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ADHD Is Highly Prevalent in Patients Seeking Treatment for Cannabis Use Disorders

Daniel P. Notzon[1,2], **Martina Pavlicova**[2], **Andrew Glass**[1], **John J. Mariani**[1,2], **Amy L. Mahony**[1], **Daniel J. Brooks**[1], **Frances R. Levin**[1,2]

[1]New York State Psychiatric Institute, NY, USA

[2]Columbia University, New York, NY, USA

Abstract

Objective—To estimate the prevalence of ADHD and determine an effective screening test for ADHD in a population-seeking treatment for cannabis use disorders.

Method—The Conners Adult ADHD Diagnostic Interview for *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*; CAADID) was used to generate sensitivity and specificity data for ADHD screening tests, which were then administered to 99 participants seeking treatment for cannabis use disorders to estimate ADHD prevalence.

Results—The prevalence estimated from the Wender Utah Rating Scale (WURS) was 45% (sensitivity = 0.88, sensitivity of 0.75), from the Conners Adult ADHD Rating Scale (CAARS) 34% (sensitivity = 0.80, specificity = 0.91), from the WURS + CAARS 36% (sensitivity = 0.71, specificity = 0.95), and from the Adult ADHD Self-Report Scale (ASRS) 46% (sensitivity = 0.61, specificity = 0.86).

Conclusion—The prevalence of ADHD in adults seeking treatment for cannabis use disorders is estimated to be between 34% and 46%. The WURS paired with the CAARS provides excellent sensitivity and specificity for the diagnosis of ADHD in this population.

Keywords

ADHD; adult ADHD; screening; coexisting disorders; substance abuse

Introduction

The prevalence of adult ADHD has been estimated at between 2.5% (Simon, Czobor, Balint, Meszaros, & Bitter, 2009) and 5% (Kessler et al., 2006) in the general population. Adult

Corresponding Author: Daniel P. Notzon, New York State Psychiatric Institute, 1051 Riverside Drive, Box 66, New York, NY 10032, USA. notzond@nyspi.columbia.edu.

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ADHD is associated with significant morbidity (Able, Johnston, Adler, & Swindle, 2007; Kessler, Lane, Stang, & Van Brunt, 2009; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1993) and at least double the lifetime risk of a substance use disorder (Biederman et al., 2006; Kessler et al., 2006) but may be underdiagnosed due to lack of detailed assessment in clinical interviews (Levin, 2007). Co-occurring ADHD and substance use are associated with increased psychiatric comorbidity (Able et al., 2007; Biederman, Newcorn, & Sprich, 1991; Faraone et al., 2000; Mannuzza et al., 1993), more severe substance use disorders (Biederman et al., 2006; Wilens, 2007), and poorer substance abuse treatment outcomes (Carroll & Rounsaville, 1993; Levin et al., 2004; Wise, Cuffe, & Fischer, 2001). In treatment-seeking patients with substance abuse disorders, the prevalence of adult ADHD has been estimated at between 10 and as high as 46% (Lambert & Hartsough, 1998; Levin, Evans, & Kleber, 1998; Schubiner et al., 2000; van Emmerik-van Oortmerssen et al., 2014; van Emmerikvan Oortmerssen et al., 2012).

In cannabis users, 53% of non-daily users and 57% of daily users met criteria for ADHD on the Adult ADHD Self-Report Scale (ASRS; with higher prevalence of the hyperactive–impulsive subtype) in one sample (Loflin, Earleywine, De Leo, & Hobkirk, 2014), and in adolescent studies as many as 32% of those with ADHD report cannabis use, with 12.5% meeting criteria for a cannabis use disorder (CUD; Molina et al., 2013). In descriptive accounts and demographic surveys, ADHD patients have described cannabis as being helpful in managing inattentiveness and impulsivity (Loflin et al., 2014; Wilens, 2004), although it has also been associated with lower quality of life and achievement measures (Fergusson & Boden, 2008b). Cannabis use by age 25 has been linked to increased adult ADHD symptoms (Fergusson & Boden, 2008a), although this may be mediated by common comorbidities such as other drug use or conduct disorder (Tims et al., 2002). With the prevalence of ADHD (Visser et al., 2014) and daily cannabis use (Substance Abuse and Mental Health Services Administration [SAMHSA], 2014) both increasing, estimating the size of this population would be helpful to determine best screening practices and for guiding policy interventions.

However, as of this writing, there are few published prevalence rates of adult ADHD in patients with cannabis use disorders, nor to our knowledge any studies that compare the results of screening tests for ADHD in this population with the results of formal diagnostic assessments. We sought to estimate the prevalence of adult ADHD in patients seeking treatment for cannabis use disorders using clinical trial data that assessed a substance-abusing population for adult ADHD with a number of screening instruments, with a secondary goal of identifying a screening instrument with the best utility in screening for this comorbidity.

Method

Initial Study

The methods of data collection for the primary study have been described elsewhere (Dakwar et al., 2012). Briefly, 102 adult individuals seeking outpatient treatment for cocaine dependence were recruited into a protocol approved by the Institutional Review Board of the New York State Psychiatric Institute (NYSPI IRB) to assess the sensitivity and specificity of

screening instruments for diagnosing ADHD in a cocaine-dependent population. These instruments included the Wender Utah Rating Scale (WURS; Ward, Wender, & Reimherr, 1993), the Conners Adult ADHD Rating Scale (CAARS; Conners, Ehrhard, & Sparrow, 1999), and the World Health Organization Adult ADHD Self-Report Scale–Version 1.1 (ASRS-V1.1; Kessler et al., 2005).

The WURS is a 25-item retrospective self-report questionnaire for adults based on the Utah Criteria for ADHD, assessing symptoms of inattention, hyperactivity, impulsivity, mood dysregulation, and conduct problems between ages 8 and 10. Each item is scored on a scale of 0 to 4 with a total greater than or equal to 36 a positive screen for ADHD. The short, self-report version of the CAARS has 26 items based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) criteria for ADHD, each rated from 0 (*not at all*) to 3 (*severe*). The ASRS, developed for epidemiologic surveys by the World Health Organization, has six items to assess for adult ADHD, requiring four positives of sufficient severity to screen positive. The results of these instruments were then compared with what was considered a definitive, “gold standard” assessment for the diagnosis of adult ADHD, the Conners Adult ADHD Diagnostic Interview for *DSM-IV* (CAADID; Epstein & Kollins, 2006), which assesses *DSM-IV* criteria for ADHD, to generate sensitivity and specificity data for these screening tests. Recruitment and data collection occurred between May 2009 and April 2011.

Current Study

Ninety-nine adult individuals seeking treatment for cannabis use disorders were recruited into a protocol approved by the NYSPI IRB and were administered ADHD screening questionnaires including the WURS, the CAARS, and the ASRS in the process of screening for enrollment into clinical trials of potential pharmacotherapies for cannabis use disorders. Standard cutoff scores for ADHD were used as in the study described previously, and the proportion of those screening positive for ADHD was calculated for each test. Sensitivity and specificity scores from the original study for the WURS, CAARS, the WURS + CAARS (where a positive screen was defined as one being positive on both assessments, and found to have high specificity for ADHD in the original study), and the ASRS were utilized as an estimate of the sensitivity and specificity of ADHD screening tests in a substance-abusing population.

Using the law of total probability, algebra, and probability identities, a formula to estimate the population proportion ($\hat{p}$) of ADHD was derived as a function of the percentage of the sample proportion testing positive on a screening test ($\hat{p}_+$) and the calculated sensitivity and specificity of the screening test for ADHD, as shown in Figure 1. Using this formula, estimated population prevalence based on the results of each screening test given to the sample was calculated along with confidence intervals (CIs). The resultant equation independently replicated a prior derivation (Rogan & Gladen, 1978).

Results

As shown in Table 1, our group of cannabis treatment seekers was male-predominant, and overrepresented African Americans and underrepresented Hispanics and Asians compared

with the local population of New York City (NYC). The observed proportion of participants screening positive for ADHD varied depending on the test used, from as low as 29% in the WURS + CAARS group to as high as 53% in the WURS alone group, as shown in Table 2. Estimated Population Prevalence of adult ADHD was calculated for each test, with the WURS showing an estimated prevalence of 45% with 95% CI [29%, 61%], the ASRS 46% with 95% CI [25%, 67%], the CAARS 34% with 95% CI [21%, 47%], and the WURS + CAARS at 36% with 95% CI [23%, 49%].

Discussion

Using data obtained via multiple ADHD screening tests, the prevalence of adult ADHD in a population seeking treatment for cannabis use disorders was estimated to be between 34% and 46%, consistent with Loflin et al. (2014) and Tims et al. (2002). This range is higher than most previous estimates of ADHD prevalence for substance abuse disorders as a whole (Schubiner et al., 2000; van de Glind et al., 2013) or cocaine dependence (Carroll & Rounsaville, 1993; Levin et al., 1998). This result echoes findings that ADHD prevalence may be dissimilar between different substance use disorder populations (van Emmerik-van Oortmerssen et al., 2014). Our outcome highlights the importance of thorough screening for ADHD and the existence of a large group of patients who may benefit from evidence-based ADHD treatment (Able et al., 2007).

The WURS provided excellent sensitivity and very good specificity as a screening test and would appear to be the best initial choice with which to assess the cannabis-using population specifically, with better sensitivity and specificity than the ASRS achieved in a large study of treatment seekers with any substance use disorder (van de Glind et al., 2013). Pairing the WURS with the high specificity CAARS produced a lower prevalence estimate, but given that this combination had a narrower 95% CI compared with the WURS alone, it perhaps has greater precision in estimating the population proportion. The ASRS had the widest 95% CI suggesting the least precision for estimating prevalence, while the CAARS alone and the WURS + CAARS had the narrowest 95% CIs. Clinically, using a CAARS as a confirmatory test after a positive WURS might be a viable strategy to reduce false positive rates while capturing most of the cannabis treatment-seeking population with ADHD.

The combination of the WURS + CAARS also puts together a screen looking exclusively at childhood symptoms with an adult symptom screen, which qualitatively suggests a higher specificity for ADHD than recall of child symptoms or report of adult symptoms alone. High specificity for ADHD in screening this comorbid cannabis-using population is pivotal, as there is some question as to how much overlap there is between adult ADHD (the diagnosis of which requires the presence of symptoms prior to age 12) and the cognitive effects of chronic cannabis use. Studies of adolescents using cannabis at least weekly have shown persistent learning, working memory (Harvey, Sellman, Porter, & Frampton, 2007; Schwartz, Gruenewald, Klitzner, & Fedio, 1989), and attention (Medina et al., 2007) deficits for several weeks to months after the initiation of abstinence, while studies including heavy adolescent users have shown persistent changes in areas including processing speed, complex attention, visual and verbal working memory, and executive functioning (Hanson et al., 2010; Pope & Yurgelun-Todd, 1996; Thames, Arbid, & Sayegh, 2014). However, these

deficits did not persist with lengthy abstinence or correlated indirectly with tetrahydrocannabinol (THC) blood levels (Pope, Gruber, Hudson, Huestis, & Yurgelun-Todd, 2001), and elsewhere deficits in memory or working memory were indistinguishable from controls with prolonged abstinence while attention deficits persisted (Hanson et al., 2010).

Given as well the prevalence of cannabis use in the ADHD population and findings linking it to either hyperactive/impulsive symptoms (Loflin et al., 2014), inattention and earlier age of cannabis onset (Bidwell, Henry, Willcutt, Kinnear, & Ito, 2014), and involvement of the endocannabinoid system in ADHD pathophysiology and the reward system (Bossong et al., 2013; Castelli et al., 2011), dismissal of co-occurring ADHD symptoms in the cannabis-using population as substance-induced cognitive changes does not seem to be supported by the body of evidence. Indeed, the effects of cannabinoids on ADHD symptoms would appear worthy of future study. Although dopamine signaling is not an adequate proxy for "motivation" as a construct, improvement in inattention symptoms with stimulant treatment of ADHD is correlated with increased dopamine signaling in the ventral striatum (Volkow et al., 2012), a brain region involved in behavioral motivation and task selection that is also altered in cannabis use disorders (Gilman et al., 2014). The question of whether treatment of comorbid ADHD and CUD with stimulants could reduce marijuana use in treatment-seeking patients, as with methylphenidate for tobacco smoking cessation with comorbid severe ADHD (Nunes et al., 2013), would also appear worthy of future inquiry.

Limitations

A major limitation of this study is the use of sensitivity and specificity figures generated from a cocaine-dependent population, which may differ biologically from a cannabis-using population, and could contribute to the wide CIs for each of the prevalence estimates described here. Of note, the sensitivity and specificity values used here for the ASRS were significantly different from those obtained in an international, multi-site survey in the substance-abusing population as a whole (van de Glind et al., 2013). Another limitation of the study is that due to time, funding and staff constraints, participants were not formally screened to confirm a CUD diagnosis. However, one past study of cannabis treatment seekers showed only 2/75 screens failing to meet *DSM-IV* criteria for cannabis dependence (Budney, Radonovich, Higgins, & Wong, 1998), and another only 7/136 (Gray et al., 2011), suggesting that our participants were very unlikely to include a significant proportion of "false-positives" for CUDs.

The above limitations argue for further research involving direct assessment of the CUD population with diagnostic instruments such as the CAADID and the *Structured Clinical Interview for DSM-5* (SCID-5) to replicate our findings. Furthermore, our sample is relatively small and treatment-seeking, which may limit generalizability. Patient tendencies to under-report ADHD symptoms (Barkley, 2008) and use of more restrictive *DSM-IV* criteria may have resulted in underestimation of prevalence. Lack of information about childhood ADHD symptoms particularly with the *DSM-IV* criteria being used could lead to overestimation or underestimation of ADHD prevalence via recall bias.

Conclusion

The prevalence of ADHD in adults seeking treatment for marijuana use disorders is estimated to be between 34% and 46%, much higher than in most previous estimates of ADHD prevalence in the substance abuse population as a whole. The WURS is an excellent initial screening test with high sensitivity in this population, and when paired with the CAARS as a confirmatory test could provide increased specificity for the diagnosis of ADHD.

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Biographies

Daniel P. Notzon, MD, is an instructor in clinical psychiatry at the Columbia University Department of Psychiatry. His research interests include novel medication treatments for cannabis use disorders, and clinical and epidemiological aspects of comorbid substance abuse disorders and mental illness.

Martina Pavlicova, PhD, is an associate professor of biostatistics at the Columbia University Medical Center. Her research interests focus on biostatistical methods for clinical trials and longitudinal analysis, and their application to substance abuse clinical research.

Andrew Glass, MA, is a biostatistician at the Division of Biostatistics in Psychiatry at the New York State Psychiatric Institute. His research interests include analysis of clinical trial data with applications to substance abuse.

John J. Mariani, MD, is an associate professor of clinical psychiatry at the College of Physicians and Surgeons at Columbia University and a research psychiatrist at the New York State Psychiatric Institute. He is the director of Columbia University's Substance Treatment and Research Service (STARS). His research interests include medication treatments of cannabis, cocaine, sedative/hypnotic, and alcohol use disorders.

Amy L. Mahony, MA, is the director of Research Assessment Training and senior project manager at the Substance Treatment and Research Service (STARS) of Columbia University, Division on Substance Abuse. Her research interests focus on substance use and medication treatment, with focus on multi-site projects and coordination/administration.

Daniel J. Brooks, MA, is a project coordinator in the Division on Substance Abuse at the New York State Psychiatric Institute with 18 years of experience working on multi-site clinical trials focused on the treatment of substance abuse disorders. His research interests include the treatment of cocaine dependence and comorbid disorders such as ADHD and depression.

Frances R. Levin, MD, is the Kennedy–Leavy professor of psychiatry at the Columbia University Medical Center. Her research interests focus on treatment approaches for individuals with substance use disorders with and without psychiatric comorbidity.

$$\hat{p} = (\hat{p}_{+} + \text{specificity} - 1) / (\text{sensitivity} + \text{specificity} - 1)$$

Figure 1.
Estimating prevalence.

Table 1

Demographic Characteristics of Sample.

Gender	
Male	73%
Female	26%
Race	
African American	25%
Hispanic	21%
Caucasian	44%
Asian	5%
Other	4%
Age (years)	35 ± 11
Education (years)	14 ± 3
Employment	
Full-time	27%
Part-time	8%
Student	7%
Unemployed	29%
Disabled	3%
Other/unknown	25%
Marital status	
Single	59%
Married	13%
Divorced/separated	11%
Other/unknown	16%

Table 2

Observed and Estimated Prevalence Rates.

	WURS	CAARS	WURS + CAARS	ASRS
Observed proportion	53%	33%	29%	36%
Sensitivity	0.88	0.80	0.71	0.61
Specificity	0.75	0.91	0.95	0.86
Estimated population prevalence	45%	34%	36%	46%
95% confidence interval	[29%, 61%]	[21%, 47%]	[23%, 49%]	[25%, 67%]

Note. WURS = Wender Utah Rating Scale; CAARS = Conners Adult ADHD Rating Scale; ASRS = Adult ADHD Self-Report Scale.