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ADHD in Adults: A Systematic Review and Meta-Analysis of Prevalence Studies in Outpatient Psychiatric Clinics

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Abstract

Objective: Systematic review and meta-analysis to estimate the pooled prevalence of ADHD in adult attendees of outpatient mental health clinics and to investigate factors influencing prevalence rates. **Methods:** The following were extracted: demographics, design of the study (screening only or two-phase), scales/criteria for diagnosis of ADHD, number of ADHD, and non-ADHD participants. **Results:** The pooled prevalence of ADHD from screening studies ($n = 9$) was 26.7%, (95% CI [17.2–37.4]), ADHD = 1727, No ADHD = 3,578. From studies employing a two-stage design ($n = 5$), prevalence was 14.61%, CI [10.39–19.41], ADHD = 561, No ADHD = 3,578. Age and gender did not have any significant effect on the estimated prevalence. By contrast exclusion of psychotic disorders lowers prevalence. The screening scale used also influence prevalence rates. **Conclusion:** Meta-analysis shows high rates of adult ADHD among psychiatric outpatient clinics. Applying DSM-5 criteria increased prevalence rates. More methodologically robust studies, using two-stage design, need to be conducted to help assist in service planning. *(J. of Att. Dis. 2022; 26(12) 1523-1534)*

Keywords

ADHD, adults, epidemiology, systematic review, meta-analysis, psychiatric population, prevalence

Introduction

ADHD is a neurocognitive disorder characterized by significant difficulties with inattention or hyperactivity and impulsiveness or a combination of the two (American Psychiatric Association, 2013). Although it has been considered a disorder of childhood, evidence is emerging of on-going and impairing adult symptom expression in about one- to two-thirds of patients (Sibley et al., 2018; Turgay et al., 2012). Symptoms of hyperactivity/impulsivity may decline with increasing age but inattentiveness decline to a lesser degree (Faraone et al., 2006). Similarly, symptoms of mood dysregulation, sleep disturbance, procrastination, and low frustration tolerance tend to persist or to worsen throughout adult life (Biederman et al., 2020; Yadav et al., 2021). Furthermore, epidemiological research in children has shown that ADHD is commoner in males than females (Buitelaar, 2002). However, epidemiological studies in adulthood indicate an equal gender distribution in ADHD (Kooij et al., 2005), or a small predominance for men (Kessler et al., 2005). The over representation of males in childhood may reflect under diagnosis in females who may present more often with inattention problems whereas hyperactivity with ensuing disruptive behavior is commoner in boys. This may change in adulthood, due to increased help seeking among females compared to males (Rucklidge, 2010). This increased self-referral might explain the higher numbers of women with ADHD presenting in adulthood (Ginsberg et al., 2014). In addition, a number of studies have found that many children with ADHD go unrecognised and may present in adulthood for the first time (Fayyad et al., 2017; Kooij et al., 2010). It is also possible that some of the adult cases are manifested for the first time in adulthood given that a number of studies have suggested an adult-onset form of ADHD (Agnew-Blais et al., 2016; Caye, Rocha et al., 2016; Moffitt et al., 2015). Extant data is inconsistent resulting in an ongoing debate and a recognised need for further research to clarify this important point (Agnew-Blais & Arseneault, 2018). Arguably, the diagnosis is harder to establish in adults than it is in children due to symptom overlap, sharing numerous symptoms with

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other psychiatric pathologies (Ginsberg et al., 2014; Mao & Findling, 2014) and obtaining a collateral history may be difficult. Additional reasons for under-diagnosis of adult ADHD include the frequent presence of comorbid psychiatric syndromes, which in clinical practice may be identified as the primary or only diagnosis (McCarthy et al., 2013). Professionals working in Adult Mental Health Services (AMHS) may be less aware that ADHD frequently persists into adult life, less knowledgeable about the clinical presentation of ADHD and the consequences of ADHD across the lifespan (Kooij et al., 2010). During the last decade a number of studies have investigated the prevalence of adult ADHD in psychiatric populations. The most concerning finding is that only a small fraction of adults with ADHD are diagnosed within the mental health services (Adamis et al., 2018; Deberdt et al., 2015; Nylander et al., 2009). Varying methodological differences between studies contribute to the wide range in prevalence rates. A previous systematic narrative review has reported this variability in prevalence rates and indicated that in psychiatric populations the rate of ADHD is higher than in the general population (Gerhand & Saville, 2021). However, accurate estimates of prevalence of adult ADHD are crucial for service planning and resource allocation, including development of specialist clinics.

Thus, the aim of the present study is to conduct a systematic review of the available epidemiological studies and to estimate the pooled prevalence of ADHD in adult psychiatry outpatient clinics. Secondary aims are to examine factors that influence the pooled prevalence and to test the null hypothesis that there will be no difference in the rate of ADHD diagnosis by gender by using meta-analytic techniques.

Methods

Search Strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines were followed. (Moher et al., 2009). The databases PubMed, EBSCO, CINAHL Complete, Scopus, and EMBASE were searched by using Boolean operators of the following keywords: Prevalence, Epidemiology, ADHD, Attention Deficit Hyperactivity Disorder, Hyperkinetic Disorder, Psychiatric Population, Psychiatric Patients, Mental Health and Filters: Journal Article, English, Adult (Prevalence AND [ADHD OR Attention Deficit Hyperactivity Disorder OR Hyperkinetic Disorder] AND [Psychiatric Population OR Psychiatric Patients OR Mental health]). Detailed search strategy is reported in Supplemental Material. We also searched for other relevant articles in the references of original papers and reviews mostly in our personal databases. The final search was done on 21/9/21 and it was limited to publications in the English language, but not limited to the year of publication.

Studies Selection

Two authors (DA, CF) independently performed the search, screening the title and abstract of all articles yielded by the keywords search. A review of the full-text articles of the selected studies was also independently evaluated. Any disagreement between them was resolved by consensus. Studies were included if: (a) they had prospective design, (b) examined populations attending psychiatry outpatient clinics only, (c) clearly defined ADHD and non-ADHD groups by using a validated scale or research diagnostic criteria, (d) data were available and sufficient to provide statistical information for the meta-analysis, and (e) English language. Exclusion criteria were (a) retrospective studies, (b) studies which examined a population with a specific psychiatric disorder (e.g., studies in bipolar disorder or eating disorder or learning disabilities, etc.), (c) studies in settings other than outpatient clinics (e.g., inpatients), and (d) abstracts from conference or proceedings. However, further searches of the latter were conducted to establish if any had been subsequently published. Duplications were removed, retaining the larger study, if applicable. The same two authors (DA, CF), also independently rated all studies using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Studies Reporting Prevalence Data (Munn et al., 2014). The quality appraisal of the studies is shown in Supplemental Table S1.

Data Extraction and Statistical Analysis

Studies identified included both one and two stage studies. Data have been extracted and analyzed for the phase one (screening) and the phase two (in depth interviews) separately. Therefore, from each study the following data were extracted: country in which the research was conducted; design of the study; description of the sample; age range of participants; mean age and standard deviation; number of analyzed participants in the first and separated in the second phase of the study; scales/criteria for diagnosis of ADHD; gender; the number of participants with ADHD and the number of non-ADHD participants. Study quality was not quantified due to the subjective nature of the process and concern regarding the number of variables in the statistical models. Given the small number of identified studies, any unnecessary increase in variables and levels (moderators) increased the risk of biases.

For the meta-analysis, a random-effects model was incorporated, given that the studies included different populations. When moderators (confounding variables) were included, a mixed-effect model was constructed. To assess the overall effect of multiple moderators within mixed-effect models, omnibus tests of all the model coefficients were conducted (referred to as QM). If a study reported median and interquartile range or range for one variable, the mean and standard deviation were calculated based on

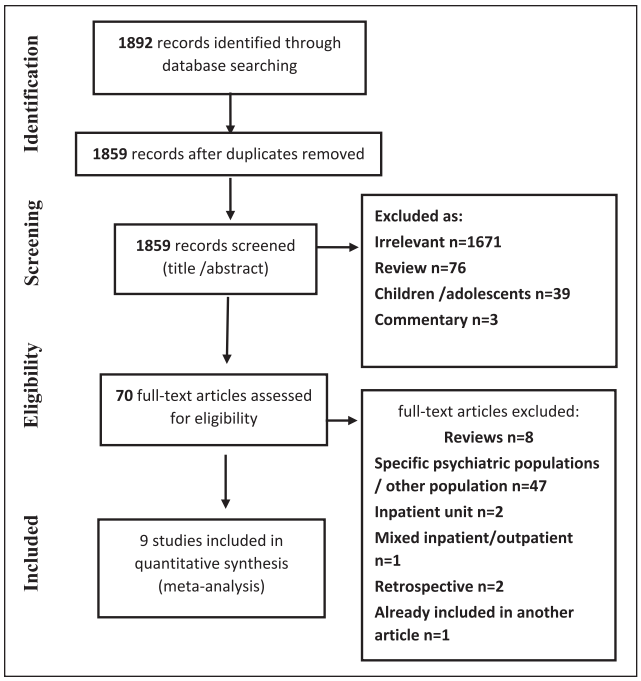

Figure 1. Flow diagram of the study.

already published methods (Hozo et al., 2005; Wan et al., 2014).

For the measurement of effect size, the inverse of double-arcsine transformation was calculated using the DerSimonian-Laird estimator. In addition, homogeneity was investigated using the Q test and for the quantification of heterogeneity, the Higgins I^2 (which shows the percentages of variance not explained by chance). Bias in study availability (publication bias) was explored by visual inspection of funnel plots and using Egger's test. Influence diagnostics were also used to examine the influence of each study on the results. For the meta-regression models (moderators) the Knapp-Hartung adjustment was used to obtain more reliable estimates (Higgins et al., 2002). Analysis was carried out with the "metafor" and "meta" package of R software (Balduzzi et al., 2019; Viechtbauer, 2010).

Results

From a total of 1,859 records, nine studies where identified which fulfilled the inclusion criteria and from which estimates of the prevalence of ADHD based on screening was established (one-stage studies). Five of the studies allowed for prevalence estimates from two stage design. Flow diagram of the selection of studies is given in Figure 1.

Meta-analysis of studies using screening scales. The most common scales used were the Adult ADHD Self-Report Scale; the six questions (ASRS-6) or the full scale (ASRS) for the assessment of adult ADHD symptoms, the Wender Utah Rating Scale (WURS) for retrospective rating of childhood ADHD symptomatology or a combination of those two and the Mini-International Neuropsychiatric Interview-Plus (MINI-Plus). See also Table 1.

The studies which meet the inclusion criteria and selected are presented in Table 1. A total of 5,149 people had been screened of whom 2,983 (57.9%) were female. A total of 1,727 participants were identified as ADHD positive using various screening scales.

Using a random-effects model, it shows that the pooled prevalence of the examined studies is 26.7% (95% CI [17.2–37.4]). The forest plot for the meta-analysis is shown in Figure 2. The Q test for heterogeneity showed significant heterogeneity among the studies $Q = 466.33$, df: 8, $p < .001$, and the $I^2 = 96.96\%$. Egger's test shows no funnel plot asymmetry ($t = 1.72$, df: 7, and $p = .13$) and, therefore, small risk of publication bias (Funnel plot is shown in Supplemental Figure S1). Examination of the influence statistics showed no significant influence of any individual study (see Supplemental Figure S2).

Moderators (Meta-Regression Analysis)

Age of participants. A mixed-effect model was used for this analysis. It was found that the age of the subjects did not have any significant effect on the prevalence (β estimator = 0.0018, $z = 0.195$, $p = .846$, 95% CI [−0.0165 to 0.02], and the heterogeneity has been increased to $I^2 = 97.43\%$.

Sample population. Three studies excluded individuals with psychosis, while the other six included all outpatient attendees irrespectively of psychiatric diagnosis (see also Table 1 for those particular studies). A mixed effects model showed that when all patient cohorts were included, the estimation of prevalence was lower (β $\text{estimator}_{(all)} = 0.502$, $z = 10.048$, $p < .0001$, 95% CI [0.404–0.600], β $\text{estimator}_{(nonpsychotic)} = 0.629$, $z = 8.812$, $p < .0001$, 95% CI [0.489–0.769]). Test of moderators coefficients (QM) showed this difference to be significant: $QM = 178.6238$, df: 2, $p < .0001$. Indeed, subgroup analysis shows that the pooled prevalence of the studies without a psychotic population was 34%, CI: (17–54), compared to 23%, CI: (19–31), in populations with no diagnostic exclusion. When the sample population was included as a moderator, the heterogeneity was reduced to $I^2 = 95.43\%$.

Scales used. In this analysis the effect of each screening scale for ADHD prevalence was examined. A mixed effects model was constructed with "scales" inputted as the moderator. The results of the model are shown in Table 2. As expected, all the scales had a significant effect on the prevalence, WURS has the highest effect and MINI-Plus the lowest. Thus, when the WURS is used alone the prevalence is estimated higher and when the MINI-Plus is used alone lower prevalence estimates were reported. The QM test shows that

Table 1. Characteristics of Studies in Prevalence of ADHD (Screening Phase).

Authors	Country	Age range	Design	Population	N total	Scales	Criteria	Mean age	SD	Male	Female	ADHD + males	ADHD + females	ADHD − males	ADHD − females	ADHD+	ADHD−
Almeida Montes et al. (2007)	Mexico	18–55	Cross-sectional	Nonpsychotic	161	MINI-Plus	DSM-IV-TR	28.39	10.7	59	102	5	22	54	80	27	134
Nylander et al. (2009)	Sweden	NR	Cross-sectional	Nonpsychotic	141	WURS	DSM-IV	39	13.19	43	98	10	47	33	51	57	84
Syed et al. (2010)	Ireland	18–65	Cross-sectional	All	243	ASRS-6	DSM-IV	42.5		106	137	40	18	66	119	58	185
Rao and Place (2011)	England	20–70	Cross-sectional	All	124	ASRS/WURS	DSM-IV	45		57	67	12	15	45	52	27	97
Deberdt et al. (2015)	Multinational	17–72	Cross-sectional	Nonpsychotic	2,274	ASRS-6	DSM-IV	43.25	7.95	937	1,337	NR	NR	NR	NR	1,079	1,195
Leung and Chan (2017)	China	18–64	Cross-sectional	All	254	ASRS-6	DSM-IV	42	11.4	73	181	NR	NR	NR	NR	94	160
Adamis et al. (2018)	Ireland	18–65	Cross-sectional	All	634	ASRS/WURS	DSM-IV	40.38	12.85	308	326	64	67	244	259	131	503
Stickley et al. (2018)	Japan	18–65	Cross-sectional	All	684	ASRS-6	DSM-IV	43.3	11.5	178	506	NR	NR	NR	NR	173	667
Valsecchi et al. (2021)	Italy	18–70	Cross-sectional	All	634	ASRS-6	DSM-IV-TR	47.2	12	335	229	NR	NR	NR	NR	81	553

Note. NR = no reported; WURS = Wender Utah Rating Scale; ASRS = Adult ADHD Self-Report Scale.

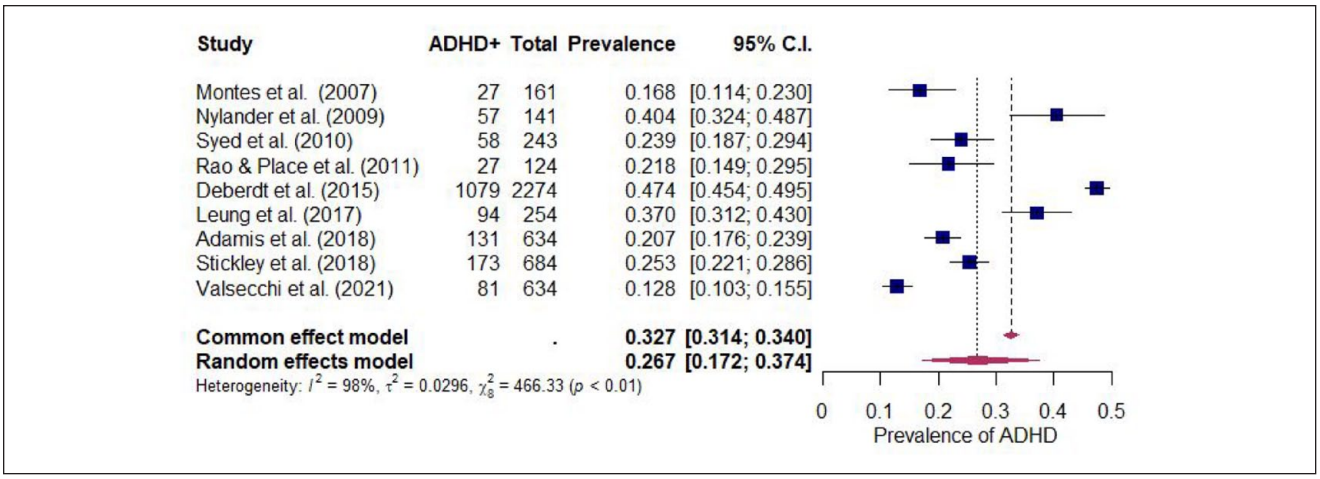

Figure 2. Forest plot for studies examined prevalence of ADHD using screening scales.

Table 2. Parameters Estimates When the Scales Used as Moderator Variable.

						CI	
	n	β estimate	*SE*	z-Value	*p*-Value	Low	Upper
ASRS-6	5	0.5644	0.0609	9.2689	<.0001	0.4450	0.6837
ASRS/WURS	2	0.4800	0.0978	4.9071	<.0001	0.2883	0.6717
MINI-Plus	1	0.4246	0.1397	3.0397	.0024	0.1508	0.6985
WURS	1	0.6897	0.1405	4.9098	<.0001	0.4144	0.9651

Note. *n* = number of studies; *SE* = standard error; CI = confidence intervals.

those differences were significant (QM=143.3379, df :4, p<.0001). However, when the scales used as a moderator, the heterogeneity was increased to I^2=97.57%.

Subgroup analysis shows that the prevalence of the studies using MINI-Plus (one study only, Almeida Montes et al., 2007) was 16.80%, CI (11.45–23.3). In the study which used the WURS alone, (Nylander et al., 2009) the prevalence estimate was 40.4%, CI [32.5–48.6]. Five studies using the ASRS-6 (Deberdt et al., 2015; Leung & Chan, 2017; Stickley et al., 2018; Syed et al., 2010; Valsecchi et al., 2021), gave a pooled prevalence of 28.52% (CI [17.38–41.16]). In two studies, which use both ASRS and WURS (Adamis et al., 2018; Rao & Place, 2011), the pooled prevalence was intermediate at 20.81% (CI [17.98–23.78]).

Meta-analysis of studies employed second phase epidemiological investigation. Five studies (with 3,054 patients, 57.23% female) reported prevalence rates using a two-stage design, and hence a more detailed assessment. The studies are presented in Table 3. The number of those diagnosed with ADHD was 561 (18.4%).

The pooled prevalence of ADHD in psychiatry outpatient clinics from the five studies was estimated to be 14.61%, CI (10.39–19.41). The forest plot for the meta-analysis is shown in Figure 3. The Q test for heterogeneity showed significant heterogeneity among the studies Q=48.14, df: 4, p<.001, and the I^2=93.54%. Egger's test shows no funnel plot asymmetry (t=1.28, df: 3, and p=.91) suggesting no publication bias. Examination of the influence plots (see Supplemental Figure S3) and influence statistics showed significant influence of one individual study (Valsecchi et al., 2021). After exclusion of this study, the pooled prevalence from the random effects model was 16.31%, CI [13.88–18.91]. The heterogeneity dropped to I^2=57.45% and was no longer significant; Q=7.051, df: 3, and p=.07 (See Figure 4).

Moderators (meta-regression analysis)

Age of *participants.**** The age of the subjects did not have any significant effect on the prevalence (β estimator=−0.012, z=1.67, p=.06, CI (−0.026–0.002), but the heterogeneity was reduced a little to I^2=90.61%.

Sample. When the sample was used as moderator (including/ excluding psychotic patients) the mixed -effect model showed that in studies excluding patients with psychosis, the estimation of prevalence was lower (β $\text{estimator}_{(all)}$=0.367, z=7.60, p<.0001, 95% CI [0.273–0.462], β $\text{estimator}_{(nonpsychotic)}$=0.438, z=7.264, p<.0001,

Table 3. Characteristics of Studies Which Estimate the Prevalence of ADHD (Second Phase; In Depth Assessments).

Authors	*N* total	Scales	Criteria	Mean age	*SD*	Males	Females	ADHD+	ADHD−	ADHD + males	ADHD + females	ADHD − males	ADHD − females	ADHD + Mean age	ADHD- Mean age
Nylander et al. (2009)	47	DSM-IV	DSM-IV	35.8	11.61	43	98	30	17	9	22	34	76	NR	NR
Deberdt et al. (2015)	2009	DIVA.2	DSM-5	41.5	8.04	834	1,175	349	1,660	180	169	654	1,006	NR	NR
Leung and Chan (2017)	254	DIVA.2	DSM-5	42	11.4	73	181	49	205	18	31	55	150	40.1	42.6
Adamis et al. (2018) *	110	CAADID	DSM-5	35.9	11.75	308	326	89	21	43	46	265	280	35.62	36.52
Valsecchi et al. (2021)	634	DIVA.2	DSM-IV	47.2	12	335	299	44	590	17	27	282	308	41.6	47.6

Note. NR = no reported.
*Unpublished data (Authors kindly provided data).

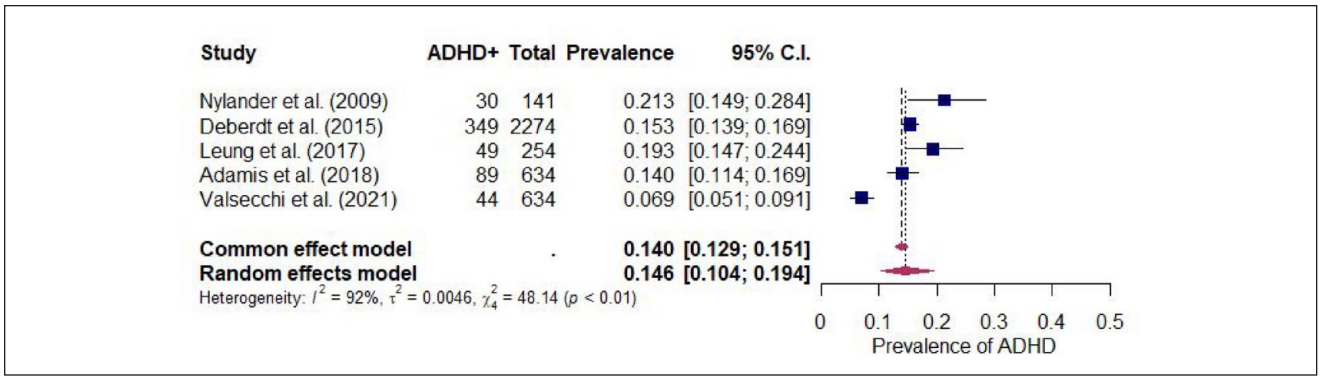

Figure 3. Forest plot for studies examined prevalence of ADHD using second phase assessments.

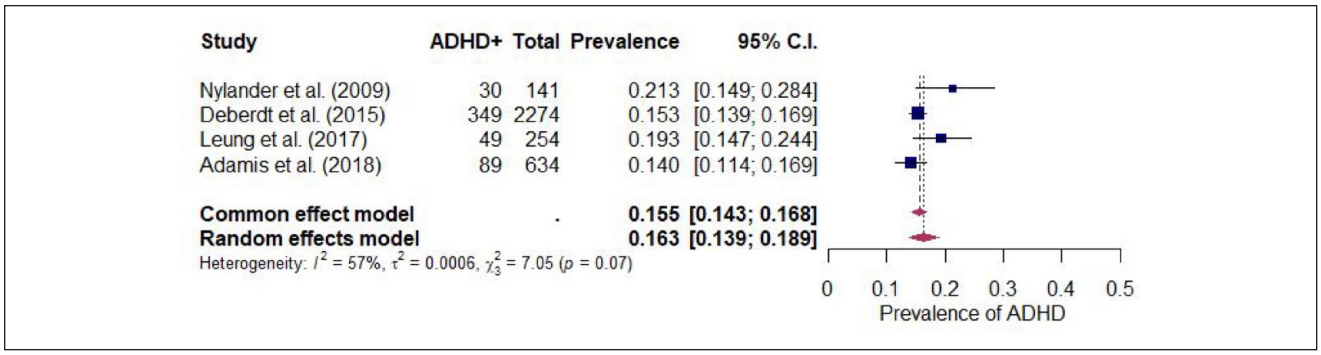

Figure 4. Forest plot after excluding one study with significant influence statistics.

CI [0.32–0.56]). QM test shows that this difference was significant QM = 110.566, *df*: 2 and $p < .0001$.

Criteria used. Table 3 highlights that all studies used scales which were based on DSM-VI criteria, but some studies also applied DSM-5 criteria after converting the scales to DSM-5 (adjusting for age of onset and number of symptoms). Diagnostic criteria were, therefore, added as a moderator. Studies using the DSM-5 criteria had higher coefficients (β estimators) compared to those using DSM-VI criteria: β $\text{estimator}_{(\text{DSM-5})} = 0.413$, $z = 8.2138$, $p < .0001$, CI [0.315–0.512], β $\text{estimator}_{(\text{DSM-IV})} = 0.366$, $z = 5.734$, $p < .0001$, CI [0.241–0.491] and this difference was significant, QM = 100.347, *df*: 2, and $p < .0001$. Therefore, studies applying DSM-5 criteria tent had higher prevalence rates compared to those using DSM-IV criteria.

Meta-analysis of ADHD diagnosis according to gender. The null hypothesis, that there is no difference in gender ratio in terms of ADHD diagnosis, was tested. This meta-analysis included data of 1,593 males of whom 267 had been diagnosed with ADHD and 1,809 females of whom 295 were diagnosed with ADHD (see also Table 3). Using a random-effects model with restricted maximum likelihood estimation, it was found that gender had a small (*OR*: 1.17, 95% CI [0.82–1.66]) non-significant ($p = .38$) effect on the presence or not of ADHD. The *Q* test for heterogeneity showed significant heterogeneity among the studies $Q = 9.96$, *df*: 4, $p = .04$, and the $I^2 = 57.8\%$.

Discussion

In summary, the meta-analysis concluded that when screening tests were used, the pooled prevalence of ADHD among psychiatry outpatient patients was 27%. When a more detailed assessment is conducted, prevalence rates of ADHD dropped to 14.61%. Among existing screening scales, WURS provided the highest estimates, followed by the ASRS-6 and the most restrictive was the MINI-PLUS. A lower prevalence rate was also found when using a two-stage study design.

When DSM-5 criteria are used, as opposed to DSM-IV, prevalence rates are higher. The diagnostic profile of the study cohorts had an effect on the prevalence of ADHD. When individuals with psychosis were excluded, the prevalence increased in both epidemiological study designs (screening and in-depth assessments). The age of the sample population did not have any effect on the estimated

prevalence. Finally, it was found that ADHD was equally prevalent in both genders.

False positives are typically identified following a two-stage assessment process and, therefore, it is not surprising that the estimated prevalence was lower following in depth assessments. This is likely to be the most approximate estimation of true prevalence. Even with this more conservative estimate, rates of 14.61% ADHD among adult psychiatry outpatient clinic attendees are high. Nearly one out of six attendees have ADHD. Of equal concern is the report that the majority of ADHD cases were undiagnosed, and as such unlikely to be treated. Individuals with unrecognised ADHD might present to adult services with related or comorbid symptoms, which may take precedence in diagnosis and subsequent treatment. It was suggested that treatment efficacy of other disorders is limited when the underling ADHD is not treated (Katzman et al., 2017; Sternat et al., 2018). This finding has important clinical implications. General adult psychiatrists need to be aware that ADHD may persist into adulthood and need to be prepared to treat it. Until recently the prominent impression among general adult psychiatrists was that ADHD was a disorder of childhood (Kooij et al., 2010; McCarthy et al., 2013). Evidence shows that persists into adulthood, has high comorbidity and is under recognized and untreated across countries and cultures (Fayyad et al., 2017). In addition, there is a possibility that for some, ADHD may have onset later in the life. Three population-based studies have suggested an adult-onset form of ADHD (Agnew-Blais et al., 2016; Caye, Rocha et al., 2016; Moffitt et al., 2015), but these findings are challenged by contrasting data . For example, a more recent study based on repeated comprehensive assessments from age 10 to 24 of a normal sample finds that only two cases were diagnosed with adult-onset ADHD. (Sibley et al., 2018). Cases of adult-onset ADHD symptoms were mainly those diagnosed with substance use and other mental disorders (Sibley et al., 2018). Thus extant data are insufficient to confirm an adult-onset ADHD although sporadic cases may exist (Asherson & Agnew-Blais, 2019; Taylor et al., 2021).

The prevalence of ADHD in adult mental health services is higher than that estimated in the general population. A meta-analysis of seven epidemiological studies of community samples (Simon et al., 2009) reported population prevalence of 2.5%. A multinational study, including 20 countries from the World Health Organization, reported a similar prevalence of 2.8% worldwide. (Fayyad et al., 2017). The higher rate found in psychiatry outpatient clinics may be explained by the high rates of psychiatric comorbidity among adult ADHD. Untreated childhood ADHD is known to be a risk factor for subsequent mental illness, including depression, conduct disorder, and substance misuse (Biederman et al., 1997). There is some suggestion that this is both a shared genetic liability and a causal relationship (Demontis et al., 2019). Individuals with ADHD who received treatment with medication had a 20% lower rate of depression than their untreated counterparts (Chang et al., 2016). These presentations are often more obvious, and may result in service attendance. It is also possible for some individuals that subclinical ADHD becomes clinical as the person becomes older related to the loss of the structure of school and family home and exposure to more demanding and less supportive environments (Caye et al., 2017).

Other systematic reviews and meta-analyses in specific psychiatric populations, for example (Gerhand & Saville, 2021; van Emmerik-van Oortmerssen et al., 2012) also reported higher prevalence estimates in psychiatric populations compared to community general population.

Regarding demographic factors (age, gender), the present meta-analysis showed no significant effects. This is at odds with previous studies which have shown that symptoms of ADHD reduce with age and show lower preponderance among females in community samples. (Fayyad et al., 2017; Polanczyk & Jensen, 2008; Simon et al., 2009). Generally, the male-to-female ratio in clinical samples goes from 3:1 in childhood to around 1:1 in adulthood (Caye, Spadini et al., 2016; Gaub & Carlson, 1997; Grevet et al., 2006), suggesting that males had a tendency to overcome the disorder, while ADHD in females had a tendency to persist. One explanation is that hyperactivity in boys decreases with age whereas the attentional difficulties in girls become more apparent and impairing with age. Another possible explanation is under-diagnosis in girls, perhaps due to their presentation with predominantly attentional problems rather than the more typical and obvious combined type, with both attentional and hyperactive-impulsive type (Caye, Spadini et al., 2016; Ginsberg et al., 2014; Rucklidge, 2010). Given the study context in clinical samples, the more likely explanation is one of referral bias, in that in the examined studies, attendance is more heavily weighted to females.

An exploration of the specifics of age associations is crucial given the variable findings in extant data. A prior meta-analysis of population-based studies reported a negative association with age (Simon et al., 2009) in that prevalence rates decreased with increasing age. In the Simon et al. (2009) meta-analysis, the mean age was 34 years which is not representative of the adult population mean age (Simon et al., 2009). Similarly, the studies reviewed in the present meta-analysis did not include individuals over age 70. However, one Swedish population-based study in older people (over 65) reported a 3% prevalence of continuity of childhood ADHD symptoms into adult life. This rate of continuity remains after excluding those with dementia (Guldberg-Kjär & Johansson, 2009; Guldberg-Kjar & Johansson, 2015). A second study, in a Dutch older population (55–85 years), reported a prevalence of 2.8% who had

full-blown, syndromic ADHD and 4.2% symptomatic ADHD (Michielsen et al., 2012). Although both studies may suggest persistent of ADHD symptomatology into older age comorbidities or other causes of similar symptomatology were not well controlled.

This study also found that the presence or absence of psychotic disorders affect ADHD prevalence rates. In studies which excluded those diagnosed with psychotic disorders prevalence rates were lower. In clinical practice it is clear that ADHD does not prevent the development of psychotic illness in the same individual. Indeed, epidemiological and clinical studies (Dalsgaard et al., 2014; Hennig et al., 2017; Jutla et al., 2020) have shown that there is an increased relative risk for schizophrenia or psychotic disorders in people with ADHD compared to the normal population. Similarly, studies using genetic and clinical variables showed a significant link of ADHD and psychosis (Brainstorm Consortium, Anttila et al., 2018; Olde Loohuis et al., 2021). Despite a lower prevalence of ADHD among individuals who also have a psychotic disorder, the exclusion of them will lead to unhelpful underestimates of the true cases of ADHD (false negatives). In contrast, inclusion could also increase the risk for false positives if the cognitive impairment is attributed to ADHD and not to psychotic illness. This points to a need for, future studies to include all psychiatry outpatient attendees with careful application of a comprehensive psychiatric assessment, to make sure that the attention symptoms are not due to the psychotic illness.

The screening scales used in the different studies examined had an effect on prevalence rates. This is common in epidemiological studies because sensitivity and specificity of scales can influence the results. However, in the present meta-analysis the combination of the scales showed that WURS alone (which is a retrospective self-reported scale for childhood symptoms of ADHD) increased the prevalence while the use of MINI-PLUS alone (which is a structure scale) reduced it. Given that all scales used had a good sensitivity and specificity, it seems from the present analysis that the combination of a retrospective childhood scale (WURS) and a scale examining present symptomatology (ASR-6) is the more reliable method to achieve an approximate estimation of prevalence for a screening stage of an epidemiological study.

Finally, the results show that the estimated pooled prevalence was higher when the DSM-5 criteria were used compared to DSM-IV criteria. Individual studies in different settings have also reported a higher prevalence of ADHD when the DSM-5 criteria were used for example (Bitter et al., 2019; Rigler et al., 2016; van de Glind et al., 2014). The greater inclusiveness noted applying DSM-5 criteria probably results from diagnostic changes. DSM-5 has (a) increased the age of onset from 7 to 12 and (b) reduced the number of symptoms in DSM-5 from six to five (out of nine) for those aged 17 and above.

Limitations of the Study/Strengths of the Study

One important limitation is that there were relatively few studies which examined the prevalence of ADHD using a two-stage design. Thus, the confidence interval of the pooled prevalence was wide. More studies are needed to reach a more precise estimate. A second limitation is that of the high level of heterogeneity and the very small number of papers included in the regression analyses may lead to biased results with limited statistical power. These latter two limitations are important weaknesses of our finding. In addition, we include a study (Nylander et al., 2009) in which the WURS scale was used in the screening stage. WURS is a retrospective scale for assessment of ADHD in childhood and perhaps can increase the risk of bias in the estimation of prevalence when used in adults. However, the estimation of the influence statistics did not show any significant influence of this study. Despite these limitations, the present work has some strengths of which the most important are the systematic approach and the analyses of different moderators.

Recommendations

This work aligns with other emerging studies attesting to a high prevalence of ADHD in adult mental health outpatient clinics. However, more studies are needed in order to have a greater body of evidence, and a more precise estimate of the prevalence of ADHD in adult outpatient psychiatric clinics. This is essential to allow for optimum service planning. Future studies needs to be well designed

With one or two stages, dependent on resources, to include an in depth assessment for ADHD in order to increase diagnostic reliability and reduce false positive and most importantly false negatives. Where specialist ADHD services are being established, their brief should include training colleagues in adult psychiatric services in the diagnosis and management of ADHD in adults. Specialist services should also provide opinions and advice on treatment for these patients as well as in young people with ADHD transferred from child and adolescent psychiatry services to adult services and who continue to require treatment for ADHD.

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