

Evaluation and Treatment of Attention-Deficit Hyperactivity Disorder: A Systematic Review

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Abstract

Objective: A growing number of research on ADHD among children on evaluation and treatment. The goal of this systematic review was to spot light on evaluation and treatment of ADHD among children and young adults.

Methods: Authors began with recognizing the important examination proof that spots light on evaluation and treatment of ADHD among children and young adults. Authors led electronic writing look in the accompanying data sets: Ovid Medline (2000- present), Ovid Medline Daily Update, Ovid Medline in process and other non-filed references, Ovid Embase (2000- present), The Cochrane Library (latest issue) and Web of Science. Just examinations in English language were incorporated. The precise selection was acted in close collaboration with a clinical examination curator.

Results: Following the PRISMA criteria, a narrative synthesis of the findings was presented. Overall, the research suggested a significant negative correlation between ADHD symptoms and a person's aptitude for mathematics. The inattentive aspect of ADHD was shown to have a stronger correlation with this trait than the hyperactive-impulsive aspect. Two studies demonstrated a strong genetic link between arithmetic and ADHD, with the inattentive subtype being more strongly associated with math than the hyperactive-impulsive subtype.

Conclusion: Inattentive ADHD symptoms are most affected by math, according to the research. Distinct ADHD subgroups may have different causes. Different varieties of ADHD manifest differently in youngsters, therefore it's crucial to correctly diagnose one to predict arithmetic difficulties. Shared genetic traits contribute to ADHD and math covariation, but environmental variables also play a role. These insights help us understand ADHD and may lead to non-pharmacological therapies that target the underlying causes. If these therapies are utilized alone or in addition to pharmaceutical therapy, children may do better in school. ADHD and arithmetic problems may have a neurological cause.

Keywords: ADHD; Children; Evaluation; Treatment; Systematic Review

Introduction

Like other psychiatric syndromes, attention-deficit hyperactivity disorder (ADHD) has evolved and been refined over the past 50 years, from its initial contemporary description in the Diagnostic and Statistical Manual of Mental Disorders (second edition; DSM-II) as a hyperkinetic reaction of childhood to its current inclusion in DSM-5 [1] as a lifespan neurodevelopmental condition with specific criteria for

children and adults. Research and clinical needs have guided this process of reviewing and reformulating diagnostic criteria throughout time. When seen through the lens of scientific inquiry, the ADHD diagnostic formulation may be seen as a component of a more comprehensive working hypothesis on the origins and organizational principles of the illness [3]. That's why it's important to compare this diagnostic formulation to hard data; that's how we know it's getting closer to reflecting the truth of nosology as borne out by the results of established studies. Since diagnostic systems' major function is to provide practical guidelines for clinical decision making, the bar for diagnostic innovation is set high, and diagnostic development has been mostly incremental in character [4]. The fundamental causes of ADHD have also been left out of this re-evaluation and refining process since diagnostic systems in psychiatry have chosen a descriptive or phenomenological approach. This diagnostic scheme may, however, soon be revised. Research on the causes and mechanisms of attention deficit hyperactivity disorder (ADHD) presents fresh challenges to our understanding of the disorder and opens the door to possibly more successful therapy methods.

An essential objective is to leverage scientific findings to provide a wider variety of more effective treatment interventions for patients with ADHD.

Having attention deficit hyperactivity disorder (ADHD) is a significant burden on the person, their family, and the community [5]. ADHD is a common, debilitating illness that is commonly associated with other mental problems. Several substances are readily accessible, highly recommended, and commonly employed as part of medication-based therapy methods [6,7]. However, it is still unclear whether or not these interventions are successful in the long run on crucial academic, occupational, and social outcomes [8,9]. In addition, inadequate adherence exacerbates such consequences, particularly during prolonged usage in adolescents [10]. The development of tolerance to medicine, stigma associated with ADHD, and social resistance to treatment are all examples of psychosocial processes that may be contributing to these constraints [8,11]. Clearly, there is a great need for new long-term therapy for ADHD. By altering the way the field thinks about the causes of ADHD, scientific advances may help encourage the creation of new tactics for boosting the efficacy of present therapies or the emergence of new options. This Seminar will discuss the problem of long-term therapy in three parts. The first part of this article describes the general agreement among experts on the clinical state of ADHD, including its diagnosis, epidemiology, developmental course, and therapy. The second section presents an up-to-date overview of ADHD science, focusing on advancements in aetiology and pathophysiology. In the third part, we take a cursory look at how some of the most significant scientific findings are starting to challenge notions of ADHD in specific ways and at the possibility that they may stimulate new therapeutic views and treatments.

Aim of the Study

The main aims of our systematic review will be:

- To investigate the evaluation of ADHD among children and young adults.
- To assess different treatment approaches among children and young adults with ADHD.

Methods

Eligibility criteria

- Studies including children and young adults aged 2 - 18 years.
- Diagnosed within the ADHD diagnostic criteria of ICD-11 or DSM-5 including all terms associated with ADHD.
- Exclusion of:
 - Animal studies
 - Children diagnosed with ADHD and any other chronic conditions.

Study types

Randomised control trials (RCT), non-RCT, observational studies, case control studies. Case reports and case series will be excluded.

Outcomes

Primary

Assessment of treatment and evaluation of ADHD among children and young adults.

Secondary

None.

Data collection and analysis

Information will be extracted from the included articles utilizing an electronic information extraction structure using EndNote software. Two reviewers freely will extract information, utilizing a standard information extraction structure which will be created by the reviewers. The extraction structure incorporated the accompanying data:

1. Publication subtleties: Title, authors, journal name and year and city, of distribution, country in which the review was led, sort of distribution, and wellspring of financing.
2. Study subtleties: Study design (cross-sectional, cohort, case-control), settings (clinical or population based), concentrate on transience (planned or review), patients' enlistment techniques (successive or non-continuous), the geographical area, year of information assortment and reaction rate, qualification (consideration and avoidance rules), name of appraisal tool(s), approval of evaluation tool(s).
3. Study members' subtleties: Number of people reviewed/examined, population qualities including mean age (SD), and gender distribution, relationship status, demographic data.

Search strategy

The studies will be identified through search in PubMed, Cochrane library, Embase, Scopus, Web of Science, CINAHL and google scholar databases. Grey literature will be also searched. Search will be done and selecting only articulated published in English language. Moreover, selected articles will be chosen from peer-reviewed journals. In addition, the bibliographies of any qualified articles recognized will be checked for extra literature and reference search will be done for all included references utilizing ISI Web of Science. The selected period during the search will be (2000- present).

Keywords

"Child" OR "Children" OR "Young" OR "Attention" OR "Deficit" OR "Hyperactivity" OR "Disorder" OR "ADHD" OR "Treatment" OR "Evaluation" OR "Diagnosis" OR "Management" OR "Systematic Review".

Study selection

Out of the whole list returned by the database search, one reviewer will choose the most relevant titles. The abstracts of the remaining studies will be reviewed first, following the aforementioned inclusion and exclusion criteria, after duplicates have been culled from the list using reference works. The second reviewer will then categorize the research as "include," "unsure," or "reject". An impartial third party will be contacted in the event of a dispute.

Strategy for data synthesis

We expect that, owing to the nature of the topic, there will be scarce of published randomized and non-randomized control studies accessible as expected by researchers. In order to do this, we will have two reviewers utilize a data extraction table to compile informa-

tion on the study’s design, population, inclusion/exclusion criteria, sample characteristics, methodology, and findings. This data will be utilized to conduct in-depth analyses of the papers, from which appropriate conclusions will be drawn to provide answers to the research questions. After assessing the title, abstract, and full text of the studies according to the eligibility criteria, the data of interest will be collected using a standard form. The following information will be collected:

- Authors,
- Date,
- Setting,
- Diagnosis of ADHD,
- Management approach for ADHD.

Data analysis

The data that will be recovered were entered into the Statistical Package for the Social Sciences, known as SPSS, and coded before a frequency analysis that will be carried out in order to determine patterns of similarity. The content that is duplicated throughout the selected articles will be organized into its own individual tabs so that it could be seen more clearly. The data will be collected from the study that is considered to be eligible using descriptive statistics. After that, a narrative synthesis will be constructed using the summaries of the selected articles. Forest plots will be generated using extracted data entered to SPSS.

Results

A total of 1618 studies were identified in the search, all of them were assessed for eligibility, and 16 articles were included in this review (Figure 1).

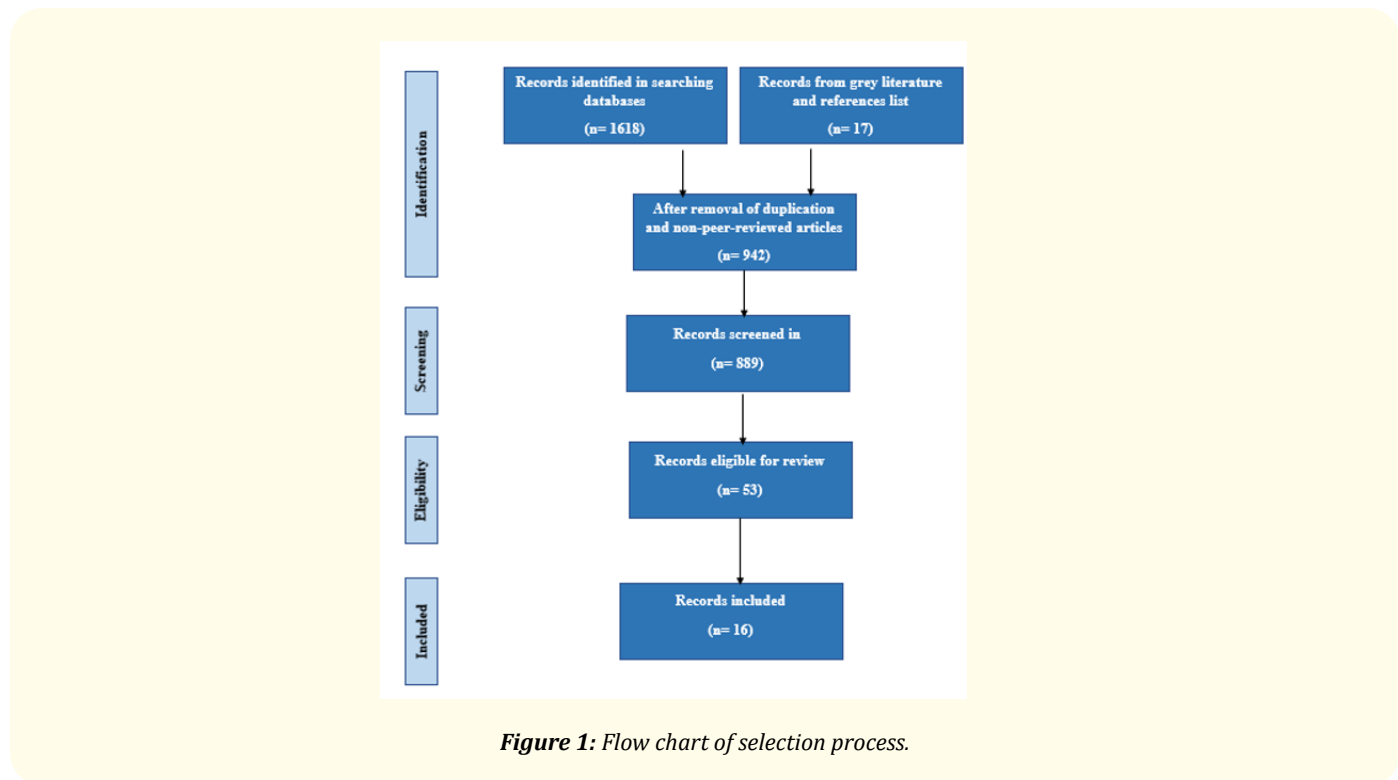


Figure 1: Flow chart of selection process.

An individual's physical health, as well as their academic, social, and vocational performance, may be negatively impacted by ADHD. ADHD is a disorder that often begins in infancy but may also be persistent, persisting at least to some degree into adulthood. Psychoeducation, learning and academic assistance, school accommodation, symptom management intervention, parenting behaviors, and assessment and treatment of related disorders should all be included into any comprehensive evaluation of treatment results. As a patient develops, so too will their treatment plan. When treating a kid aged 6 - 12, for instance, the focus should be on parental behaviors, but when working with an adolescent, psychoeducation about the dangers of drug misuse and car accidents should take center stage. It is important to recognize the widespread unmet clinical need for effective treatment of ADHD before continue with our assessment of the various methods now in use [12].

Psychostimulant drugs are recommended by medical organizations in the United States [13], Canada [14], Latin America [15], and Europe [16]. The Internet is a great place to get helpful guides and tools for dealing with ADHD [16,17]. Most of these groups, however, advise starting with psychoeducation and behavioral treatment, especially for those with less severe symptoms and disability. However, US standards urge that medication be evaluated at the outset of care [18]. All experts agree that parent training in the form of behavior management should be the first line of defence in treating children less than 6 years old, with medication being reserved for the most extreme or unresponsive instances. Medication treatment for children less than 5 years is not recommended until parent training has been undertaken and a second opinion from a clinician with competence in ADHD in young children has been sought, as per the National Institute for Health and Care Excellence (NICE) guidelines [16].

ADHD is best regarded as the extreme endpoint of a continuum, and there is overwhelming evidence that the differences between individuals with and without ADHD are gradational rather than fundamental. DSM-5 and ICD-11 continue to operationalize ADHD as a categorical diagnostic, meaning that it is a syndrome with symptom thresholds that imply the presence of clear boundaries between health and disorder and between unaffected and impaired. Current clinical limits are fairly arbitrary, founded on clinical experience concerning the number and severity of symptoms or degree of impairment that necessitates care, but there is no proof that this classification is right for ADHD. Is there room for improvement in the present category models, or do they adequately capture the condition's essence? In spite of doubts regarding their therapeutic usefulness, other dimensional models have been presented, but none have been deemed superior to the existing methods in terms of their ease of use and potential impact [19-22].

As was previously noted, there is no question in anyone's mind that ADHD is a complex and diverse condition based on the available scientific evidence. People with the disorder vary greatly from one another in terms of their genetic predisposition, environmental exposures, brain architecture, and cognitive and motivational characteristics, among many other factors. Researching ADHD's variability poses significant problems (studies aimed at doing so need large samples, several measurements that cover the whole spectrum of impairments, and the use of advanced multivariate analytical tools), but it also provides promising therapy prospects. Precision medicine, in which therapies are tailored to each patient's unique set of biomarkers and underlying cognitive and brain processes, might result from an acceptance of heterogeneity [20]. Others with ADHD and executive dysfunctions may benefit from executive training, while people with motivational or cognitive energy anomalies may not. It has been claimed that neuropsychological subtyping of ADHD groups might make this type of approach more feasible [21]. However, advancements are hindered by the fact that there is no agreement on which pathophysiological dimensions are most clinically relevant and whether or not people tend to cluster along these dimensions to create distinct subgroups. The Research Domain Criteria (RDoC) effort at the National Institute of Mental Health in the United States aims to combat the difficulties posed by diversity. ADHD is a lifelong condition that starts in early childhood and spreads throughout later years [22,23].

It was mentioned before how there seems to be several kinds of ADHD in development that aren't now differentiated by diagnostic methods. Though the core of the ADHD phenotype will always be defined by its early onset and continued manifestations into adulthood, four subtypes are emerging that may have important therapeutic implications. Differential prognosis or treatment response of people with these diverse developmental characteristics is still poorly understood, however. Considering a problem from a child's point of view

highlights the potential benefits of early intervention and preventative measures [24]. Cost-effective early identification of at-risk people has been hampered by a lack of knowledge of the early cognitive and behavioral antecedents and determinants of later ADHD [25]. Although innovative techniques to strengthening underlying brain networks are being tested, we also lack effective therapies that can be administered during the earliest years of life [26]. Parental training, psychoeducation, and support have been useful in lowering the likelihood that comorbid disorders would arise and mitigating the impairment that comes with them as a result of the disorder's progression [27].

Discussion

This research synthesis provides evidence for the negative correlation between ADHD and mathematical competence. After accounting for variables including intelligence, age, socioeconomic level, and the use of psychostimulants, the majority of studies (76.47%) still showed a significant correlation [28]. Almost all studies found that people with ADHD symptoms performed worse on arithmetic exams compared to healthy controls, regardless of the study's statistical power. It is worth noting that inattentiveness exhibited a larger link with mathematical issues than hyperactive-impulsive symptoms did in studies that broke down ADHD into its component symptoms. The majority of studies that did not discover a relationship reported a small sample size, suggesting that their analyses were underpowered. Studies with a high level of genetic sensitivity have revealed that shared genetic [29,30] and environmental [19] elements contribute to the often observed association between ADHD and subpar mathematical ability. These investigations provided further evidence that inattentive symptoms of ADHD may be more strongly linked to underperformance in mathematics [30], which is in line with the findings of phenotypic analyses. These findings highlight the need to examine the symptoms of impulsive behavior and how they relate to mathematical aptitude.

Students with ADHD have a harder time studying mathematics in elementary school [31] because the subject demands more sustained mental effort and independent study time than any other. Deficits in executive functioning, such as planning, organizing information, retaining information for future use, inhibiting an inappropriate response, using working memory, cognitive flexibility, and the ability to deduce when provided with limited information, have been linked in multiple studies to this challenge [32,33]. Differential relationships between the two ADHD domains and mathematics are suggested by the greater association between attentional components and mathematics compared to the hyperactive-impulsive variables. This data highlights ADHD's variability and suggests the two domains may have somewhat distinct aetiologies. A behavioural genetics research that looked at the link between inattentiveness and hyperactivity-impulsivity in children aged 7 to 12 lends more credence to this theory [34]. According to the results, genes that play a role in inattention don't interact much with those that play a role in hyperactivity-impulsivity. Genetic variables were found to contribute to the stability of the link between the two dimensions, and it was found that these elements remained mostly unchanged across time. This condition is developmental in nature, and it was shown that there were new genetic factors at each age. Hyperactivity-impulsivity at age 7 predicted the occurrence of inattentiveness at age 12, but not vice versa [34], suggesting a unidirectional longitudinal link between the two characteristics. This might be regarded as evidence for a causal link between the two domains, with the possibility that genetic variables affecting the first domain also affect the second domain.

The DSM-IV criteria for ADHD clinical subtypes are not only based on arbitrary cut offs on dimensional measures of inattention and hyperactivity/impulsivity, but also reflect developmental inconsistencies. As the hyperactive symptoms subside in contrast to the inattentive ones with time, some children showing ADHD-C in early childhood might fit the criteria for ADHD-I later in childhood or adolescence [35]. However, some kids who initially satisfy the criteria for ADHD-H may transition to ADHD-C when inattentive symptoms become more evident over the school years [35]. Therefore, these maturational shifts need to be taken into account when evaluating the research' findings. Only four longitudinal studies were found in this study that looked at the connection between arithmetic and ADHD. More longitudinal study is needed to better understand the aetiology and course of the condition because of the possible influence of development on the disorder. Results from these research may improve categorization and provide direction for non-pharmaceutical approaches to

treatment and prevention. Now that the DSM-V is out, it's possible to diagnose someone with both Attention Deficit Hyperactivity Disorder and Autism Spectrum Disorder, and research has shown that both conditions are linked to numerical impairment. This article summarizes research that has focused on DSM-IV-centered diagnostic criteria. This revised method of case categorization may now be used in future research.

Conclusion

Overall, the examined research demonstrates a negative correlation between ADHD and mathematics, with the inattentive symptoms bearing the brunt of the negative impact. The distinct relationships between the two ADHD subtypes and mathematics suggest that they may have different underlying causes. Different forms of ADHD manifest themselves in different ways in children, thus it's crucial to correctly diagnose one of the two forms in order to predict which kids will have trouble with arithmetic. The reviewed genetic studies indicate that shared genetic variables contribute to the observed covariation between ADHD and mathematics, albeit environmental factors also play a role. These findings help us better understand ADHD and may lead to the creation of non-pharmacological therapies that address the underlying causes of the condition rather than just the symptoms. Children may be better able to handle the demands of the regular classroom and have a higher opportunity to enjoy and succeed in school if these interventions are utilized alone or in addition to pharmaceutical therapies. More study is required to understand the precise elements that contribute to the correlation between ADHD and arithmetic impairments and to demonstrate the degree to which the two conditions have a shared neurological base.

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