

World Journal of *Psychiatry*

World J Psychiatr 2020 September 19; 10(9): 202-222



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ABOUT COVER

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RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: Jia-Hui Li; Production Department Director: Yun-Xiaojuan Wu; Editorial Office Director: Jia-Ping Yan.

NAME OF JOURNAL

World Journal of Psychiatry

ISSN

ISSN 2220-3206 (online)

LAUNCH DATE

December 31, 2011

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Rajesh R Tampi

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2220-3206/editorialboard.htm>

PUBLICATION DATE

September 19, 2020

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<https://www.wjgnet.com/bpg/gerinfo/208>

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<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Observational Study

Alcohol and drug use disorders in adult attention-deficit/hyperactivity disorder: Prevalence and associations with attention-deficit/hyperactivity disorder symptom severity and emotional dysregulation

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Author contributions: Anker E and Heir T designed the study; Anker E collected and analyzed the data; Anker E, Haavik J, and Heir T actively participated in the writing of the manuscript; all authors approved the final draft.

Supported by NevSom University of Oslo, No. 51379.

Institutional review board

statement: The study was reviewed and approved by (Regionale Komiteer for Medisinsk og Helsefaglig Forskningsetikk). Norwegian Regional committees for medical and health research ethics.

Informed consent statement: All study participants gave written informed consent to participate in the study.

Conflict-of-interest statement:

Espen Anker has received speaker honoraria from Shire; Jan Haavik has received speaker honoraria from Lilly, Shire, HB Pharma,

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Abstract

BACKGROUND

High risk of alcohol and drug use disorders in people with attention-deficit/hyperactivity disorder (ADHD) calls for exploratory research of relationships with clinical features of ADHD.

AIM

To estimate prevalence of alcohol/drug use disorders and associations with ADHD symptom severity and emotional dysregulation, in adults with ADHD.

METHODS

This observational cross-sectional clinical study consisted of patients admitted to a private psychiatric outpatient clinic in Oslo, Norway (2014-2018). Five-hundred and fifty-eight eligible patients diagnosed with ADHD (Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria) agreed to participate. Alcohol and drug use disorders were diagnosed using the Mini International Neuropsychiatric Interview (MINI). Dependence and abuse were merged into "use" disorder as in MINI version 7.0/DSM-5. Questions were related both to lifetime and the past 12-mo. ADHD severity was assessed by the Adult ADHD Self Report Scale (ASRS). Subdivisions of the ASRS questionnaire as inattentive items and hyperactive/impulsivity items were recorded separately. Emotional dysregulation was assessed by the eight-item version of Barkley's Current Behavior Scale - Self Report.

Medice and Biocodex; Trond Heir reports having no competing interests.

Data sharing statement: Data are from a private psychiatric outward in Oslo. Public availability would compromise privacy of the respondents. According to the approval from the Norwegian Regional committees for medical and health research ethics, the data is to be stored properly and in line with the Norwegian Law of privacy protection. However, anonymized data is freely available to interested researchers upon request, pending ethical approval from the ethics committee. Interested researchers can contact project leader Espen Anker (espen.anker@online.no) with requests for the data.

STROBE statement: The authors have read the STROBE Statement – checklist of items, and the manuscript was prepared and revised according to the STROBE Statement – checklist of items.

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Manuscript source: Unsolicited manuscript

Received: June 3, 2020

Peer-review started: June 3, 2020

First decision: June 20, 2020

Revised: July 11, 2020

Accepted: August 15, 2020

Article in press: August 15, 2020

Published online: September 19, 2020

P-Reviewer: Bertocci M

RESULTS

The 12-mo prevalence was 5.3% for alcohol use disorder and 13.7% for drug use disorder. The lifetime prevalence was 12.0% for alcohol use disorder and 27.7% for drug use disorder. Men had higher rates of both alcohol use disorder and drug use disorder compared to women. The prevalence of drug use disorder was more than twice that of alcohol use disorder for both sexes. The drugs most participants reported having used were (in descending order): Amphetamine (19.1%), cannabis (17.1%), cocaine or ecstasy (7.4%), benzodiazepines (7.4%), and heroin or other opioids (2.9%). Lifetime drug use disorder was significantly associated with both hyperactivity-impulsivity symptoms and emotional dysregulation symptom severity. Lifetime alcohol use disorder, on the other hand, was not significantly associated with ADHD symptoms or emotional dysregulation when adjusted for gender and age.

CONCLUSION

Patients with ADHD have a high lifetime prevalence of drug use disorder, which is associated with higher levels of hyperactivity-impulsivity symptoms and emotional dysregulation.

Key Words: Attention-deficit/hyperactivity disorder; Adult ADHD Self Report Scale; Emotional dysregulation; Substance use disorder; Alcohol use disorder; Drug use disorder

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Core Tip: High rates of alcohol and drug use disorders in people with attention-deficit/hyperactivity disorder (ADHD) needs further explanation. In this study of adult ADHD patients in clinical practice, we found a remarkably high incidence of past or current drug use disorder, especially for amphetamine and cannabis. Drug use disorder but not alcohol was associated with clinical features of ADHD, such as hyperactivity-impulsivity symptoms and emotional dysregulation. The findings point to self-medication for ADHD as a plausible explanation and suggest early diagnosis and treatment of ADHD as a preventive strategy against substance abuse.

Citation: Anker E, Haavik J, Heir T. Alcohol and drug use disorders in adult attention-deficit/hyperactivity disorder: Prevalence and associations with attention-deficit/hyperactivity disorder symptom severity and emotional dysregulation. *World J Psychiatr* 2020; 10(9): 202-211

URL: <https://www.wjgnet.com/2220-3206/full/v10/i9/202.htm>

DOI: <https://dx.doi.org/10.5498/wjp.v10.i9.202>

INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a life-span neuropsychiatric disorder, with core symptoms of inattention, hyperactivity, and impulsivity^[1]. ADHD is caused by a multitude of additive and interactive genetic and environmental factors operating in a complex manner^[2-4]. The prevalence of ADHD in the general adult population is estimated to be 3%-5%^[5,6]. Furthermore, ADHD is a dimensional diagnosis in which attention deficits and hyperactivity-impulsivity may appear in various degrees and combinations^[7].

The co-occurrence of ADHD and substance use disorder (SUD), such as alcohol use disorder (AUD) or drug use disorder (DUD), has been studied in a variety of clinical and research settings. Overall, there is an earlier onset and elevated risk of SUD in people with ADHD^[6,8-16], but the direction of causality, underlying mechanisms, and clinical implications of the strong association between ADHD and SUD are still unclear.

It is well documented that many patients with ADHD strive to regulate negative emotions^[17-19]. They may be quick to anger, easily frustrated, and emotionally over-excitable, a symptom cluster defined as emotional dysregulation (ED)^[20-22]. Although ED may be understood as a transdiagnostic factor^[23], in the development of psychopathology^[24] it appears to be specifically related to impulsivity^[25]. ED is

S-Editor: Liu JH**L-Editor:** A**P-Editor:** Li JH

associated with SUD in children and adolescents^[26] as well as in adults with ADHD^[27]. The strong relationship between ADHD and ED^[17-19] makes it challenging to determine which of them is mainly related to SUD.

The aim of the present study was to estimate the prevalence of AUD and DUD in a clinical sample of adults with ADHD, and to examine the association with ADHD symptom severity and ED.

MATERIALS AND METHODS

This was an observational cross-sectional clinical study.

Participants

The study sample consisted of adult patients, age ranging from 18 to 69, who fulfilled the criteria for ADHD according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (commonly referred to as the DSM-5)^[1]. They were admitted to a private psychiatric clinic in Oslo, Norway, which specialized in psychiatric examinations and treatment of ADHD.

Recruitment was conducted between 2014 and 2018. ADHD was assessed using DIVA 2.0, the semi-structured Diagnostic Interview for Adult ADHD, second edition^[28], which was performed by a psychiatrist for all patients included in the study. A clinical diagnosis of ADHD was established according to DSM-5^[1]. During these years, 656 of the assessed patients fulfilled the diagnostic criteria of ADHD and were invited to participate in the study, of whom 65% were self-referred and 35% were referred by healthcare practitioners. None of the participants were using prescribed stimulant medication prior to study inclusion.

Of the 656 patients (351 men and 305 women) with ADHD, 585 (89.2%) gave written informed consent to participate in the study. There were no exclusion criteria. The study was approved by the Regional Medical Ethics Committee, South-East Norway, 2015/426. Assessments were carried out in accordance with ethical standards and the principals of the Declaration of Helsinki.

Measures

The age of the participants was recorded as their numbers of lived-years when entering the study. Gender was recorded as women (scored as 0) and men (scored as 1) from the information revealed by the participant. Sociodemographic information included: If the participant was married or cohabiting, scored as 1, and if not, scored as 0; If the participant was living with children, inclusive partial custody, scored as 1, and if not (even though having children somewhere else), scored as 0; Educational level, categorized by the number of years in education, with 12 years or less scored as 1, 13-15 years scored as 2, or more than 15 years scored as 3; and, work participation, which was defined as "yes" and scored as 1, if work was reported as the main source of income, and if not was scored as 0.

AUD and DUD were diagnosed using the specific module of the Mini International Neuropsychiatric Interview (MINI), Norwegian Translation Version 6.0.0, according to DSM-IV criteria^[29,30]. Dependence and abuse were merged into "use" disorder, as in MINI version 7.0/DSM-5, and questions were both restricted to the last 12-mo and related to lifetime prevalence. The presence of AUD was scored as 1, and absence as 0. The presence of DUD was scored as 1, and the absence as 0. ADHD symptom severity was measured using the Adult ADHD Self Report Scale (ASRS) Symptom Check List, v1.1 by the World Health Organization 2007. The ASRS is a reliable and valid screening instrument for evaluating ADHD in adults^[31]. This 18-item version yields a score ranging from 0 to 72 points. We recorded subdivisions of the ASRS questionnaire, as inattentive items (item 1-4 and 7-11) and hyperactive/impulsivity items (item 5, 6, and 12-18) separately^[32].

ED was assessed by questionnaire with 8 items from the 99-item Current Behavior Scale - Self Report questionnaire^[33-35]. The 8 items were: 1: Quick to get angry or become upset; 2: Easily frustrated; 3: Overreact emotionally; 4: Easily excited by activities going on around me; 5: Lose my temper; 6: Argue with others; 7: Am touchy or easily annoyed by others; and 8: Am angry or resentful. The items were scored as never or rarely (0), sometimes (1), often (2), or very often (3). This yielded a total ED score ranging from 0 to 24.

Procedure

The data were collected during routine assessment in an outpatient clinic. Afterwards, the patients were asked if they approved the use of their clinical information in an anonymous form as statistic material for this clinical trial. They gave their written informed consent to participate in the study after the examination.

Statistical analysis

We performed χ^2 tests or *t*-tests to compare sociodemographic characteristics between women and men. We used logistic regression analyses to examine associations between AUDs and DUDs as dependent variables and ADHD symptom severity and ED as independent variables. All tests were two-tailed. Because of our two hypotheses, we used multiple test correction according to Bonferroni, considering differences significant if $P < 0.025$. There were no missing data. All statistical analyses were carried out using the software package IBM 2016 SPSS version 22^[36].

RESULTS

Prevalence rates

Table 1 shows the sociodemographic and clinical characteristics of the men ($n = 317$) and women ($n = 268$) in the study. More women than men were living with children and women reported higher levels of ADHD symptoms and ED compared to men. **Table 2** shows the 12-mo prevalence and lifetime prevalence of AUD and DUD in men and women. Men had a significantly higher prevalence of both AUD and DUD compared to women. The prevalence of DUD was more than twice the prevalence of AUD for both sexes.

Prevalence of different drugs

In the total sample, 162 (27.7%) of the participants had a history of lifetime DUD related to amphetamine ($n = 112$, 69.1%), cannabis ($n = 100$, 61.7%), cocaine or ecstasy ($n = 43$, 26.5%), benzodiazepines ($n = 43$, 26.5%), heroin or other opioids ($n = 17$, 10.5%), and unspecified drugs ($n = 26$, 16.0%).

Associations with ADHD symptoms and ED

Tables 3 and 4 show associations between lifetime SUD and clinical characteristics, including hyperactivity-impulsivity and ED. Lifetime AUD was not significantly associated with the levels of ADHD symptoms or ED when adjusted for gender and age (Table 3). Lifetime DUD, on the other hand, was significantly associated with both hyperactivity-impulsivity and ED (Table 4).

DISCUSSION

In our clinical sample of adults with ADHD, we observed a 12-mo prevalence of 5.3% for AUD and 13.7% for DUD. The lifetime prevalence was 12.0% for AUD and 27.7% for DUD. All prevalence rates were higher for men than for women.

The 12-mo prevalence of AUD was similar to the general population prevalence reported in Norway and the United States^[37-39]. In contrast, the 12-mo prevalence of DUD was considerably higher than the United States (3.9%)^[40] and European (3.0%) estimated prevalences of DUD in the general population^[38]. A similar pattern was found for lifetime prevalence of AUD and DUD. While the lifetime prevalence of AUD in our study was lower than that in the general Norwegian or United States population^[37-39], the lifetime prevalence of DUD was considerably higher than what has been found in the Norwegian population^[41,42].

Our findings demonstrate the need to distinguish between different types of SUD to understand comorbidity in patients with ADHD. The finding that DUD, in contrast to AUD, was far more prevalent than in the general population, as well as our findings that DUD but not AUD was associated with increased ED and ADHD symptom severity, questions previous statements that ADHD is strongly associated with SUD in general^[13,14] or that the ADHD symptom severity is associated with increased risk for all kinds of SUD outcomes^[16]. According to our findings, there appears to be a significant difference between the risk of AUD and DUD in people with ADHD, at least in this Norwegian patient population.

Table 1 Demographic characteristics, attention-deficit hyperactivity disorder symptom severity, and emotional dysregulation in 585 adult patients diagnosed with attention-deficit hyperactivity disorder in a psychiatric clinic specialized in examination and treatment of attention-deficit hyperactivity disorder

	Men, n = 317	Women, n = 268	All patients, n = 585
Age in years, mean ± SD	36.2 (11.5)	37.5 (11.2)	36.8 (11.4)
Range	18-67	18-69	18-69
Married or cohabitant	143 (45.1)	107 (39.9)	250 (42.7)
Living with children	110 (34.7)	117 (43.7) ^a	227 (38.8)
Years of education: ≤ 12	172 (54.3)	129 (48.1)	301 (51.5)
13-15	121 (38.2)	108 (40.3)	229 (39.1)
> 15	24 (7.6)	31 (11.6)	55 (9.4)
Work participation	193 (60.9)	149 (55.6)	342 (58.5)
ADHD symptom severity ¹ , mean ± SD	50.4 (9.5)	52.3 (9.5) ^b	51.4 (9.5)
Inattention, mean ± SD	27.0 (4.6)	27.8 (4.9) ^a	27.4 (4.7)
Impulsivity-hyperactivity, mean ± SD	23.3 (6.6)	24.7 (6.5) ^b	24.0 (6.6)
Emotional dysregulation ² , mean ± SD	11.0 (5.6)	13.4 (5.3) ^c	12.1 (5.6)

When others not specified, figures are given as numbers (percentage).

^a*P* < 0.05.

^b*P* < 0.01.

^c*P* < 0.001; women compared with men.

¹Attention-deficit hyperactivity disorder (ADHD) symptom severity was assessed by the Adult ADHD Self Report Scale.

²Emotional dysregulation was assessed by 8 items from the Current Behavior Scale - Self Report questionnaire. SD: Standard deviation.

Table 2 Prevalences of alcohol or drug use disorders in 585 adult patients diagnosed with attention-deficit hyperactivity disorder in a psychiatric clinic specialized in examination and treatment of attention-deficit hyperactivity disorder

	Men, n = 317	Women, n = 268	All patients, n = 585
AUD			
- 12-mo	24 (7.6)	7 (2.6) ^b	31 (5.3)
- Lifetime	47 (14.8)	23 (8.6) ^a	70 (12.0)
DUD			
- 12-mo	55 (17.4)	25 (9.1) ^b	80 (13.7)
- Lifetime	103 (32.5)	59 (22.0) ^b	162 (27.7)
AUD or DUD			
- 12-mo	67 (21.1)	29 (10.8) ^b	96 (16.4)
- Lifetime	114 (36.0)	65 (24.3) ^b	179 (30.6)

^a*P* < 0.05.

^b*P* < 0.01; women compared with men (χ^2). Figures are given in numbers (percentage). AUS: Alcohol use disorder; DUD: Drug use disorder.

Several factors can help explain this. First, genome-wide association studies have shown strong genetic correlations between ADHD and DUD^[43,44], while some genetic factors contributing to the risk of developing AUD are negatively correlated with ADHD^[45]. Second, there may be some shared environmental determinants for ADHD and DUD^[44] – for example, maternal DUD^[46]. Third, drug dependence, especially the misuse of amphetamine and cannabis, has been suggested to be a result of self-medication related to ADHD symptoms^[47-49], which corresponds to the fact that amphetamine and cannabis were the preferred drugs for abuse in our study.

The higher prevalence rates of AUD and DUD in men compared to women are in accordance with gender differences in the general population^[37-40]. In line with others,

Table 3 Associations between age, gender, attention-deficit hyperactivity disorder relevant clinical characteristics, and outcome of lifetime alcohol use disorder in a clinical sample of 585 adult attention-deficit hyperactivity disorder patients, non-adjusted and adjusted analysis

	Non-adjusted			Adjusted		
	OR	95%CI	P value	OR	95%CI	P value
Age, increasing in 10 yr	1.32	1.06-1.64	0.013	1.32	1.05-1.64	0.016
Gender, men vs women	1.94	1.14-3.31	0.015	2.19	1.27-3.77	0.005
Inattentive	1.03	0.98-1.09	0.27	1.01	0.95-1.07	0.82
Hyperactivity-impulsivity	1.05	1.01-1.09	0.027	1.03	0.98-1.08	0.24
Emotional dysregulation	1.05	1.00-1.09	0.06	1.04	0.98-1.10	0.16

CI: Confidence interval; OR: Odds ratio.

Table 4 Associations between age, gender, attention-deficit hyperactivity disorder relevant clinical characteristics, and outcome of lifetime drug use disorder in a clinical sample of 585 adult attention-deficit hyperactivity disorder patients, non-adjusted and adjusted analysis

	Non-adjusted			Adjusted		
	OR	95%CI	P value	OR	95%CI	P value
Age, increasing in 10 yr	1.10	0.94-1.29	0.24	1.08	0.92-1.27	0.36
Gender, men vs women	1.71	1.18-2.49	0.005	2.01	1.36-2.97	< 0.001
Inattentive	1.02	0.97-1.05	0.77	0.97	0.93-1.02	0.21
Hyperactivity-impulsivity	1.04	1.02-1.07	0.003	1.04	1.01-1.08	0.021
Emotional dysregulation	1.05	1.01-1.08	0.006	1.05	1.01-1.09	0.019

CI: Confidence interval; OR: Odds ratio.

we found that women reported higher levels of hyperactivity-impulsivity^[50] and ED^[51] compared with men.

Our observation that DUD was associated with higher ED is consistent with findings that ED in general increases the risk of developing and maintaining drug addiction^[52]. DUD typically appears later in life than ADHD and ED, suggesting that DUD is modified by ADHD and ED, rather than *vice versa*. Nevertheless, it is possible that DUD may reinforce the symptoms of both ADHD and ED.

Methodological considerations

Patients attending a private and not governmental-funded ADHD clinic may not be representative for patients with ADHD in general. They may have a higher socio-economic status and be less impaired compared to those in public outpatient clinics or hospitals. Also, the prevalence of morbidity may not be representative of the total ADHD patient population. Still, the reported comorbidity prevalence rates in our study were similar to recently reported prevalences for the total Norwegian population^[12]. Finally, the cross-sectional design places strong limitations on interpretations of causal relationships.

CONCLUSION

In conclusion, in this study of adult ADHD patients, we found a much higher prevalence of DUD than what has been reported in general populations. DUD was independently associated with both higher symptom levels of hyperactivity-impulsivity and ED. Thus, a co-morbid DUD should be considered in adult ADHD patients, particularly in males and among individuals with high levels of hyperactive-impulsive ADHD core symptoms or ED. The causal mechanisms of the relationship

between ADHD and DUD are not known, but self-medication for hyperactivity-impulsivity and ED is one possibility. Thus, early recognition and targeted interventions may be necessary to prevent the negative consequences of ADHD.

ARTICLE HIGHLIGHTS

Research background

The co-occurrence of attention-deficit hyperactivity disorder (ADHD) and substance use disorders, such as alcohol use disorder (AUD) and drug use disorder (DUD), has been studied in a variety of clinical and research settings. It is still unclear whether an increased risk of abuse or dependence applies to all forms of substance use to the same extent.

Research motivation

We have yet to fully understand the magnitude and nature of substance use among the adult population with ADHD. By obtaining more knowledge about the prevalence of AUD and DUD in adults with ADHD and the associations with clinical features of ADHD, this information can lead to hypotheses as to why some people with ADHD are at greater risk of developing substance use disorder.

Research objectives

To estimate the prevalence of AUD and DUD in adults with ADHD, and to estimate the associations with ADHD symptom severity and emotional dysregulation.

Research methods

This was an observational cross-sectional clinical study with a study sample consisting of 585 adult ADHD patients, who were admitted to a private psychiatric outpatient clinic over a 5-year period. ADHD was diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition criteria. AUD and DUD were diagnosed using the Mini International Neuropsychiatric Interview. ADHD severity was assessed by the Adult ADHD Self Report Scale. Emotional dysregulation was assessed by the 8-item version of Barkley's Current Behavior Scale - Self Report.

Research results

The 12-mo prevalences of AUD and DUD were 5.3% and 13.7%, respectively. The lifetime prevalence was 12.0% for AUD and 27.7% for DUD. A history of DUD but not AUD was positively associated with hyperactivity-impulsivity ADHD core symptoms, as well as emotional dysregulation.

Research conclusions

Compared to findings in the normal population, adult ADHD patients had much higher prevalence of past or current DUD but not AUD. DUD was particularly related to amphetamine and cannabis. Associations of DUD with clinical features of ADHD point to self-medication of ADHD as a possible causative factor and suggest early diagnosis and treatment of ADHD as a preventive strategy against substance abuse.

Research perspectives

Future research should be supplemented by longitudinal studies of children and adolescents with ADHD to investigate who develops substance use disorders. The effect of early ADHD treatment on substance abuse can be investigated by intervention studies.

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