



# FACTORS IMPACTING GENDER DIAGNOSTIC DIFFERENCES IN ADHD: A REVIEW

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## ABSTRACT

ADHD is a neurodevelopmental disorder commonly diagnosed in children. To date, it is more commonly diagnosed in boys compared to girls although there has been no significant difference reported in adulthood. The objective of this review is to investigate various factors affecting gender differences in ADHD including, historical context, symptom presentation, age of onset, physician biases, and comorbidities. This review includes literature from a variety of academic databases such as Web of Science, MEDLINE, ERIC, PubMed as well as from grey literature. Our findings include systemic gender discrepancies that exist in the reported prevalence, diagnosis, and treatment of ADHD. Additionally, there are several gender-based factors that may contribute to the differences in ADHD presentation for girls including a more inattentive subtype, later age of onset, and misdiagnosis due to comorbidities. This discrepancy in diagnosis has been attributed to various factors which include ineffective diagnostic criteria, physician bias, and comorbidities. Limitations of this review include evident gaps in the literature on the association between ADHD and non-binary gender development, misdiagnosis of girls with comorbidities, as well as differences in the effectiveness of treatment on different genders. Furthermore, there is little standardization in methods and variables collected, especially the minimal recruitment of female participants. Lastly, future studies should investigate the impact of clinical versus community-based settings on children with ADHD.

## INTRODUCTION

ADHD is a neurodevelopmental, psychiatric condition wherein an individual displays a pattern of inattention and/or hyperactivity-impulsivity that negatively interferes with functioning or development, as per the Diagnostic and Statistical Manual of Mental Disorders (DSM-V).<sup>1</sup> In the DSM-V, ADHD is further categorized into three subtypes: predominantly inattentive, predominantly hyperactive, or a combination of both.<sup>1</sup> The symptoms of the inattention component include daydreaming, distractibility by external stimuli and difficulty focusing on a single task for a prolonged period.<sup>1</sup> Symptoms of the hyperactivity-impulsivity component can be expressed such as fidgeting, excessive talking and restlessness.<sup>[1]</sup>

In children and adolescents, ADHD is more commonly diagnosed in boys, with the prevalence ratio of male-to-female ADHD diagnosis ranges estimated to be at 2:1 in population-based studies and between 5:1 to 9:1 in clinical samples.<sup>[2-3]</sup> However, this disparity diminishes in adulthood with ratios closer to 1:1.<sup>[4]</sup> Investigating the underlying factors that contribute to these discrepancies have been a primary area of focus for ADHD research. This review aims to synthesize the various factors currently identified within the literature that contribute to this difference.

## METHODOLOGY

The methods of this review included the use of several databases to find relevant sources. These searches were conducted using MEDLINE, Web of Science, PubMed, ERIC, and other grey literature sources. A search was conducted in 2022 for English-language publications, published after the year 2000.

Terms related to ADHD and gender differences (i.e. female, girl, gender) were utilized in the search. Articles that were selected for use in this review contained information on at least one factor or implication of gender-based differences in ADHD. The chosen articles' references were also reviewed to find relevant studies.

## FACTORS INFLUENCING DIAGNOSTIC GENDER DISPARITIES

### I. History of ADHD

Despite its reputation as one of the most studied child mental disorders, historic ADHD research has largely been conducted on homogenous samples of boys.[2] This focus has predisposed the disorder to lasting biases and misrepresentation in diagnosis. ADHD has been assigned various diagnostic labels historically.[5] These labels have attempted to classify developmentally atypical children, most commonly boys, who display symptoms of inattention, impulsivity, and/or hyperactivity.[5] Prior to the 1960s and the induction of the disorder into the DSM, explanations for the disorder mainly explored physical etiology.[5] These etiologies are intended to explain the increase in hyperactive behaviours displayed by boys in classrooms.[5]

In the mid-1900s, a combination of factors including the Baby Boom, and educational reform contributed to larger classroom sizes, and longer time spent seated at desks, creating an environment that highlighted and punished any child that displayed hyperactivity.[6-7] This most commonly would be boys who had trouble staying focused and would be labelled as disruptive to the class.[6-7] With this increasing prevalence, the focus on these disruptive children began to grow, triggering the allocation of resources into uncovering the etiology behind ADHD.[6-7]

In the United States, researchers began a further exploration into how to identify and treat the ADHD symptoms of hyperactivity. In 1968, the publication of the DSM-II marked a transition in the diagnostic criteria and the conceptualization of ADHD, as this edition was the first to include ADHD as a psychological disorder.[5,8] However, in this edition, ADHD was labelled as Hyperkinetic Reaction of Childhood, defined in two sentences, "The disorder is characterized by overactivity, restlessness, distractibility, and short attention span, especially in young children; the behaviour usually diminishes by adolescence".[8] This new label shifted the diagnostic protocols to symptom-based diagnostic criteria, dependent on behaviour encompassing both hyperactive and inattentive features rather than focusing on physical etiology.[5] This shift also attempted to aid physicians in diagnosing, and often medicating hyperactive boys who were unable to focus in the classroom setting.[8] With more research, progress continued with the development of newer versions of the DSM, eventually culminating in the label of ADHD first introduced during the revision of the DSM-IV.[9]

Although the late DSM-V's diagnostic criteria equally value both hyperactive and inattentive presentations, the historical bias towards hyperactivity in boys has led to misrepresentation in the disorder and often leaves those who present with inattentive symptoms, more commonly girls, overlooked.[2,8]

### II. Difference of Hyperactivity and Impulsivity Symptoms

Although ADHD subtypes can be found in anyone, many studies have found differences in the expression of the disorder in boys and girls.[10-11] Boys are more prone to exhibit hyperactivity/impulsivity symptoms, while girls are more likely to exhibit inattention symptoms.[10-11] In terms of day-to-day interactions, studies suggest that boys display more behavioural and conduct problems and are more impulsive when compared to girls.[10] In comparison to other types of ADHD symptoms, studies demonstrate that hyperactivity/impulsivity symptoms are substantial predictors of diagnosis.[10] This increased visibility of hyperactivity/impulsivity symptoms compared to inattentive symptoms would also contribute to the disparity and may lead to less frequent diagnoses and treatment of the disorder in girls.[10]

### III. Age of Onset

Current research illustrates that there is a difference in the age of onset for ADHD between sexes. Specifically, boys are more likely to report visible symptoms of ADHD in childhood, while girls report a large increase in symptom presentation in early adolescence.[11] A proposed explanation by Murray et al. (2019) of this difference is that symptoms in girls remain subthreshold in stable childhood environments but crossover into the clinical range as autonomy and life stressors increase.[11] This is further supported by findings that show inattention is minimally disruptive in childhood and is more predominant in girls.[11] However, in adolescence, with the introduction of more structured academic and occupational responsibilities, inattention symptoms displayed by girls become more apparent leading them to be diagnosed later in life.[11]

This later age of onset of ADHD for females often leads them to be excluded from diagnosis as one of the current criteria in the DSM-V requires an onset of symptoms prior to age 12.[11] The DSM-V elevated the previous threshold of ADHD age-of-onset criteria in the DSM-IV from age 7 to 12.[11-12] However, due to current research indicating onset for girls with ADHD can occur later in life, it is suggested that additional research is needed to determine if the age-of-onset criteria should be further elevated and if current diagnostic indicators should be changed to be more suitable for adolescence.[11]

Similarly, another plausible theory suggests that ADHD symptoms presented by females during childhood are often overlooked by parental figures, educators, health care providers and other individuals capable of observing the child's behaviour.[13]

For example, one study reported that parents and educators tend to underestimate the levels of ADHD symptoms presented by girls in comparison to boys.<sup>14</sup> This may reflect a cultural expectation bias since media representation of ADHD is predominantly male.<sup>[14]</sup> Thus, causing a spike in female ADHD prevalence during adolescence when self-referral is more common.<sup>[13]</sup> This is also supported by a greater willingness for girls to self-report ADHD symptoms during adolescence, while boys in this age group are generally more hesitant to receive treatment.<sup>[11]</sup>

#### IV. Physician Biases

Another key driver in the disparity of ADHD diagnoses between genders are the physicians and healthcare professionals responsible for diagnosis. Researchers have studied how strictly professionals adhere to diagnostic criteria depending on the gender of a patient or if they tend to place more emphasis on certain symptoms.<sup>[15-17]</sup>



In a 2012 Germany study by Bruchmüller, Margraf & Schneider, researchers surveyed 1000 child psychologists, psychiatrists, and social workers where they each received one of four available case vignettes.<sup>15</sup> There are eight different cases, one child with ADHD and three non-ADHD children, for both a boy and a girl. Upon asking for a diagnosis, 16.7% of therapists diagnosed ADHD in non-ADHD cases regardless of gender. In the boy version of these vignettes, therapists diagnosed ADHD two times more than they did with the girl vignettes.<sup>[15]</sup> This study was replicated with Iranian psychiatrists where they found that overdiagnosis was 2. [45] times more likely in boys than in girls.<sup>[16]</sup> The psychiatrists' gender had no significant impact on overdiagnosis.<sup>[16]</sup>

One possible explanation for this is the availability of heuristics and biases that impact clinical judgement. Despite existing diagnostic criteria, several reviews show misdiagnoses of disorders by physicians for heuristic, rather than data-based reasons.<sup>[15,17]</sup> An example of a heuristic can be the similarities between the actual patient and an imaginary, stereotypical, ADHD patient. Specifically, the representativeness heuristic can lead physicians to diagnose based on how a child compares to the “prototypical ADHD child” instead of through the explicitly defined diagnostic criteria provided by the DSM-V.<sup>[15]</sup> This bias has been linked to a noticeable overdiagnosis in boys and underdiagnosis in girls as demonstrated in a study by Bruchmüller, Margraf & Schneider.<sup>[15]</sup>

#### V. Misdiagnosis with Comorbidities

ADHD misdiagnosis can occur due to the presence of comorbid psychiatric disorder symptoms in which ADHD is overlooked by health care professionals. <sup>18</sup> ADHD diagnosis may be missed in clinical referrals when it co-exists with comorbidities.

In such cases, girls who actually have ADHD have been found to be treated for a mood disorder before receiving their ADHD diagnosis.<sup>[19]</sup> Multiple factors may contribute to this misdiagnosis including differences in predominant symptoms (internalizing rather than externalizing), which may be related to depression or anxiety before an ADHD diagnosis is considered.<sup>19</sup> Additionally, the presence of obsessive-compulsive disorder, often accompanied by perfectionistic behaviours, can mitigate ADHD symptoms and delay diagnosis resulting in a lack of need for referral by a child's parent/guardian for treatment.<sup>[19]</sup>

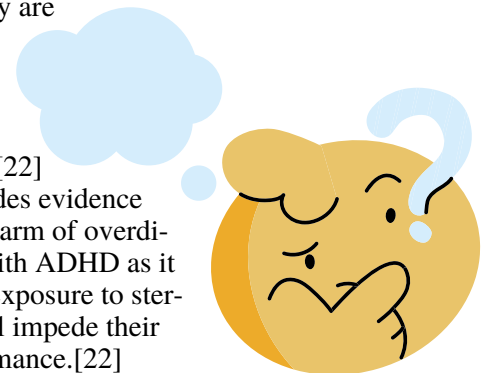
Nevertheless, the atypical presentation of ADHD in girls with comorbidities may be a barrier to treatment.<sup>[20]</sup> Girls with ADHD have shown a higher prevalence of depression, anxiety, and conduct disorder when compared to a control population.<sup>[19]</sup> This points to the importance of early identification and treatment. Being as though ADHD is usually first recognized by an individual close to the child, the attitudes and knowledge of people around these children can be a significant determinant if and how the child's condition is treated.

## IMPACTS AND EFFECTS OF UNDERDIAGNOSIS & OVERDIAGNOSIS

### I. Stereotype Threat

Stereotype threat theory alludes that in circumstances where negative stereotypes are purposely called to mind, it can cause an individual to unconsciously confirm this stereotype and underperform.<sup>[21]</sup> A study by Foy in 2018 conducted in the United States examined the potential that labels for mental disorders can act as a stereotype threat in certain situations.<sup>[22]</sup> In this specific study, they examined the effects of ADHD stereotype threat on performance.<sup>[22]</sup> The results of the study revealed that participants with ADHD achieved lower scores on both verbal and quantitative questions in comparison to participants without ADHD.<sup>[22]</sup> While those with ADHD who were explicitly exposed to negative stereotypes regarding the disorder achieved significantly lower scores on the quantitative questions, those who were not exposed to the stereotype threat.<sup>[22]</sup> It is hypothesized that concerns regarding confirming these negative stereotypes can lead one to ‘self-handicap’ which means they are likely to avoid putting in the effort to protect themselves from potential failure.<sup>[22]</sup>

This study provides evidence of the potential harm of overdiagnosing boys with ADHD as it is probable that exposure to stereotype threat will impede their academic performance.<sup>[22]</sup>





## II. Suggested Treatment Modifications Based on Gender Research

To better understand modifications that may need to be made to account for gender differences, it may be appropriate to first begin by discussing the literature on ADHD treatment. A review by Rucklidge reveals that individuals, regardless of gender, struggle beyond simply the symptoms of ADHD (e.g., in psychosocial or cognitive functioning), and that these challenges need to be considered when making an individualised plan.[10] Many non-pharmacological treatments have been developed over the years (such as cognitive training therapies, neurofeedback, etc.) with varying degrees of effectiveness; most of which fall under behavioural or cognitive-behavioural management.[10] Factors in successful adolescent ADHD treatment include parent and teacher programs, which have been found to increase child compliance, reduce disruptive behaviours, and improve interactions.[10]

Neurological research has shown behavioural therapy alters neurotransmitter pathways through behavioural management. In addition, the integration of parents and teachers into said management can positively impact social factors, which have been found to contribute to profiles of the disorder.10 What is of interesting note, is that initial results presented by the Multi-modal Treatment Study of ADHD (MTA) indicated that behavioural management presented no added benefit to medications.[10,23] Subsequent studies, however, have shown no added benefit was true only for those with uncomplicated ADHD, but for those with additional comorbidities such as anxiety or disruptive behavioural disorders, the psychosocial component was found to improve outcomes.[24]

Having discussed the characteristics of successful psychosocial approaches, this leaves the question of where these psychosocial approaches differ based on gender.[10] As previously stated, ADHD continues to be overlooked or misdiagnosed in adolescent girls or adult women.[25] Current non-pharmacological treatments discussed above have been developed with little to no regard for pubertal changes and were developed with elementary school-aged boys as sample populations.25 Therefore, it can be difficult to successfully implement these recommendations for different genders and age groups.[25] As it stands, the treatment literature on gender treatment effects, moderating role of sex, and sex comparisons have been scarce.[10] The previously discussed MTA study is one of few to explore the moderating effects of gender on treatment response, findings that gender was not found to moderate outcomes; however, their population sample was 80% male.[10,23] In a similar manner, little is known about the interactions between hormones and ADHD pharmacological treatments, such as stimulant medications.[25] Two studies to date have looked at the effects of estrogen on amphetamines and effects when administered during follicular versus luteal phases of the menstrual cycle.[25]

Research shows that the effects of stimulant medications may increase in the presence of estrogen but dampened or diminished in the presence of progesterone.[25] As a result, it may be relevant to consider co-occurring problems or developmental age of the individual being treated, for it seems cyclical variations in the menstrual cycle and fluctuating hormone levels are among other factors that may need to be accounted for when addressing ADHD symptoms and treatment in females. [10,25] That said, further research needs to be conducted to inform better guidelines and recommendations for gender differences in treatment.

## III. Implications of Age of Onset

As described earlier, the age of onset of ADHD is delayed in females compared to males as girls often report exacerbations in symptom presentation later in adolescence and early adulthood.[11] One theory within the literature suggested earlier in life, when girls are in stable childhood environments, they are able to form and utilise adaptive behaviours to address ADHD symptoms. [26] However, a transition period involving significant changes in their environment, routine, and/or responsibilities, such as the transition to post-secondary education, may exacerbate ones' ADHD symptoms.[26]

During these transitions, these challenges/stressors can lead women to a therapeutic setting in which their potentially long-standing ADHD is finally diagnosed. [26-27] More recently, preliminary findings and anecdotal evidence suggest that the COVID-19 pandemic may act as a transition period leading to more diagnoses in women with ADHD.[28] Patient and health care professionals have identified that the unprecedented challenges of the pandemic may interfere with adaptive behaviour and functioning, leading to increased anxiety and depression.[28] For some, the pandemic may serve as a tipping point that makes ADHD symptoms no longer avoidable or manageable without help. This is consistent with a study by Bennett et al., in which they identified that females comprised a higher proportion of ADHD diagnoses compared to pre-pandemic years.[29]

## EMERGING BARRIERS AND FUTURE DIRECTIONS

### I. Gender development and ADHD

Majority of research investigating sex and gender differences in individuals with ADHD focus on the experiences of cisgender people. While it is important to continue to explore how ADHD is experienced by cisgender people, there is also a need to explore the experiences of gender-diverse people (e.g. transgender, non-binary, Two-spirit, etc).[30] Recently, a few clinical review studies suggest a higher prevalence of ADHD amongst people with gender dysphoria but to date, there is a lack of controlled studies that have adequately examined the prevalence rate of ADHD in this population.[31-33]

Additionally, in the minimal research conducted in this field, the population pool tends to be European or North American white participants, whose experiences of gender socialization may be different than those of people of other racial/cultural backgrounds. One source of grey literature discusses how children with ADHD exploring their own gender identity can be impacted by their unique executive functioning skills in which their impulse control, emotional regulation, and focus can be affected.[34] It is important to continue research in this field to fully support these children in a safe and appropriate way.

## II. Limitations within the Literature

Perhaps an important limitation to consider in this review is the lack of current literature regarding the association between ADHD and non-binary gender development, gender differences in the effectiveness of treatment, and the misdiagnosis of girls with comorbidities since, historically, research focused on boys with ADHD.[5]

When conducting our search and reviewing the articles, the research question may not have been able to be fully answered as a result of the unavailability of perspectives. Another limitation to consider is the way in which variables were measured and what methods were used to collect data. For example, the majority of the studies we've looked at that investigate the prevalence of ADHD, have lacked recruitment of female participants typically exceeding clinical evaluation of boys.

It may be important to also explore the impact of clinical versus community-based settings on children with ADHD. Community-based approaches to improve health care and the treatment children receive could offer broader cultural, social, and biological perspectives. When research projects are motivated by community priorities, it becomes more of a collaborative process. Clinical-based studies often have difficulties generalising their results which doesn't allow them to produce conclusive answers.[35]

## CONCLUSION

Despite its reputation as one of the most studied child mental disorders, there continues to be a discrepancy in the diagnosis of ADHD between genders. The male-to-female ADHD diagnosis ratio is skewed in childhood and adolescence, but the disparity diminishes in adulthood with ratios closer to equal.

This review aims to understand the underlying factors that contribute to these discrepancies and identify gaps in the literature—these factors include ineffective diagnostic criteria, physician bias and comorbidities. The need for future research examining gender differences is important to improve personal livelihood and productivity for

individuals with ADHD. Although there exists a multitude of research on ADHD, there are still significant gaps within diagnostic criteria between boys and girls as well as identification of ADHD alongside comorbid conditions, differences in treatments, and how gender development may impact youth with ADHD. Community-based longitudinal studies have the potential to address certain knowledge gaps regarding the presentation of ADHD and ensure that the results are applicable for all genders.

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