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Adult ADHD Is Associated With Gambling Severity and Psychiatric Comorbidity Among Treatment-Seeking Problem Gamblers

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Abstract

Objective: The aim of this study is as follows: (a) exploring retrospective childhood and adult ADHD symptomatology in treatment-seeking gamblers, (b) providing detailed characteristics of the association between pathological gambling (PG) and ADHD, and (c) identifying risk factors for a history of ADHD. **Method:** Eighty problem gamblers (20% female) were examined using a standardized interview (PG: *Diagnostic and Statistical Manual of Mental Disorders* [4th ed.; *DSM-IV*] criteria, Gambling Attitudes and Beliefs Survey; ADHD: Wender Utah Rating Scale–*deutsche Kurzform*, Adult ADHD Self-Report Scale; comorbidities: Mini International Neuropsychiatric Interview). **Results:** Forty-three percentage of patients screened positive for childhood ADHD, and in 11%, ADHD persisted in adulthood. Patients with adult ADHD had more severe gambling problems ($p = .009$, $d = 1.03$) and a higher number of psychiatric comorbidities ($p < .001$, $d = 1.62$) compared with those without ADHD. Substance abuse/dependence constituted a predictor for having a history of ADHD (odds ratio [OR] = 4.07, $p = .025$). **Conclusion:** ADHD–PG comorbidity is linked to factors that worsen the prognosis. Thus, screening for ADHD and verifying persistence in adulthood should be an integral component in the *interdisciplinary* treatment of problem/pathological gamblers. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

adult ADHD, pathological gambling, problem gambling, cormorbidity, impulsivity

Introduction

Descriptions of adult ADHD appear in the scientific literature from 1976 onward, yet in practice the disorder was often considered to resolve by itself during adolescence and young adulthood (Kooij et al., 2010). Current evidence suggests that childhood ADHD persists during adolescence and adulthood in around two thirds of participants (Lara et al., 2009; Retz-Junginger et al., 2002), and thus is among the most common psychiatric disorders in childhood that persist into adulthood (Kooij et al., 2010). ADHD is defined as a clinical syndrome characterized by the presence of developmentally inappropriate levels of inattention, hyperactivity, and impulsivity, starting in childhood and leading to impairment (Kooij et al., 2010). The estimated prevalence ranges from 3% to 7% in children and 2% to 5% in adults, respectively, depending on the classification criteria applied (Fatseas, Debrabanta, & Auriacombe, 2012; Kooij et al., 2010; Retz-Junginger et al., 2002). The relevance of this topic is highlighted by changes of ADHD criteria in the recently published *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013), which allow consideration of symptoms of ADHD that develop later in life and cannot be clearly identified until the early adolescent years (APA, 2013).

Adult ADHD is associated with severe impairment such as higher levels of unemployment, lower levels of productivity during employment, irritability and low frustration tolerance, a higher risk of accidents, and increased rates of substance abuse (Kooij et al., 2010). Up to 90% of adult clinical populations with ADHD present with one or more comorbid conditions (Sobanski, 2006). The most common comorbidities are substance use disorders (SUDs), mood and anxiety disorders, personality disorders, and eating disorders, which complicate the diagnosis as symptoms of ADHD and those conditions overlap (Sobanski, 2006; Sobanski et al., 2007). ADHD is also reported as a major

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risk factor for developing SUDs (Fatseas et al., 2012; Kooij et al., 2010). A meta-analytic and meta-regression analysis indicated an overall prevalence of ADHD in SUD populations of approximately 23% (van Emmerik-van Oortmerssen et al., 2012).

The co-occurrence of nonsubstance-related addiction (such as pathological gambling [PG]) and ADHD has recently received more attention, with the few existing studies indicating a high prevalence of ADHD among treatment-seeking pathological gamblers (Fatseas et al., 2016; Grall-Bronnec et al., 2011). PG is the most extensively studied nonsubstance-related addictive disorder, and the only one included as a diagnosis in *DSM* (included since 1980; Code: 312.31) and International Classification of Diseases (ICD; included since 1991; Code: F63.0). The disorder is listed among the "Habit and Impulse Disorders" in the 10th revision of the ICD (ICD-10) and was defined as an impulse-control disorder in *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; APA, 1994**)**. The recently published *DSM-5* reclassified PG as gambling disorder (GD) alongside other addictive behaviors (as one of the substance-related and addictive disorders). This reclassification was proposed based on the finding that PG is similar to substance-related disorders in clinical expression, brain origin, comorbidity, and physiology, and the distinct similarities, which were observed in the activation of the reward system between substance-related addiction and PG (APA, 2013). Noteworthy, the vast majority of studies providing estimates for PG prevalence in different samples are still based on *DSM-IV* criteria as *DSM-5* was only introduced recently. In addition, the current lack of validated assessment instruments using *DSM-5* criteria requires the term *pathological gambling* to be used instead of GD within this article.

ADHD has been linked to addiction in a large number of studies (e.g., Carpentier, van Gogh, Knapen, Buitelaar, & De Jong, 2011; van Emmerik-van Oortmerssen et al., 2012; Vogel et al., 2016). Yet there are little data on the comorbidity of PG and ADHD (particularly ADHD persisting in adulthood), despite early studies pointing to the presence of ADHD during childhood as a potential risk factor for the development of problem gambling in adulthood (Carlton, & Manowitz, 1992; Carlton, Manowitz, McBride, Nora, Swartzburg, & Goldstein, 1987; Rugle & Melamed, 1993; Specker et al., 1995). Those studies suffer from methodological biases like limited sample size, selection bias related to the choice of the studied population, or the retrospective nature of the ADHD assessment. These pitfalls were avoided in a longitudinal study by Breyer et al. (2009), and results indicated that individuals who report childhood ADHD symptoms, which continue on to young adulthood, experience greater severity of gambling problems compared with participants without these symptoms.

A more recent study by Grall-Bronnec et al. (2011) was of particular interest for the current investigation, due to the specific focus on childhood as well as adult ADHD among pathological and at-risk gamblers (3-4 *DSM-IV* PG criteria met) seeking treatment (N = 84; 14% female). More than 25% of the participants had a history of ADHD (i.e., childhood ADHD or ADHD persistent in adulthood), which is similar to findings for patients with SUDs (van Emmerik-van Oortmerssen et al., 2012). Participants with a history of ADHD had more severe gambling problems and a higher level of gambling-related cognitions, a higher frequency of psychiatric comorbidities, and a heightened risk of suicide. These results demonstrate that the co-occurrence of PG and ADHD is relatively frequent and seems to harm the prognosis for both disorders. Subsequent studies, using the same assessment instruments for childhood and adult ADHD, resulted in similarly high rates for lifetime or current ADHD in treatment-seeking problem gamblers (Fatseas et al., 2016) and students with excessive gambling behavior (Romo et al., 2015).

A recent meta-analysis, which explored the relationships between problem gambling and ADHD and included 24 studies, concluded that there is a significant correlation between symptoms of ADHD and problem gambling, with a weighted mean effect of r = .17 (Theule, Hurl, Cheung, Ward, & Henrikson, 2016). The mean prevalence rate of ADHD in individuals with problem gambling was reported with 18.5%. Existing studies support the existence of a relationship between PG and ADHD, although some controversy persists. For example, Davtian, Reid, and Fong (2012) revealed that the level of impulsivity, although high among pathological gamblers, did not differ between those with and without ADHD. Moreover, questions are raised pertaining to the influence of gender, which has not been studied sufficiently in both disorders, PG and ADHD. Both ADHD and PG are less prevalent among women compared with men (e.g., Fayyad et al., 2007; Petry, Stinson, & Grant, 2005), and the few existing studies on the prevalence of ADHD in PG populations focus either solely on male samples (Carlton et al., 1987; Rugle & Melamed, 1993) or did not include gender as a variable in their analysis (Breyer et al., 2009; Grall-Bronnec et al., 2011).

In addition, there is a large variability in prevalence of each ADHD and PG across cultures and countries. Most of the variability in ADHD prevalence estimates is explained by differing methodological procedures (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014). Besides differences in survey methods, rates of PG may also differ as a result of variability in the availability and accessibility of gambling opportunities. However, it has been shown that in some cases national prevalence rates are stable over time, despite an increase in gambling opportunities (Hodgins, Stea, & Grant, 2011). Considering that the majority of studies concerned with the relationship between ADHD and PG

have been conducted in North America (Theule et al., 2016), continued research in other countries is necessary to capture a more complete picture of this association.

Due to the lack of recognition and understanding of ADHD—especially adult ADHD—many patients are misdiagnosed and do not receive adequate treatment (Kooij et al., 2010), despite the existence of effective treatment options (Adler, 2008). Pharmacological treatment with stimulants has been recommended as the first-line treatment of ADHD (National Institute for Health and Care Excellence [NICE], 2008). It has been argued though that stimulant medications may not be recommended when there is a history of addiction, due to the risk of diversion and misuse of pharmaceutics. Evidence of the potential of abuse of pharmaceutical stimulants demonstrated that these drugs (particularly when injected or in immediate-release form) produce subjective and reinforcing effects, similar to that of illicit psychostimulants (Kaye & Darke, 2012). However, it has also been shown that higher stimulant doses are associated with long-term treatment adherence, one of the most consistent factors associated with a favorable addiction treatment outcome, in individuals with ADHD and SUD (Skoglund et al., 2016).

It was the overall objective of the present study to explore (a) retrospective childhood ADHD as well as adult ADHD symptomatology in participants seeking treatment for problem gambling, using state-of-the-art, standardized instruments for the assessment of ADHD; (b) the relationship between ADHD and problem gambling severity; (c) factors associated with a history of ADHD; (d) gender differences, and (e) prescription rates and potential misuse of ADHD medication to scientifically challenge concerns about the prescription of stimulant medication to patients with addictive disorders.

Method

Sample and Procedure

In this cross-sectional study, participants were evaluated by means of a structured and standardized interview. The inclusion and exclusion criteria for participants as well as the measures for problem gambling and ADHD were chosen to assure the comparability of results to prior studies (especially Grall-Bronnec et al., 2011). Cooperations were arranged for the assignment of patients for potential study participation during the course of the research (June 2013-January 2015) with five gambling-treatment institutions in Vienna and bordering provinces.

Participants were recruited using posters and flyers with brief information on the study, which were placed in waiting rooms of the collaborating institutions. In addition, the staff was informed in detail about the study and encouraged to actively bring it to the patients' attention. Participation in the study was completely voluntary and anonymous. To participate in the study, participants had to be between 18 and 65 years of age, meet at least three *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; APA, 2000) criteria for PG (*DSM-IV-TR* Axis I: 312.31), seek treatment (psychosocial and/or medical) for gambling-related problems, have sufficient German language skills, and sign written informed consent. Participants had to be excluded from the study for any of the following reasons: Acute intoxication, acute psychotic episode, cognitive impairment (insufficient spatial or temporal orientation, and/or the inability to understand or to repeat/recall the study information). Exclusion criteria were assessed verbally, prior to the interview, by a clinical psychologist. Notably, as all participants included in the current study met at least three *DSM-IV-TR* criteria for PG, the sample as a whole is referred to as "problem gamblers" throughout this article.

A total of 80 participants (20% female), aged 21 to 70 years (M = 43.1, SD = 12.4), took part in this study. The required sample size was calculated with G*Power 3 (Faul, Erdfelder, Buchner, & Lang, 2009) to detect effects of medium size or above of ADHD on the studied variables, $\alpha = .05$ and $\beta = .80$. None of the patients who agreed to participate had to be excluded from the study. Two thirds of the sample were single or divorced, and more than half of participants were unemployed (58.8%) at the time of the study. The majority of participants reported vocational training as their highest educational attainment (57.5%), 15% had completed compulsory education, 15% secondary education, and 8.8% had obtained a university degree (see Table 1).

The standardized and structured interview was completed in a single session (approximately 90 min; without breaks to keep study conditions as equal as possible for all participants); this was conducted by a clinical psychologist trained in scientific interviewing techniques. Participants were compensated for the time spent for the study with a voucher of €20. As the study screened for ADHD and other psychiatric comorbidities, patients who screened positive for any comorbidity were offered further diagnostic and treatment options.

Measures

All assessment instruments were selected to enable comparisons with existing studies, especially the study by Grall-Bronnec et al. (2011), and to be as brief as possible while still adequately assessing the studied variables.

Problem gambling. The 10 *DSM-IV diagnostic criteria for PG* were gathered through a structured interview, and used to divide gamblers into three groups: "at-risk gamblers" (three to four criteria), "pathological gamblers" (five to

Table 1. Sociodemographic Characteristics of the Sample by Gender and ADHD Group.

	Total $N = 80$	Male $n = 64$	Female $n = 16$	p_{gender}	No history of ADHD[a] $n = 46$	Childhood ADHD[b] $n = 25$	Adult ADHD[c] $n = 9$	$p_{ADHDgroup}$
Age, *M* (*SD*)	43.1 (12.4)	42.2 (12.4)	46.8 (12.1)	.193	44.0 (12.9)	43.0 (10.9)	38.7 (14.2)	.503
Marital status, *n* (%)				.772				.031*
Single/divorced	53 (66.3)	43 (67.2)	10 (62.6)		25 (54.3)	21 (84.0)	7 (77.8)	
In a relationship/married	27 (33.8)	21 (32.8)	6 (37.5)		21 (45.7)	4 (16.0)	2 (22.2)	
Employment status, *n* (%)				.409				.404
Employed	33 (41.3)	28 (43.8)	5 (31.3)		19 (41.3)	12 (48.0)	2 (22.2)	
Unemployed	47 (58.8)	36 (56.3)	11 (68.8)		27 (58.7)	13 (52.0)	7 (77.8)	
Highest educational attainment, *n* (%)				.372				.866
Compulsory education	15 (18.8)	12 (18.8)	3 (18.8)		7 (15.2)	5 (20.0)	3 (33.3)	
Secondary education	12 (15.0)	9 (14.1)	3 (18.8)		7 (15.2)	4 (16.0)	1 (11.1)	
Vocational training	46 (57.5)	39 (60.9)	7 (43.8)		27 (58.7)	14 (56.0)	5 (55.6)	
University degree	7 (8.8)	4 (6.3)	3 (18.8)		5 (10.9)	2 (8.0)	0 (0)	
ADHD group classification, *n* (%)								
No history of ADHD[a]	46 (57.5)	37 (57.8)	9 (56.3)	.910	—	—	—	—
ADHD only in childhood[b]	25 (31.3)	20 (31.3)	5 (31.3)	.412	—	—	—	—
ADHD persistent in adulthood[c]	9 (11.3)	7 (10.9)	2 (12.5)	.324	—	—	—	—

Note. WURS-k = Wender Utah Rating Scale–*deutsche Kurzform*.
[a]WURS-k score < 30.
[b]WURS-k score ≥ 30 *and* three or less marks in the darkly shaded boxes within Part A of the ASRS-v1.1 (see www.hcp.med.harvard.edu/ncs/ftpdir/adhd/18Q_German_final.pdf).
[c]WURS-k score ≥ 30 *and* four or more marks in the darkly shaded boxes within Part A of the ASRS-v1.1.
*$p < .05$.

seven criteria), and "severe pathological gamblers" (eight to 10 criteria; following Grall-Bronnec et al., 2011). The Gambling Attitudes and Beliefs Survey (GABS) is a 34-item self-rated questionnaire for measuring a wide range of cognitive biases, irrational beliefs, and positively valued attitudes toward gambling on a 4-point Likert-type scale ("strongly agree" to "strongly disagree"; Breen & Zuckerman, 1999). Higher scores indicate higher levels of irrational beliefs and attitudes toward gambling (range = 35-140). The survey was translated into German in a back-and-forth English–German translation by the research team because there was no German translation available. This instrument was used to ensure comparability of the results of the present study with those of recent research on the prevalence of ADHD in PG patients (Grall-Bronnec et al., 2011). Furthermore, favorite type of game, gambling frequency during the last month (occasions and duration in hours per occasion), gambling history (age at first gambling experience, duration of problem gambling), as well as treatment history ("How many times did you seek professional help for your gambling problems?") were assessed and analyzed descriptively.

Adult ADHD. The Adult ADHD Self-Report Scale (ASRS-v1.1) is an 18-item self-report inventory based on *DSM-IV-TR* criteria, rating ADHD symptoms using a 5-point Likert-type severity scale from 0 (*never*) to 4 (*very often*) (World Health Organization, 2003). According to the ASRS-v1.1 Symptom Checklist instructions, if four or more marks appear in the darkly shaded boxes within Part A (see www.hcp.med.harvard.edu/ncs/ftpdir/adhd/18Q_German_final.pdf), the participant has symptoms highly consistent with ADHD. The short version of the scale, consisting of six items (Part A of the long version), was found to be the most predictive of symptoms consistent with ADHD with a sensitivity of 68.7% and a specificity of 99.5% in the general population. The validity of the short version is reported as acceptable among SUD patients with a sensitivity of 87.5% and a negative predictive value of 95.7% (Kessler et al., 2005; Pérez & García, 2007). This version was used to identify patients with ADHD persistent in adulthood in the current investigation. Using the 18-item version of the ASRS-v1.1 (Part A and Part B), it is possible to evaluate whether patients with ADHD persistent in adulthood present primarily with attention deficit, hyperactivity/impulsivity, or combined type symptoms of ADHD. For this ASRS version, a cutoff score of greater than 21 in Part A or Part B, or Part A *and* Part B for the combined type was proposed, given it is associated with a high rate of classification accuracy (94.5%; Kessler et al., 2005). This version of the scale was used to specify the ADHD subtype in the current investigation.

Childhood ADHD. The Wender Utah Rating Scale–*deutsche Kurzform* (WURS-k) is a widespread standardized instrument for retrospective assessment of childhood ADHD in adults (Retz-Junginger et al., 2002). The scale is highly sensitive for childhood ADHD. Retz-Junginger et al. (2002) analyzed the German version in a sample of 703 adult participants. The retest reliability of the short version can be considered high (r = .9). A score of ≥30 is indicative of childhood ADHD (Retz-Junginger et al., 2003). If the symptoms do not persist into adulthood, ADHD in partial remission should be diagnosed.

Psychiatric comorbidities. Psychiatric comorbidities were assessed using the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). The MINI was designed as a brief structured interview for the major Axis I psychiatric disorders in *DSM-IV* and ICD-10, including mood disorders, anxiety disorders, addictive disorders, psychotic disorders, eating disorders, and antisocial personality disorder (ASPD). The validity and reliability of the MINI are similar to the Structured Clinical Interview for DSM Disorders (SCID) and the Composite International Diagnostic Interview (CIDI). No comprehensive screening of Cluster B personality disorders (other than ASPD) was conducted in the present investigation to keep interviews reasonably brief.

ADHD medication. Prescription, misuse, and diversion of ADHD medication in problem gamblers with or without ADHD were assessed with a standardized questionnaire.

Statistical Analysis

Statistical analysis was conducted using SPSS 20.0 for Mac OS X. Prior to data analysis, statistical assumptions were tested, and reliability statistics (Cronbach's α) for ASRS-v1.1 and WURS-k were calculated. Both questionnaires had relatively high internal consistency (ASRS-v1.1: α = .84; WURS-k: α = .83). Sociodemographic characteristics, gambling characteristics, prevalence of ADHD, and comorbid psychiatric disorders, as well as use of ADHD medication, were presented using appropriate descriptive methods (number, mean, and standard deviation for continuous data; number and percentage for categorical data).

Correlational analyses were conducted with Pearson correlations. Between-groups analyses were conducted with independent t tests (chi-square tests for categorical data) and ANOVA. For ANOVA, Welch's test was reported if the assumption of homogeneity of variances was not met. Confounders were controlled for using ANCOVA. Following a significant ANOVA, simple contrasts for pairwise comparisons were used.

To determine the predictors for the likelihood of having a history of ADHD, binomial logistic regression was used. The ability of the model to correctly classify those with and without a history of ADHD was evaluated using the area under the receiver operator characteristic (ROC) curve. An area of .90 to 1 represents excellent accuracy of the model, .80 to .90 good accuracy, .70 to .80 fair accuracy, and .60 to .70 poor accuracy. Following the logistic regression analysis, tolerance as well as the variance inflation factor (VIF) collinearity diagnostics were used to assess the extent to which predictor variables were interrelated (multicollinearity). A tolerance value less than .1 and a VIF value greater than 10 were taken as indicators for a collinearity problem.

For analytic purposes, alpha was set to $p < .05$, and p values between .05 and .15 were interpreted as statistical trends. Effect sizes were reported for significant results; for ANOVA and ANCOVA, effect sizes of $\eta^2 \geq 0.02$ signified small, $\eta^2 \geq 0.06$ medium, and $\eta^2 \geq 0.14$ large effects. For pairwise contrasts, effect sizes (Cohen's d) of $d \geq 0.20$ signified small, $d \geq 0.50$ medium, and $d \geq 0.80$ large effects.

Results

ADHD and Sociodemographic Characteristics

Thirty-four patients (42.5% of the sample) screened positive in the retrospective assessment of childhood ADHD (i.e., exceeded the cutoff for WURS-k). ADHD persisted in adulthood in nine patients (11.3% of the sample); that is, these participants exceeded the cutoff for childhood ADHD (WURS-k) *and* adult ADHD (ASRS-v1.1). Based on WURS-k and ASRS-v1.1 scores, it was possible to classify participants into three ADHD groups (see Table 1). Notably, 13 participants (16.3% of the sample) exceeded the cutoff score for adult ADHD (ASRS-v1.1) but not for childhood ADHD (WURS-k). However, these individuals were classified within the "no history of ADHD" group, because the presence of ADHD symptoms during childhood is a prerequisite for the determination of adult ADHD (Kooij et al., 2010). Reviewing sociodemographic characteristics, a significant difference between the three groups was observed in relation to marital status (Table 1). Participants with a history of ADHD (i.e., childhood ADHD or ADHD persistent in adulthood) were less likely to be in a relationship or married, compared with participants without a history of ADHD, $\chi^2(1) = 6.85$, $p = .009$, $d = 0.61$.

Comparing women and men on ADHD symptomatology, no significant differences in the mean scores or in the percentage of participants that exceeded the cutoff score for WURS-k (p = .910) and ASRS-v1.1 (p = .104) were observed (results not shown). In addition, there was no significant gender difference in terms of ADHD group classification (see Table 1).

According to the 18-item ASRS-v1.1, 11 patients (13.8% of the sample) exceeded the cutoff score for ADHD persistent in adulthood. Of those, three participants showed a

Table 2. Gambling Characteristics by Gender and ADHD Group.

	Total $N = 80$	Male $n = 64$	Female $n = 16$	p_{gender}	No history of ADHD[a] $n = 46$	Childhood ADHD[b] $n = 25$	Adult ADHD[c] $n = 9$	$p_{ADHDgroup}$
Severity of gambling (dimensional approach; *DSM-IV* score), *M* (*SD*)	7.5 (1.6)	7.6 (1.6)	7.1 (1.7)	.304	7.2 (1.6)	7.8 (1.8)	8.1 (0.6)	.031*
Severity of gambling-related cognitions (GABS score), *M* (*SD*)	88.8 (13.9)	88.1 (14.1)	91.3 (13.1)	.425	87.5 (14.0)	90.2 (14.5)	91.2 (12.3)	.631
Favorite type of game, *n* (%)				.074				.196
Nonstrategic games[d]	69 (86.3)	53 (82.2)	16 (100.0)		42 (91.3)	19 (76.0)	8 (88.9)	
Strategic games[e]	11 (13.7)	11 (17.2)	0 (0)		4 (8.7)	6 (24.0)	1 (11.1)	
Gambling frequency in the past month, *M* (*SD*)								
Occasions	3.0 (6.1)	2.8 (5.7)	4.2 (7.5)	.398	3.3 (7.2)	2.6 (4.5)	2.7 (3.2)	.887
Duration in hours per occasion	1.4 (2.5)	1.4 (2.5)	1.3 (2.8)	.947	1.5 (2.8)	1.2 (2.2)	1.2 (2.0)	.870
Gambling history								
Years since first gambling experience, *M* (*SD*)	15.9 (12.0)	17.7 (12.3)	8.6 (7.1)	<.001***	16.2 (12.3)	17.5 (12.7)	9.7 (6.0)	.028*
Years of problem gambling, *M* (*SD*)	7.7 (7.4)	8.3 (8.0)	5.2 (3.3)	.019*	7.0 (6.7)	10.0 (9.1)	4.5 (6.1)	.006**
Years from first gambling experience to developing gambling problem, *M* (*SD*)	8.2 (10.7)	9.4 (11.4)	3.5 (5.2)	.003**	9.2 (11.2)	7.5 (10.8)	5.2 (6.6)	.546
How many times did you seek professional help for your gambling problems? *M* (*SD*)	1.9 (1.1)	1.9 (1.0)	1.9 (1.2)	.958	1.8 (0.9)	2.2 (1.3)	1.7 (1.0)	.199

Note. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders (4th ed.; American Psychiatric Association, 1994); GABS = Gambling Attitudes and Beliefs Survey; WURS-k = Wender Utah Rating Scale–*deutsche Kurzform*.

[a]WURS-k score < 30.

[b]WURS-k score ≥ 30 *and* three or less marks in the darkly shaded boxes within Part A of the ASRS-v1.1 (see www.hcp.med.harvard.edu/ncs/ftpdir/adhd/18Q_German_final.pdf).

[c]WURS-k score ≥ 30 *and* four or more marks in the darkly shaded boxes within Part A of the ASRS-v1.1.

[d]Lottery games, slot machines, scratch cards, roulette, bingo.

[e]Sports or horse-racing bets, black jack, poker.

*$p < .05$. **$p < .01$. ***$p < .001$

predominant symptom pattern consistent with the inattentive ADHD type, four were classified as having the hyperactive-impulsive type, and four had combined type symptoms. Notably, the cutoff score for the 18-item ASRS version differs from the cutoff for the six-item version used to identify patients with ADHD persistent in adulthood in Table 1; thus, the number of participants with ADHD persistent in adulthood differs from the results reported above.

Three patients reported lifetime use of ADHD medication. In all three cases, the medication (in all cases Ritalin®) had been prescribed. Two of these patients were classified within the "ADHD in childhood only" group and one patient presented with "ADHD persistent in adulthood" in the current investigation. Thus, of all participants identified as having a "history of ADHD" in the present study ($n = 34$), only 8.6% had received medication in the past, and none of the patients were *currently* receiving pharmacological treatment for ADHD. One patient reported oral misuse of the medication in combination with alcohol on five occasions (lifetime).

Gambling History and the Relationship Between ADHD and PG

The majority of patients were classified as severe pathological gamblers (56.3% met ≥8, 36.3% met 5-7, and 7.5% met 3-4 *DSM-IV* PG criteria), with a mean *DSM-IV* PG score of 7.5/10 (Table 2). The level of gambling-related cognitions was relatively high, with a mean GABS score of 88.8/140. Most participants were "off-line" gamblers (91.2%; results not shown), with a preference for nonstrategic games (Table 2). The vast majority of gamblers engaged in slot machine gambling (76.2%).

Age correlated significantly with years since first gambling experience, $r = .55$, $p < .001$, with problem gambling years, $r = .25$, $p = .025$, and with years from first gambling

experience to developing gambling problem, $r = .44$, $p < .001$. Therefore, age was included as a confounder in further analyses of these variables.

Evidencing difference based on gender, men had a significantly longer gambling history; that is, they had a higher number of years since first gambling experience ($M = 17.71$, $SE = 1.54$) compared with women ($M = 8.60$, $SE = 1.77$), $F(2, 77) = 21.23$, $p < .001$, $\eta^2 = 0.15$. In addition, men had a higher number of problem gambling years ($M = 8.28$, $SE = 0.99$) compared with women ($M = 5.15$, $SE = 0.83$), with a trend toward significance after controlling for age, $F(2, 77) = 3.82$, $p = .054$, $\eta^2 = 0.04$. However, women progressed much faster from their first gambling experience to the development of gambling problems; that is, the time frame (in years) between first gambling experience and first gambling problems was significantly shorter for women ($M = 3.45$, $SE = 1.29$) compared with men ($M = 9.43$, $SE = 1.42$), $F(2, 77) = 9.20$, $p = .003$, $\eta^2 = 0.09$. With regard to the favorite type of game, the majority of men (82.2%) and all female gamblers preferred nonstrategic games, resulting in a difference with a trend toward significance, $\chi^2(1) = 3.19$, $p = .074$, $d = 0.41$ (see Table 2).

To analyze the relationship between ADHD and problem gambling, the sample was again subdivided into three ADHD groups (no history of ADHD, ADHD only in childhood, and ADHD persistent in adulthood; see Table 2). There was a significant difference between ADHD groups in relation to gambling severity. ANOVA of the number of *DSM-IV* criteria for PG as dependent and ADHD group as independent variable revealed a small overall effect of ADHD on gambling severity, $F(2, 37.8) = 3.80$, $p = .031$, $\eta^2 = 0.04$, with a difference of large effect size between patients with no history of ADHD ($M = 7.24$, $SE = 0.24$) and those with ADHD persistent in adulthood ($M = 8.11$, $SE = 0.20$), $t(35) = -2.78$, $p = .009$, $d = 1.03$.

Moreover, there was a significant difference in years since first gambling experience and number of problem gambling years between the groups (Table 2). However, using years since first gambling experience as dependent and ADHD group as independent variable, ANCOVA revealed that there was no significant effect of ADHD on years of gambling after controlling for age, $F(3, 76) = 0.25$, $p = .779$. In addition, ANCOVA of the number of problem gambling years as dependent and ADHD group as independent variable revealed that the effect of ADHD on years of problem gambling lost its significance after controlling for age, $F(3, 76) = 2.25$, $p = .113$.

Psychiatric Comorbidities Other Than ADHD

Overall, 71.3% of the sample screened positive for at least one psychiatric comorbidity (current or past) according to the MINI. Of those patients with a co-occurring psychiatric disorder, 13 (16.3%) screened positive for one, 15 (18.8%) for two, and 28 (35.0%) for three or more comorbidities.

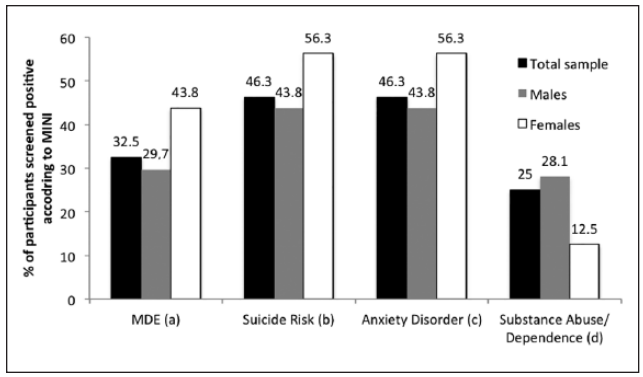

Figure 1. Current psychiatric comorbidities of the total sample ($N = 80$) and by gender (males: $n = 64$; females: $n = 16$).
Note. (a) Past 2 weeks; (b) past month; (c) generalized anxiety disorder, panic disorder, agoraphobia, social phobia, obsessive–compulsive disorder or posttraumatic stress disorder in the past month; (d) past 12 month. MINI = Mini International Neuropsychiatric Interview; MDE = major depressive episode.

Figure 1 depicts the most prevalent *current* psychiatric comorbidities of the sample. The current suicide risk of the sample was high, with 23.8% of patients being at low risk of suicide, 12.5% at medium, and 11.3% at high risk. Apart from comorbidities included in Figure 1, one female participant screened positive for a current eating disorder and one for a current manic episode, and five male participants screened positive for lifetime ASPD.

To analyze the relationship between ADHD and psychiatric comorbidities, the sample was again subdivided into three ADHD groups (no history of ADHD, ADHD only in childhood, and ADHD persistent in adulthood). ANOVA of the number of psychiatric comorbidities as dependent variable and ADHD group as independent variable revealed a large overall effect of ADHD on psychiatric comorbidity, $F(2, 76) = 11.75$, $p < .001$, $\eta^2 = 0.24$, with a difference of medium to large effect size between patients with no history of ADHD ($M = 1.29$, $SE = 0.25$) and those with childhood ADHD ($M = 2.52$, $SE = 0.29$), $t(76) = -3.15$, $p = .002$, $d = 0.79$; a difference of very large effect size between patients with no history of ADHD and those with ADHD persistent in adulthood ($M = 3.78$, $SE = 0.43$), $t(76) = -4.35$, $p < .001$, $d = 1.62$; and a difference of large effect size between patients with childhood ADHD and those with ADHD persistent in adulthood, $t(76) = -2.06$, $p = .043$, $d = 0.82$.

Factors Associated With a History of ADHD

A logistic regression was performed to ascertain the effects of specific comorbidities (anxiety disorders, mood disorders, substance abuse/dependence) and gambling severity (number of *DSM-IV* PG criteria) on the likelihood of having a history of ADHD. For this purpose, participants in the subgroups "ADHD only in childhood" ($n = 25$) and "ADHD persistent

Table 3. Binomial Logistic Regression Analysis (Final Model) Showing Factors Associated With a "History of ADHD" (N = 80).

Variables	*B* (*SE*)	OR	95% CI	*p*
Substance Abuse/Dependence	1.40 (0.63)	4.07	[1.20, 13.85]	.025*
Mood Disorders	1.27 (0.65)	3.56	[0.99, 12.73]	.051°
Anxiety Disorders	1.12 (0.58)	3.07	[0.99, 9.54]	.053°
Gambling Severity[a]	0.39 (0.20)	1.04	[0.71, 1.53]	.842

Note. r^2 = .26 (Cox & Snell), .35 (Nagelkerke). Model $\chi^2(4) = 23.45$, $p \leq .001$. OR = odds ratio; CI = confidence interval; *DSM-IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994); PG = pathological gambling.
[a]Number of *DSM-IV* PG criteria.
*$p < .05$. °$p < .10$.

in adulthood" (n = 9) were combined together into a single group of participants considered as having a "history of ADHD" (n = 34). The logistic regression model was statistically significant, $\chi^2(4) = 23.45$, $p < .001$ (see Table 3). The model explained 35% (Nagelkerke R^2) of the variance in ADHD history and correctly classified 71% of cases.

Substance abuse/dependence was identified as a significant predictor for a history of ADHD (p = .025). Patients presenting with substance abuse or dependence were 4.07 times more likely to have a history of ADHD, compared with those who did not show these comorbidities. Participants with a mood disorder were 3.56 times more likely and those with an anxiety disorder were 3.07 times more likely to have a history of ADHD, with both disorders showing a trend toward significance for being predictors for a history of ADHD (see Table 3). Gambling severity was not a significant predictor for a history of ADHD (see Table 3).

The Hosmer–Lemeshow goodness-of-fit test demonstrated that the final model was not optimally calibrated with p = .029. However, the area under the ROC curve was .78 (95% confidence interval [CI] = [0.68, 0.89]; $p < .001$), indicating that the model discriminated fairly well between patients who had a history of ADHD and those who did not. Following logistic regression analysis, tolerance statistics as well as the VIF collinearity diagnostics were used to test for multicollinearity. Both statistics indicated that collinearity was not a problem for this model (the tolerance value was >.7 and the VIF < 1.5 for all predictors). Thus, the results of the individual predictors were most likely valid, and the model was accurate.

Discussion

The main findings of this cross-sectional study support prior results in that the prevalence of ADHD among problem gamblers is high and that comorbid ADHD is associated with more severe gambling problems. More than 40% of treatment-seeking problem gamblers had either ADHD in partial remission or ADHD persistent in adulthood. The prevalence of childhood (31%) and adult ADHD (11%) was considerably higher among problem gamblers in the present study, compared with estimates in the general population, reported with 3% to 7% in children and 2% to 5% in adults (Fatseas et al., 2012; Kooij et al., 2010; Retz-Junginger et al., 2002). Moreover, the prevalence of ADHD in the current sample fell well within the ADHD prevalence range among populations seeking treatment for addictive disorders, in particular patients with SUDs (van Emmerik-van Oortmerssen et al., 2012). In addition, the results in relation to the prevalence of *adult* ADHD are in line with the rare studies that investigated the association between childhood *and* adult ADHD and PG in treatment-seeking gamblers, reporting a prevalence of 11% (Grall-Bronnec et al., 2012) and 9% (Fatseas et al., 2016), respectively, for ADHD persistent in adulthood. Three recent studies reported a considerably higher rate of adult ADHD (assessed with the ASRS) among problem gamblers, with 25% (Waluk, Youssef, & Dowling, 2015), 23% (Aymami et al., 2015), and 21% (Chamberlain, Derbyshire, Leppink, & Grant, 2015), respectively. However, these rates may be overestimated, because the studies failed to include a measure for childhood ADHD, and ADHD symptoms during childhood are a prerequisite for the determination of ADHD persistent in adulthood (Kooij et al., 2010). Notably, within the current investigation, 13 participants exceeded the cutoff for adult ADHD, but not for childhood ADHD. Although these individuals were classified within the "no history of ADHD" group, this result supports previous findings with reference to high impulsivity levels among pathological gamblers (e.g., Brevers et al., 2012).

With more than 30%, the percentage of patients with childhood ADHD only (symptoms did not persist into adulthood; that is, ADHD was in partial remission) was considerably higher in the present investigation, compared with results reported by Grall-Bronnec et al. (2011) with 16% and Fatseas et al. (2016) with 11.5%. Notably, the authors of those studies used a different cutoff for the WURS-k and considered a score of ≥46/100 sufficient for making a diagnosis of childhood ADHD. This cutoff score was rejected for the current investigation for the following reasons: (a) The authors of the WURS-k suggest a cutoff score of ≥30 as indicative of childhood ADHD (Retz-Junginger et al., 2003); and (b) the total maximum WURS-k score for the

current investigation was 84, as the four control questions of the questionnaire were not included in the overall score, but scored separately as suggested by the authors of the scale (Retz-Junginger et al., 2002). Using a higher cutoff, which has not been validated, might have led to an underestimation of childhood ADHD in these studies. This view is supported by the results of a recent study conducted by the authors of the WURS-k (Retz, Ringling, Retz-Junginger, Vogelgesang, & Rösler, 2016). They found that 29% of treatment-seeking patients with GD had a WURS-k score of ≥30 points (indicating a full ADHD syndrome in childhood), which is in keeping with the findings of the present investigation.

The participants of the current study showed a very high problem gambling severity, which exceeded that reported in previous studies of treatment-seeking gamblers (e.g., Grall-Bronnec et al., 2011). ADHD had an effect on problem gambling severity; specifically, patients with ADHD persistent in adulthood showed a significantly higher gambling problem severity, compared with those with no history of ADHD. This is in line with previous studies investigating problem gamblers (Aymami et al., 2015; Fatseas et al., 2016; Grall-Bronnec et al., 2011; Waluk et al., 2015) and has also been demonstrated in patients with SUDs in terms of a greater addiction severity in participants with comorbid ADHD (Carpentier et al., 2011; Vogel et al., 2016). Given the relatively high mean age (43 years) of the present sample in combination with the large effect of ADHD on gambling severity, our results support the finding by Theule et al. (2016); an older age of problem gamblers is linked to a stronger relationship between symptoms of ADHD and gambling severity.

It has been suggested that impulsivity is not only a cardinal feature of both ADHD and PG, but the two disorders may also share the same form of impulsivity; that is, poor decision making (DeVito et al., 2009; Mowinckel, Pedersen, Eilertsen, & Biele, 2015). Deficits in decision making, such as repeated gambling despite considerable long-term harm, may be associated with the participants' inability to use available information to their advantage (DeVito et al., 2009). PG and ADHD share several neurocognitive abnormalities that may be summarized as impulsivity and are linked to decision making difficulties such as a lack of inhibition and disruptions in reward processing (Breyer et al., 2009; van Holst, van den Brink, Veltman, & Goudriaan, 2010). Consequently, if both PG *and* ADHD are present, these neurocognitive abnormalities are likely to become more severe. This may in part explain differences in problem gambling severity between participants with and without ADHD persistent in adulthood.

The results of the present investigation confirm those of numerous previous studies with reference to the high rate of psychiatric comorbidities among pathological gamblers (e.g., Dowling et al., 2015), a fortiori when they are undergoing treatment, as seeking treatment may be motivated by co-occurring psychiatric symptoms/disorders rather than PG itself (Kessler et al., 2008). ADHD had a large overall effect on psychiatric comorbidity; that is, patients with ADHD in childhood had a higher number of comorbidities than patients with no history of ADHD, whereas patients with ADHD persistent in adulthood had the highest psychiatric burden of all participants. These results suggest that ADHD–PG comorbidity may be associated with cumulative risk factors for co-occurring psychiatric disorders. Moreover, an effect of specific comorbidities (anxiety disorders, mood disorders, substance abuse/dependence) on the likelihood of having a history of ADHD was revealed. These results are in line with prior studies, demonstrating that substance use, anxiety, and mood disorders represent risk factors for having a history of ADHD (Fatseas et al., 2016; Grall-Bronnec et al., 2011; Kessler et al., 2006). Impulsivity as a common characteristic of PG, ADHD, SUDs, and mood disorders may serve as an explanation for the clinical pattern observed in the current investigation (Grall-Bronnec et al., 2012). Therefore, a detailed analysis of impulsivity in addition to adequate diagnosis of ADHD and other psychiatric comorbidities in pathological gamblers likely has a clinical, prognostic, and therapeutic advantage, and may allow for better matching of the treatment approach with individual patient needs.

Several studies have also reported a considerably increased risk of suicidal ideation, suicide attempts, and suicide among pathological gamblers (e.g., Thon et al., 2014). Adding to these results, more than 46% of the patients in the present sample were currently at risk of suicide. More recent studies indicate a strong linkage of suicide risk and Cluster B personality disorders among pathological gamblers, which should be considered in future studies (Bischof et al., 2015).

Interestingly, no differences between male and female patients were observed with regard to childhood or adult ADHD prevalence. Although the transnational prevalence of adult ADHD is estimated with 4.1% in men and 2.7% in women (Fayyad et al., 2007), gender differences in symptom expression, prevalence, and diagnostic rates of ADHD seem to decrease with age (Biederman, Faraone, Monuteaux, Bober, & Cadogen, 2004). Although no previous study specifically investigated gender differences in relation to ADHD in problem gamblers, a recent meta-analysis found that gender did not moderate the relationship between symptoms of ADHD and gambling severity (Theule et al., 2016). In addition, a meta-analysis of studies estimating the prevalence of ADHD in SUD patients found no effect of gender on ADHD prevalence (van Emmerik-van Oortmerssen et al., 2012). This leads to the conclusion that ADHD and SUD might represent the outcome of a final common pathway with an overlap in risk factors (e.g., genetic vulnerability) in both males and females. Due to the similarities between SUDs and PG, this may also serve as

an explanation for the lack of gender differences with regard to ADHD in the current investigation.

We did, however, find a difference between men and women pertaining to their gambling history. In accordance with the literature, women were significantly older when they had their first gambling experience (Potenza, Steinberg, McLaughlin, Wu, Rounsaville, & O'Malley, 2001). Although males had a significantly longer gambling history and a higher number of problem gambling years, there was clear evidence of a telescoping effect, that is, women progressed much faster from their first gambling experience to the development of gambling problems (Tavares, Zilberman, Beites, & Gentil, 2001).

Previous studies indicate a habitual underdiagnosis of ADHD, with an estimated 75% of cases never diagnosed (Goodman & Thase, 2009) and only 11% of affected individuals ever receiving adequate treatment (Barkley & Brown, 2008). The present results highlight the potential underestimation of ADHD and the lack of adequate treatment in problem gamblers. Of all participants identified as having a "history of ADHD," less than 9% have ever received medication, and none of the patients were *currently* receiving pharmacological treatment for ADHD. Only one patient reported misuse (oral) of the medication, in combination with alcohol. Although this result should not lead to the derivation of any conclusion with reference to the prevalence of misuse of ADHD medication in problem gamblers, the overall low pharmacological treatment rate highlights the lack of recognition, adequate assessment, and treatment of adult ADHD in this high-risk population.

As high levels of impulsivity are an inherent feature of addictive disorders, it is possible that impulsivity in problem and pathological gamblers is frequently attributed to the addictive disorder alone, without considering the possibility of comorbid ADHD (Grall-Bronnec et al., 2012). However, the results of the current investigation confirm that ADHD is a psychiatric disorder, which is frequently associated with problem gambling and PG. Given that the present investigation is one of the rare studies that investigate this association, it is of particular interest for clinicians treating PG patients, and should encourage them to include assessments of childhood ADHD in their diagnosis and verify persistence in adulthood. The potential shortcoming of current treatment approaches to adequately assess and treat psychiatric comorbidities was highlighted by the alarmingly high psychiatric burden and especially the high rates of suicidal ideation in patients *already undergoing treatment*. This is an important area of improvement, because effective management of underlying psychiatric disorders is crucial for a stabilization of PG and increasing treatment retention rates (Dowling, Merkouris, & Lorains, 2016). Paying increased attention to psychiatric comorbidities, especially comorbid SUDs, but also mood and anxiety disorders, as potential risk factors for having a history of ADHD may also help to identify and verify comorbid ADHD at an earlier stage, which is extremely relevant due to the absence of a universally accepted standard method for clinical validation of adult ADHD (Kessler et al., 2006). Moreover, the present results add to previous findings concerned with gender differences in the experience of gambling and related problems. The telescoped PG trajectory in women highlights the importance of dismantling treatment barriers for female gamblers to include them in treatment systems at earlier stages (Zanki & Fischer, 2010).

Overall, the presented findings highlight the need for an improved recognition and management of ADHD, especially in high-risk groups such as problem gamblers, to treat in an efficient and cost-effective way. Following guidelines for adequate diagnosis and treatment, such as the U.K. National Institute for Health and Clinical Excellence guidelines (NICE, 2008) as a gold standard for Europe, will incur costs, but may also substantially reduce societal costs (e.g., due to productivity losses) and costs of special education and other services (e.g., the criminal justice system), and increase patients' overall health and quality of life.

Strengths and Limitations

The major strength of this study was the use of state-of-the-art, standardized, and validated instruments to assure accurate assessment of PG, ADHD, and psychiatric comorbidities. This selection also allowed replicating the results of the rare studies that investigated the association between childhood *and* adult ADHD and PG in treatment-seeking gamblers and to evaluate their robustness (Fatseas et al., 2016; Grall-Bronnec et al., 2011). Importantly, childhood and adult ADHD were assessed via screening instruments. These can only serve as pointers for the presence of ADHD and do not substitute the clinical diagnosis by an expert. Moreover, the self-reporting of retrospective childhood ADHD (WURS-k) may have reduced the validity of results. However, previous studies demonstrated that adults with ADHD are able to describe their childhood behavior adequately and detailed in retrospective assessments (Murphy & Schachar, 2000).

Monetary reimbursement of study participants has been shown to lead to a potential social desirability bias in some studies (e.g., Fry & Dwyer, 2001). To minimize this potential bias, the participants of the current study were informed prior to the interview, verbally and in writing, that they would receive the voucher irrespective of their answers, completion of the interview, and also in case they withdrew their consent for use of the collected data.

The cross-sectional design of this study needs to be considered as a limitation, which prevents establishing of any causal link between the variables. In addition, due to the sample size and the explorative nature of the investigation, significance thresholds were not corrected for multiple testing and are only to be taken as heuristic pointers/accumulated

test statistics for descriptive purposes, not as absolute statements about the relations found in the totality of the population from which the sample was drawn. However, the study population was clearly defined to reduce a selection bias, and demographically (including gender distribution, education, marital, and employment status), participants were very similar to data reported from other studies on treatment-seeking gamblers (e.g., Grall-Bronnec et al., 2011; Tavares et al., 2001; Zanki & Fischer, 2010). Moreover, despite the low rate of female participants in the present sample (20%), the proportion of female problem gamblers was still higher compared with prior studies (Carlton et al., 1987; Grall-Bronnec et al., 2011; Rodriguez-Jimenez et al., 2006; Rugle & Melamed, 1993). Thus, the current study may contribute to a better understanding of PG in females and encourage further research on gender differences in the experience of gambling and related problems.

Authors' Note

The Austrian National Bank had no role in the manuscript development, analysis or interpretation of results, nor with the writing of the manuscript or the decision to submit the paper for publication.

Ethical Aspects

The study protocol and all related documents provided to the participants (such as participant information used to obtain informed consent) were approved by the Institutional Review Board (IRB) of the Medical University of Vienna (IRB No. 1062/2013).

Declaration of Conflicting Interests

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References

Adler, L. (2008). Diagnosing and treating adult ADHD and comorbid conditions. *The Journal of Clinical Psychiatry*, *69*(11), e31.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

Aymami, N., Jimenez-Murcia, S., Granero, R., Ramos-Quiroga, J. A., Fernandez-Aranda, F., Claes, L., . . . Mechon, J. M. (2015). Clinical, psychopathological, and personality characteristics associated with ADHD among individuals seeking treatment for gambling disorder. *BioMed Research International, 2015*, Article 965303.

Barkley, R., & Brown, T. (2008). Unrecognized attention-deficit/hyperactivity disorder in adults presenting with other psychiatric disorders. *CNS Spectrums*, *13*, 977-984.

Biederman, J., Faraone, S., Monuteaux, M., Bober, M., & Cadogen, E. (2004). Gender effects on attention-deficit/hyperactivity disorder in adults, revisited. *Biological Psychiatry*, *55*, 692-700.

Bischof, A., Meyer, C., Bischof, G., John, U., Wurst, F. M., Thon, N., . . . Rumpf, H. J. (2015). Suicidal events among pathological gamblers: The role of comorbidity of Axis I and Axis II disorders. *Psychiatry Research*, *225*, 413-419.

Breen, R., & Zuckerman, M. (1999). Chasing in gambling behavior: Personality and cognitive determinants. *Personality and Individual Differences*, *27*, 1097-1111.

Brevers, D., Cleeremans, A., Verbruggen, F., Bechara, A., Kornreich, C., Verbanck, P., & Noel, X. (2012). Impulsive action but not impulsive choice determines problem gambling severity. *PLoS ONE*, *7*(11), e50647.

Breyer, J., Botzet, A., Winters, K., Stinchfield, R., August, G., & Realmuto, G. (2009). Young adult gambling behaviors and their relationship with the persistence of ADHD. *Journal of Gambling Studies*, *25*, 227-238.

Carlton, P., & Manowitz, P. (1992). Behavioral restraint and symptoms of attention deficit disorder in alcoholics and pathological gamblers. *Neuropsychobiology*, *25*, 44-48.

Carlton, P., Manowitz, P., McBride, H., Nora, R., Swartzburg, M., & Goldstein, L. (1987). Attention deficit disorder and pathological gambling. *Journal of Clinical Psychiatry*, *48*, 487-488.

Carpentier, P., van Gogh, M., Knapen, L., Buitelaar, J., & De Jong, C. (2011). Influence of attention deficit hyperactivity disorder and conduct disorder on opioid dependence severity and psychiatric comorbidity in chronic methadone-maintained patients. *European Addiction Research*, *17*, 10-20.

Chamberlain, S. R., Derbyshire, K., Leppink, E., & Grant, J. E. (2015). Impact of ADHD symptoms on clinical and cognitive aspects of problem gambling. *Comprehensive Psychiatry*, *57*, 51-57.

Davtian, M., Reid, R. C., & Fong, T. W. (2012). Investigating facets of personality in adult pathological gamblers with ADHD. *Neuropsychiatry*, *2*, 163-174.

DeVito, E., Blackwell, A., Clark, L., Kent, L., Dezsery, A., Turner, D., . . . Sahakian, B. J. (2009). Methylphenidate improves response inhibition but not reflection impulsivity in children with attention deficit hyperactivity disorder (ADHD). *Psychopharmacology*, *202*, 531-539.

Dowling, N. A., Cowlishaw, S., Jackson, A. C., Merkouris, S. S., Francis, K. L., & Christensen, D. R. (2015). Prevalence of psychiatric co-morbidity in treatment-seeking problem gamblers: A systematic review and meta-analysis. *Australian & New Zealand Journal of Psychiatry*, *49*, 519-539.

Dowling, N. A., Merkouris, S. S., & Lorains, F. K. (2016). Interventions for comorbid problem gambling and psychiatric disorders: Advancing a developing field of research. *Addictive Behaviors*, *58*, 21-30.

Fatseas, M., Alexandre, J. M., Vénisse, J. L., Romo, L., Valleur, M., Magalon, D., . . . Grall-Bonnec, M. (2016). Gambling

behaviors and psychopathology related to attention-deficit/hyperactivity disorder (ADHD) in problem and non-problem adult gamblers. *Psychiatry Research*, *239*, 232-238.

Fatseas, M., Debrabanta, R., & Auriacombe, M. (2012). The diagnostic accuracy of attention-deficit/hyperactivity disorder in adults with substance use disorders. *Addictive Disorders*, *25*, 219-225.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160.

Fayyad, J., De Graaf, R., Kessler, R., Alonso, J., Angermeyer, M., Demyttenaere, K., . . . Jin, R. (2007). Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *The British Journal of Psychiatry*, *190*, 402-409.

Fry, C., & Dwyer, R. (2001). For love or money? An exploratory study of why injecting drug users participate in research. *Addiction*, *96*, 1319-1325.

Goodman, D., & Thase, M. (2009). Recognizing ADHD in adults with comorbid mood disorders: Implications for identification and management. *Postgraduate Medicine*, *121*, 31-41.

Grall-Bronnec, M., Wainstein, L., Augy, J., Bouju, G., Feulliet, F., Venisse, J., & Sebille-Rivain, V. (2011). Attention deficit hyperactivity disorder among pathological and at-risk gamblers seeking treatment: A hidden disorder. *European Addiction Research*, *17*, 231-240.

Grall-Bronnec, M., Wainstein, L., Feuillet, F., Bouju, G., Rocher, B., Vénisse, J., & Sebille-Rivain, V. (2012). Clinical profiles as a function of level and type of impulsivity in a sample group of at-risk and pathological gamblers seeking treatment. *Journal of Gambling Studies*, *28*, 239-252.

Hodgins, D. C., Stea, J. N., & Grant, J. E. (2011). Gambling disorders. *The Lancet*, *378*, 1874-1884.

Kaye, S., & Darke, S. (2012). The diversion and misuse of pharmaceutical stimulants: What do we know and why should we care? *Addiction*, *107*, 467-477.

Kessler, R., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., . . . Walters, E. E. (2005). The World Health Organization Adult ADHD Self-Report Scale (ASRS): A short screening scale for use in the general population. *Psychological Medicine*, *35*, 245-256.

Kessler, R., Adler, L., Barkley, R., Biederman, J., Conners, C., Demler, O., . . . Zaslavsky, A. M. (2006). The prevalence and correlates of adult ADHD in the United States: Results from the National Comorbidity Survey Replication. *American Journal of Psychiatry*, *163*, 716-723.

Kessler, R., Hwang, I., LaBrie, R., Petukhova, M., Sampson, N., Winters, K., & Shaffer, H. J. (2008). DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychological Medicine*, *38*, 1351-1360.

Kooij, S., Bejerot, S., Blackwell, A., Caci, H., Casas-Brugué, M., Carpentier, P., . . . Asherson, P. (2010). European consensus statement on diagnosis and treatment of adult ADHD: The European Network Adult ADHD. *BMC Psychiatry*, *10*, Article 67.

Lara, C., Fayyad, J., de Graaf, R., Kessler, R., Aguilar-Gaxiola, S., Angermeyer, M., . . . Sampson, N. (2009). Childhood predictors of adult attention-deficit/hyperactivity disorder: Results from the World Health Organization World Mental Health Survey Initiative. *Biological Psychiatry*, *56*, 46-54.

Mowinckel, A. M., Pedersen, M. L., Eilertsen, E., & Biele, G. (2015). A meta-analysis of decision-making and attention in adults with ADHD. *Journal of Attention Disorders*, *19*(5), 355-367.

Murphy, P., & Schachar, R. (2000). Use of self-ratings in the assessment of symptoms of attention deficit hyperactivity disorder in adults. *American Journal of Psychiatry*, *157*, 1156-1159.

National Institute for Health and Care Excellence. (2008). Attention deficit hyperactivity disorder: The NICE guideline on diagnosis and management of ADHD in children, young people and adults. London, England: The British Psychological Society and The Royal College of Psychiatrists.

Pérez, E., & García, C. (2007). ASRS v.1.1., a tool for attention-deficit/hyperactivity disorder screening in adults treated for addictive behaviors: Psychometric properties and estimated prevalence. *Adicciones*, *19*, 393-407.

Petry, N., Stinson, F., & Grant, B. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the National Epidemiologic Survey on alcohol and related conditions. *The Journal of Clinical Psychiatry*, *66*, 564-574.

Polanczyk, G. V., Willcutt, E. G., Salum, G. A., Kieling, C., & Rohde, L. A. (2014). ADHD prevalence estimates across three decades: An updated systematic review and meta-regression analysis. *International Journal of Epidemiology*, *43*, 434-442.

Potenza, M., Steinberg, M., McLaughlin, S., Wu, R., Rounsaville, B., & O'Malley, S. (2001). Gender-related differences in the characteristics of problem gamblers using a gambling helpline. *The American Journal of Psychiatry*, *158*, 1500-1505.

Retz, W., Ringling, J., Retz-Junginger, P., Vogelgesang, M., & Rösler, M. (2016). Association of attention-deficit/hyperactivity disorder with gambling disorder. *Journal of Neural Transmission*, *123*, 1013-1019.

Retz-Junginger, P., Retz, W., Blocher, D., Stieglitz, R., Georg, T., Supprian, T., & Rosler, M. (2003). Reliabilität und Validität der Wender-Utah-Rating-Scale-Kurzform. [Reliability and Validity of the Wender-Utah-Rating-Scale-Shortform.] *Der Nervenarzt*, *74*, 987-993.

Retz-Junginger, P., Retz, W., Blocher, D., Weijers, H., Trott, G., Wender, P., & Rosseler, M. (2002). Wender Utah Rating Scale (WURS-k). Die deutsche Kurzform zur retrospektiven Erfassung des hyperkinetischen Syndroms bei Erwachsenen. [The German Short Form for Retrospective Assessment of the Hyperkinetic Syndrome in Adults.] *Nervenarzt*, *73*, 830-838.

Rodriguez-Jimenez, R., Avila, C., Jimenez-Arriero, M. A., Ponce, G., Monasor, R., Jimenez, M., . . . Palomo, T. (2006). Impulsivity and sustained attention in pathological gamblers: Influence of childhood ADHD history. *Journal of Gambling Studies*, *22*, 451-461.

Romo, L., Rémond, J. J., Coeffec, A., Kotbagi, G., Plantey, S., Boz, F., & Kern, L. (2015). Gambling and attention deficit hyperactivity disorders (ADHD) in a population of French students. *Journal of Gambling Studies*, *31*, 1261-1272.

Rugle, L., & Melamed, L. (1993). Neuropsychological assessment of attention problems in pathological gamblers. *The Journal of Nervous and Mental Disease*, *181*, 107-112.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Amorim, P., Janavs, J., Weiller, E., . . . Dunbar, G. C. (1998). The Mini-International Neuropsychiatric Interview (M.I.N.I.): The

development and validation of a structured diagnostic psychiatric interview for DSM-IV and ICD-10. *Journal of Clinical Psychiatry*, *59*(Suppl. 20), 22-33.

Skoglund, C., Brandt, L., Almqvist, C., D'Onofrio, B. M., Konstenius, M., Franck, J., & Larsson, H. (2016). Factors associated with adherence to methylphenidate treatment in adult patients with attention-deficit/hyperactivity disorder and substance use disorders. *Journal of Clinical Psychopharmacology*, *36*, 222-228.

Sobanski, E. (2006). Psychiatric comorbidity in adults with attention-deficit/hyperactivity disorder (ADHD). *European Archives of Psychiatry & Clinical Neuroscience*, *256*, 26-31.

Sobanski, E., Bruggemann, D., Alm, B., Kern, S., Deschner, M., Schubert, T., . . . Rietschel, M. (2007). Psychiatric comorbidity and functional impairment in a clinically referred sample of adults with attention-deficit/hyperactivity disorder (ADHD). *European Archives of Psychiatry & Clinical Neuroscience*, *257*, 371-377.

Specker, S., Carlson, G., Christenson, G., & Marcotte, M. (1995). Impulse control disorders and attention deficit disorder in pathological gamblers. *Annals of Clinical Psychiatry*, *7*, 175-179.

Tavares, H., Zilberman, M., Beites, F., & Gentil, V. (2001). Brief communications: Gender differences in gambling progression. *Journal of Gambling Studies*, *17*, 151-159.

Theule, J., Hurl, K. E., Cheung, K., Ward, M., & Henrikson, B. (2016). Exploring the relationships between problem gambling and ADHD: A meta-analysis. *Journal of Attention Disorders*. Advance online publication. doi:1087054715626512

Thon, N., Preuss, U., Pölzleitner, A., Quantschnig, B., Scholz, H., & Kühberger, A., . . . Austrian Society for the research of non-substance related Addiction. (2014). Prevalence of suicide attempts in pathological gamblers in a nationwide Austrian treatment sample. *General Hospital Psychiatry*, *36*, 342-346.

van Emmerik-van Oortmerssen, K., van de Glind, G., van Den Brink, W., Smit, F., Crunelle, C., Swets, M., & Schoevers, R. A. (2012). Prevalence of attention-deficit hyperactivity disorder in substance use disorder patients: A meta-analysis and meta-regression analysis. *Drug and Alcohol Dependence*, *122*, 11-19.

van Holst, R., van den Brink, W., Veltman, D., & Goudriaan, A. (2010). Why gamblers fail to win: A review of cognitive and neuroimaging findings in pathological gambling. *Neuroscience & Biobehavioral Reviews*, *34*, 87-107.

Vogel, T., Dom, G., Glind, G., Studer, J., Gmel, G., Strik, W., & Moggi, F. (2016). Is attention deficit/hyperactivity disorder among men associated with initiation or escalation of substance use at 15-month follow-up? A longitudinal study involving young Swiss men. *Addiction*, *111*, 1867-1878. doi:10.1111/add.13422

Waluk, O. R., Youssef, G. J., & Dowling, N. A. (2015). The relationship between problem gambling and attention deficit hyperactivity disorder. *Journal of Gambling Studies*, *32*, 1-14.

World Health Organization. (2003). *Symptomcheckliste mit Selbstbericht-Skala für Erwachsene mit ADHS (ASRS-v1.1)*. [Adult ADHD Self-Report Scale-V1.1 (ASRS-V1.1) Symptoms Checklist.] Retrieved from www.hcp.med.harvard.edu/ncs/ftpdir/adhd/18Q_German_final.pdf

Zanki, M., & Fischer, G. (2012). Glückspielsucht in Österreich unter Berücksichtigung der Genderspezifität. [Gambling Addiction in Austria Considering Gender Specificity.] *Suchtmedizin in Forschung und Praxis*, *14*, 225-236.

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