whether withdrawal was for alcohol or drugs, the highest proportion of PGD gamblers (compared to their counterparts) experienced such alcohol or drug withdrawal.

#### Association of depression and substance withdrawal comorbidity with gambling withdrawal

To explore the alternative explanation of symptom misattribution wherein respondents may be unable to accurately attribute their symptom presentation to its correct cause, we explored the extent of overlap in experiencing gambling withdrawal-like symptoms and the co-occurrence of depression and the physiological, physical health, and psychological withdrawal symptoms from alcohol and drugs (Table 7). There was not complete

overlap in gambling withdrawal symptoms and similar symptoms from alcohol/drug withdrawal or depression. Specifically the amount of overlap was about 60%, with the remaining gamblers experiencing gambling withdrawal in the absence of other similar symptoms from depression or substance use (41.7%;  $\chi^2 = 24.34$ ;  $df = 1$ ;  $p < 0.0001$ ).

For example, about one-third of those with gambling withdrawal (34.2%,  $n = 42$ ) reported also experiencing current depression ( $\chi^2 = 31.9$ ;  $df = 1$ ;  $p \leq 0.0001$ ). In contrast, this is a smaller proportion of overlap than the 45.3% ( $n = 34$ ) of those reporting both depression and restlessness/irritability when attempting to control gambling ( $\chi^2 = 47.59$ ;  $df = 1$ ;  $p \leq 0.0001$ ).

Additionally, among those experiencing gambling withdrawal, less than 20% experienced co-occurring problems from alcohol withdrawal and about 40% experienced drug withdrawal symptoms. Specifically, from alcohol use: 20% ( $n = 25$ ) experienced physiological symptoms ( $\chi^2 = 39.42$ ;  $df = 1$ ,  $p < 0.0001$ ), 11.2% ( $n = 14$ ) experienced physical health symptoms ( $\chi^2 = 21.24$ ;  $df = 1$ ,  $p < 0.0001$ ) and 20.8% ( $n = 26$ ) experienced emotional symptoms ( $\chi^2 = 41.14$ ;  $df = 1$ ,  $p < 0.0001$ ). Furthermore from drug use: 32.8% ( $n = 41$ ) experienced physiological symptoms ( $\chi^2 = 68.55$ ;  $df = 1$ ,  $p < 0.0001$ ); 24% ( $n = 30$ ) physical health symptoms ( $\chi^2 = 48.16$ ;  $df = 1$ ,  $p < 0.0001$ ); and 36.8% ( $n = 46$ ) experienced emotional symptoms ( $\chi^2 = 78.39$ ;  $df = 1$ ,  $p < 0.0001$ ). These associations were also comparable among those experiencing restlessness/

**Table 6** Depression, substance use disorder, and substance use withdrawal by gambling disorder status<sup>a</sup> (*n* = 312)

	Total sample ( <i>n</i> = 312)		No Criteria ( <i>n</i> = 119)		Subthreshold ( <i>n</i> = 117)		DSM-IV PGD ( <i>n</i> = 76)		$\chi^2$ <sup>b</sup> (df)
	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	
CES-D current depression									
No current depression	252	81.5	112	94.1	99	85.3	41	55.4	$\chi^2 = 47.2$ (df = 2)
Current depression	57	18.5	7	5.9	17	14.7	33	44.6	
DSM-IV substance use disorder									
Alcohol abuse/dependence only	23	7.6	7	6.1	9	8.0	7	9.6	$\chi^2 = 28.9$ (df = 6)
Drug abuse/dependence only	46	15.3	12	10.4	17	15.0	17	23.3	
Both	33	11.0	5	4.4	11	9.7	17	23.3	
Neither	199	66.1	91	79.1	76	67.3	32	43.9	
DSM-IV alcohol withdrawal									
Physiological	25	8.0	1	0.8	6	5.1	18	23.7	$\chi^2 = 34.9$ (df = 2)
Physical health	14	4.5	1	0.8	1	0.9	12	15.8	
Emotional	26	8.3	1	0.8	6	5.1	19	25.0	$\chi^2 = 38.0$ (df = 2)
DSM-IV drug withdrawal									
Physiological	41	13.1	2	1.7	9	7.7	30	39.5	$\chi^2 = 62.9$ (df = 2)
Physical health	30	9.6	2	1.7	4	3.4	24	31.6	
Emotional	46	14.7	3	2.5	8	6.8	35	46.1	$\chi^2 = 79.2$ (df = 2)

<sup>a</sup>Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup>All significant at  $p < 0.0001$ .

irritability and co-occurring withdrawal from alcohol (physiological: 24.7%,  $n = 15$ ;  $\chi^2 = 18.24$ ;  $df = 1$ ,  $p < 0.0001$ ; physical health: 11.7%,  $n = 9$ ;  $\chi^2 = 12.37$ ;  $df = 1$ ,  $p = 0.0004$ ; psychological: 19.5%,  $n = 15$ ;  $\chi^2 = 16.63$ ;  $df = 1$ ,  $p < 0.0001$ ) and drugs (physiological: 36.4%,  $n = 28$ ;  $\chi^2 = 48.30$ ;  $df = 1$ ,  $p < 0.0001$ ; physical health: 28.6%,  $n = 22$ ;  $\chi^2 = 42.27$ ;  $df = 1$ ,  $p < 0.0001$ ; psychological: 41.6%,  $n = 32$ ;  $\chi^2 = 58.48$ ;  $df = 1$ ,  $p < 0.0001$ ).

## Discussion

Our findings support previous reports citing the presence of gambling withdrawal-like symptoms with higher rates being associated with gambling severity (Rosenthal and Lesieur, 1992; Wray and Dickerson, 1981). The four-variable model of restlessness/irritability and feelings of

anger, guilt, and depression/hopelessness when attempting to control, cut-back, or stop gambling was significantly larger than the DSM-IV criterion of experiencing restlessness/irritability alone. Thus in future PGD criteria modifications, we recommend a consideration of broadening the restlessness/irritability criterion, as has been done in the operationalization of substance use disorder withdrawal, to specifically include language about these other symptoms.

Furthermore, while there was some overlap of gambling withdrawal symptoms among those who also reported depression and substance use withdrawal symptoms, this overlap did not account for the majority of cases, thus failing to conclusively support a symptom misattribution hypothesis. The inclusion of additional gambling withdrawal-like symptoms (e.g. feelings of

**Table 7** Depression, substance use disorder, and substance use withdrawal by gambling withdrawal-like symptom status<sup>a</sup>

Comorbid disorders	Total sample		Gambling withdrawal-like symptoms		No gambling withdrawal-like symptoms		$\chi^2$ <sup>b</sup> (df)
	<i>n</i>	Percentage	<i>n</i>	Percentage	<i>n</i>	Percentage	
<i>Depression</i>							
Current depression	57	18.8	42	34.2	15	8.3	$\chi^2 = 31.9$ (df = 1)
No current depression	246	81.2	81	65.8	165	91.7	
<i>Substance use disorder</i>							
Alcohol abuse/dependence	21	7.2	11	9.1	10	5.7	9.98 (df = 3)
Drug abuse/dependence	46	15.6	23	19.2	23	13.1	
Alcohol and drug abuse/dependence	33	11.2	19	15.8	14	8.0	$p = 0.02$
No abuse/dependence	195	66.1	67	55.8	128	73.1	
<i>Alcohol withdrawal</i>							
Physiological	25	8.2	25	20.0	–	–	$\chi^2 = 39.4$ (df = 1)
Physical health	14	4.6	14	11.2	–	–	
Emotional	26	8.5	26	20.8	–	–	$\chi^2 = 41.1$ (df = 1)
<i>Drug withdrawal</i>							
Physiological	41	13.4	41	32.8	–	–	$\chi^2 = 68.6$ (df = 1)
Physical health	30	9.8	30	24.0	–	–	
Emotional	46	15.0	46	36.8	–	–	$\chi^2 = 78.4$ (df = 1)
<i>Comorbid depression and substance use withdrawal</i>							
No comorbidity	172	58.3	50	41.3	122	70.1	$\chi^2 = 24.34$ (df = 1)
Comorbidity	123	41.7	71	58.7	52	29.9	

<sup>a</sup> Gambling disorder status is defined by three mutually exclusive groups by the number of DSM-IV pathological gambling disorder (PGD) criteria endorsed: No Criteria = zero; Subthreshold = 1–4 criteria; DSM-IV PGD = 5–10 criteria.

<sup>b</sup> All significant at  $p < 0.0001$  unless where indicated.

<sup>c</sup> Comorbid disorders include positive diagnosis of DSM-IV alcohol abuse/dependence, drug abuse/dependence, and/or meeting criteria for CES-D current depression.

anger, guilt, depression/hopelessness), to the exclusion of characteristic depression and substance use withdrawal symptoms, may be informative in PGD criteria revision discussions for DSM-V.

Age was significantly associated with other gambling withdrawal-like symptoms, although less striking than its association with the DSM-IV restlessness/irritability criterion. Given that age is also significantly associated with gambling disorder status and withdrawal symptoms more commonly occurring among those with severe disorder,

it is plausible that this association with age is spurious in this sample. Future research warrants further exploration into the association of gambling withdrawal and age.

The study design imposed limitations on the interpretation of the findings. We did not have a specific measure of illness insight or symptom misattribution, nor symptom onset information; thus, we were unable to identify with complete certainty whether these self-reported gambling withdrawal-like symptoms were misattributed to gambling rather than being correctly attributed to depression

or substance use. We also collected information on accepted PGD criteria (e.g. onset, recency, severity, duration), but did not have comparably detailed information on depression and withdrawal symptoms. Furthermore, while this is the first study to explore this issue with a non-treatment sample, our convenience sample of community-recruited gamblers, who responded to advertisements for a gambling psychometric study, limited the study's generalizability for gamblers in treatment, adolescent and older adult gamblers, and gamblers differing in their psychiatric and substance use profiles.

Future research addressing these limitations would enable a direct test of the symptom misattribution hypothesis. Such studies would also inform PGD conceptualization, refine understanding of gambling symptom presentation and enable clinicians in their provision of targeted, evidenced-based treatment.

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### Declaration of interests statement

The authors report no competing interests.

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