Journal of Womans Mental Health

Unveiling Gender Disparities in ADHD: A Literature Review on Factors and Impacts of Late Diagnosis in Females (2010-2023)

Kayla Almekhlafi[1,2,*], Sonia Jain[2,3]

[1]Department of Public Health & Health Sciences, School of Health Sciences, University of South Dakota, Vermillion, SD

[2]DNA Global, LLC Oakland, CA;

[3]University of California, Davis, Department of Public Health Sciences, Davis, California

Research Article

Open Access &

Peer-Reviewed Article

Corresponding author:

Kayla Almekhlafi, Department of Public Health & Health Sciences, School of Health Sciences, University of South Dakota, Vermillion, SD; and DNA Global, LLC, Oakland, California.

Keywords:

Attention Deficit Hyperactivity Disorder; ADHD; ADHD Comorbidity; Postpartum ADHD; Mental Health; Maternal ADHD; Gender bias; Gender Disparities

Received: April 22, 2024

Accepted: May 18, 2024

Published: May 30, 2024

Academic Editor:

Qiang Cheng, Biomedical Informatics Institute, and Computer Science Department.

Citation:

Kayla Almekhlafi, Sonia Jain (2024) Unveiling Gender Disparities in ADHD: A Literature Review on Factors and Impacts of Late Diagnosis in Females (2010-2023). Journal of Womans Mental Health - 1 (1):9-21.

Abstract

This exploratory study investigates factors and consequences of underdiagnoses or late diagnoses of attention deficit hyperactivity disorder (ADHD) in females favoring males in the referral, diagnosis, and treatment processes resulting in gender disparities. A literature review in PubMed, PsychINFO, PsychArticles, and PsychiatryOnline from 2010 to 2023 underscores significant implications of delayed ADHD diagnosis in females, hindering timely access, support, and interventions during critical developmental years. Factors associated with underdiagnosis of ADHD among girls include gender differences in symptomology presentation, comorbidity, and gender bias among parents, teachers, and healthcare providers. We highlight the role of ethnicity and cultural factors. This bias prevents girls from receiving necessary ADHD support and treatment, impacting their health, social, and economic outcomes into adulthood. We summarize strategies to urgently address gaps in ADHD research and practice. Raising awareness among communities, healthcare providers, educators, and parents is vital to alleviate these gender disparities. By illuminating factors contributing to delayed diagnoses, the study informs policymakers and stakeholders, facilitating targeted interventions to improve early detection and treatment outcomes for females with ADHD.

Introduction

In 2020, approximately 6.8% or 366 million adults globally had symptomatic attention deficit hyperactivity disorder (ADHD), and 2.6% or 140 million had persistent adult ADHD which began in childhood [44]. Yet, ADHD in childhood is often underreported and underdiagnosed among girls and increases into adulthood. National estimates show prevalence of ADHD among children and youth, ages 3-17 years at 9.8%, with twice as many boys diagnosed at 13% compared to 6% of girls (CDC, 2019). One study showed the ADHD ratio for boys vs. girls at 3:1 in childhood and 1:1 in adulthood [15]. Among adults, the prevalence of ADHD is controversial. The prevalence of adult ADHD by gender

hasbeen recorded in recent years by comparing the increase in the percentage of visits in which stimulant prescriptions for ADHD were given [10]. The study found that prescription stimulant rates increased significantly for females above 20 years (6.8, 4.8, and 1.0 per 100 for females aged 20–39, 40 –59, and ≥60 years, respectively) than males (5.9, 2.9, and 0.7 per 100 for males aged 20–39, 40–59, and ≥60 years, respectively; $P < 0.001$) [10]. Newer research has shown better diagnosis across all age groups, doubling among women ages 23-49 years [37]. Prevalence ratios vary based on assessment tools used, symptomatology assessed, study sample, and methods of diagnosis. The average age of diagnosis is 7 years old; though research shows that most adults with ADHD likely had symptoms during childhood that went unnoticed or misdiagnosed, particularly among girls [15]. Gender disparities in ADHD diagnosis and possible factors and consequences are an important area of inquiry, given its significant impacts throughout women's lifespan, including short and long-term social, emotional, health, academic, and economic impacts [31].

How ADHD presents differently over the lifespan, by gender, race/ethnicity and symptomatology is an ongoing area of inquiry [15, 16]. Growing research has shown persistent gender bias from parents, teachers, schools, and practitioners in referrals, diagnosis, and treatment of girls for ADHD. In this paper, we conducted an exploratory literature review of PubMed, PsychINFO, PsychArticles, and PsychiatryOnline from 2010 to 2023 to better understand ADHD gender disparities and associated factors and implications for girls and women. We summarize gender disparities in ADHD and associated factors for underdiagnosis among girls. We end with multidimensional impacts on girls and women and highlight key strategies to effectively address gaps in ADHD practice and research.

Gender differences in ADHD symptomatology

One of the key factors associated with the underdiagnosis of ADHD among girls is symptom presentation differences. A review found that 3.10% of the adult population had inattentive ADHD, followed by hyperactive (2.95%) and combined (2.44%) [5, 50]. Hyperactive/impulsive ADHD includes fidgeting, difficulty staying seated, excessive talking, interrupting conversations, hand, and feet tapping, and impatience; and inattentiveness may include the inability to pay attention to details, difficulty focusing, not following instructions, not listening, poor organization, avoiding tasks that require significant mental effort, frequently losing items, easily distracted, and forgetting daily tasks (APA, n.d.). A growing body of research shows that females are likely to report inattentiveness, and males exhibit greater externalized hyperactivity and impulsivity symptoms, facilitating explicit identification and diagnosis by professionals [24]. From childhood into adulthood, research shows that inattentive symptoms, more common among girls, tend to persist, and impulsive and hyperactive symptoms decrease over time [45]. Greater externalized symptoms may lead to greater referrals, assessment, and diagnosis and thereby treatment for boys vs. girls [50, 5, 29, 45].

Comorbidity

Comorbid conditions have also shown to contribute to the underdiagnosis of ADHD in females. A common occurrence of the inattentive subtype in female ADHD diagnoses is often accompanied by concurrent internalizing disorders like anxiety and depression. More than 53.5% of females and 48.5% males with ADHD had one or more of the six psychiatric comorbidities, compared to 13.7% of women and 9.1% of men in the remaining population [43]. Females vs. males with ADHD have significantly higher rates of anxiety, depression, bipolar, and personality disorders; for example, 24.4% of females with ADHD vs. 13.1% of males with ADHD have depression [43]. Girls and adolescent females with ADHD are at higher risk of self-harm than their counterparts [28]. More than 67.3% of adolescents

with ADHD had self-destructive behaviors such as non-suicidal self-harm, significantly higher among girls (71.4%) than boys (28.60%) ($p < .001$) [6]. This is especially important as physicians report that care does not include an adequate method of treatment for self-destructive girls, resulting in their placement of compulsory care as treatment [46].

It is not only types of symptoms that differ by gender, but also severity of symptoms. ADHD symptoms diagnosed tend to be more severe among boys than girls. In a study with 153 (64%) children met the diagnostic criteria for ADHD per DSM-5 guidelines, 79% were boys and 21% girls, with a 3.8:1 male-to-female ratio. Within the high-symptom group of 130 children, 62% were male and 38% were female [29]. The ratio of diagnosed to high- symptom girls stood at 0.65:1, in contrast to the ratio of 1.5:1 for boys. In comparison to boys with high ADHD symptoms, fewer girls with high ADHD symptoms were diagnosed with ADHD [29]. Females exhibited higher levels of emotional symptoms [29].

There are also biological differences between male and female children diagnosed with ADHD. A study showed that sex differences in frontal white matter microstructure may contribute to neurocognitive outcomes in children with ADHD. They concluded that boys with ADHD present greater abnormalities in frontal motor regions [35]. This suggests that boys struggle with cognitive difficulties, while girls struggle with complex, higher-order behaviors [35].

Referral bias among parents and teachers

Some studies have shown differences in parental referral for boys vs. girls [29, 20]. A comprehensive study showed that parents rated higher scores for inattentiveness among girls than boys ($p = .021$), while teachers rated higher scores for hyperactivity ($p=0.085$) and combined symptoms in boys ($p = .070$) [20]. Teacher ratings for inattentiveness among girls were lower than parents. Teachers indicated that it is within their realm to deal with students' mental health issues but lack the knowledge and resources to do so [4]. Others have also shown gender bias among parental perceptions of ADHD [29], highlighting a lack of education or community awareness of gender differences in ADHD symptomatology. More studies examining what works to educate and shift parents' perceptions, and underlying beliefs of boys vs. girls behaviors need to be further examined. Certainly, the role of teachers, school staff, and peers particularly during adolescent years may be a critical area of discovery for identifying and referring more girls for ADHD diagnosis and treatment.

Gender bias among clinicians

There is sufficient evidence to conclude gender bias among mental health and medical providers, in terms of assessment, diagnosis, and treatment of ADHD differentially by gender [9, 27, 50]. The diagnostic criteria is outdated, as it is better able to detect externalizing symptoms more common among boys, and thus leads to is diagnosis of ADHD among girls. The persistence of outdated diagnostic criteria could be a contributing factor to the misdiagnosis of ADHD in girls [50]. Limited studies have found that boys are more prone to receiving an ADHD diagnosis by psychiatrists, even when they did not meet all the DSM-5 diagnostic criteria, leading to false positives [9]. Conversely, girls were less likely to receive an ADHD diagnosis even when they did meet all the diagnostic criteria, resulting in false negatives. Boys had more than twice the odds of being diagnosed (Odds ratio = 2.45, $p < 0.05$),and receiving false positives ($p < 0.01$) [9].

Cultural bias

It is important to highlight that girls and women within specific cultures have even lower odds of being referred, let alone diagnosed, and receive appropriate treatment. Research shows that ethnic minority

children are less likely to be recognized and treated for ADHD than their non-minority counterparts [41]. Some cultures view hyperactivity and impulsivity in boys as typical and gender-preferred behaviors [41].

This could explain why some cultures have lower rates of a mental illness as they may not consider certain behaviors atypical. Minority adults are less likely to be diagnosed than non-minority adults [41]. Blacks have 47% lower odds of being diagnosed with inattentive ADHD than whites. Odds are even lower for black females by 63% compared to their counterparts [39]. Given the growing diversity of ethnicities and cultures within the US, this is an important area of inquiry to better understand cultural and ethnic disparities, pathways, interventions, and interplay between ethnicity, culture and gender for ADHD diagnosis, referrals, and treatment [41].

One study found white children were more likely to receive ADHD treatment, with Asian children having the lowest odds of receiving any treatment by 64% [40]. Reasons for clinician visits varied by ethnicity, with Asian children having higher rates of speech-language disorder and autism, and white children having more anxiety and adjustment disorders. Another study found higher levels of ADHD among Hispanics, and lowest among whites, with inattentive symptoms declining with age. Several factors contribute to minorities not seeking healthcare or mental health care. Among these, distrust in the government and healthcare, experiences of racism, social and professional stigma, insufficient knowledge or awareness, and cultural and language barriers influence the decision-making process for minorities when it comes to seeking treatment. Racism certainly may play a role in influencing willingness to approach the health care system, as well as parents' care-seeking behaviors by culture, particularly for girls [40].

The relationship between ADHD and culture is not well established, with differing opinions in ADHD prevalence, and differences potentially resulting from differential tolerance of hyperactive behavior across cultures [18]. Cross-cultural differences in authoritative parenting styles could be relevant, as tolerance for deviant behaviors is more prominent among European American groups in comparison to other culture-specific groups [18]. Stigma may also play a role in not identifying mental illness appropriately in specific cultures, among the Asian community [40]. Understanding how different groups rate ADHD as a mental health issue can help inform future research and practitioners screen, assess, diagnose, and tailor culturally responsive interventions.

Impact of ADHD on girls during childhood

Next, we summarize the multidimensional impacts of ADHD on girls and women. Underdiagnosed ADHD among girls during childhood and adolescent years has shown to have significant social-emotional, behavioral, academic short and long-term impacts. A recent study by Young et al (2020) found that undiagnosed girls had a higher risk of academic underachievement compared to their peers. They found that girls with ADHD symptoms, but no diagnosis were significantly more likely to experience difficulties with organization, time management, and completing schoolwork. Many girls with ADHD experience social and emotional difficulties. Another study found increased risk of self-injury and suicide attempts and social difficulties among girls with ADHD undiagnosed [19]. Additionally, girls with undiagnosed ADHD tend to experience greater disruptive behavioral issues at home and at school, and increased rates of oppositional behavior, defiance, and conflicts with family and friends [13; 19]. Girls with undiagnosed ADHD were more likely to experience peer rejection, social isolation, and low self-esteem compared to girls without ADHD [50]. Studies show that adolescent girls with undiagnosed ADHD are more likely to engage in risky behaviors including higher

rates of substance use, reckless driving, and early sexual activity [32, 13, 50]. Additionally, a number of studies and meta-analysis have revealed that girls with undiagnosed ADHD are at an increased risk of developing comorbid mental health disorders, such as anxiety and depression [14, 50, 19]. Finally, there are long-term implications of untreated ADHD with enduring effects into adulthood. Girls with undiagnosed ADHD have shown to be at higher risk of academic and occupational impairment, interpersonal difficulties, and mental health disorders in adulthood compared to girls without ADHD [50]. Greater evidence of stage-specific outcomes, for instance during early to late adolescent years as contexts broaden, and protective factors in different settings such as peer or parental support deserve much greater attention.

Impacts of ADHD on women during adulthood

Adverse reproductive outcomes

Numerous studies have shown adverse outcomes of ADHD, diagnosed and undiagnosed,on women and mothers during adulthood years. Research indicates that mothers with ADHD are at an increased risk of experiencing birth complications and adverse reproductive outcomes, risk-taking behaviors, maternal mental health issues, and challenging parenting practices. A study found that ADHD was related to higher levels of stress, depressive symptoms, lower social support from significant others, and unwanted pregnancies [30]. ADHD was associated with risky sexual behaviors and higher rates by four times of unplanned pregnancy than non-ADHD peers [32]. Inattentiveness and hyperactivity have shown to affect pregnancy outcomes including poor eating, depression, decreased prenatal vitamin use, or additional caffeine intake [21]. Another study found that women with ADHD were 20%-30% more likely to undergo cesarean deliveries compared to those without ADHD [36]. Furthermore, children born to mothers with ADHD had a higher risk of needing breathing support, particularly when the mother's ADHD remained undiagnosed during pregnancy.

Maternal mental health outcomes

The association between maternal ADHD and mental health issues and disorders is well- established. Bartelt, Piff, Vitek, & Barkley (2023) reported a 24% higher prevalence of postpartum depression among mothers with underdiagnosed ADHD. Murray et al. (2022) found elevated levels of stress and depressive symptoms among mothers with ADHD. Comorbidities significantly amplify the burden of ADHD on maternal health. [17] reported that females with ADHD exhibited markedly elevated rates of comorbid health and mental health issues, including insomnia, chronic pain, substance abuse, depressive disorders, and anxiety disorders. These findings highlight the complex interplay between ADHD and various comorbid conditions, compounding the challenges faced by affected mothers. The heightened risk of adverse mental health outcomes among mothers with ADHD is well-documented in the literature [3, 30]. Fuller-Thomson, Lewis, & Agbeyaka (2016) reported higher rates of lifetime major depressive disorder (31.3% vs. 14.1%), generalized anxiety disorder (35.6% vs. 9.9%), substance abuse and suicidal ideation (45.8% vs. 13.8%) among females with ADHD compared to those without. They had significantly higher rates of childhood abuse. These findings underscore the urgent need for targeted interventions to address the mental health needs of mothers with ADHD and mitigate the risk of adverse outcomes.

Challenging parenting outcomes

Research has consistently shown challenges parents with ADHD face when managing their children's behavior and emotional needs. [48] observed that maternal ADHD symptoms were linked to lower levels of positive parenting and higher levels of inconsistent discipline. Mothers reported higher levels

of harsh responses to their children's negative emotional expressions. This research shows the impact of ADHD on motherhood and parenting with potential long-term effects on their offspring, family dynamics, and other facets.

Furthermore, [22] found that parents with ADHD reported diminished sleep quality and heightened levels of parenting distress during the first year of their infants' lives, underscoring the strain experienced in fulfilling parental responsibilities.

Social and economic impacts of ADHD

The social challenges faced by individuals with ADHD extend to maternal roles, impacting interpersonal relationships and social functioning. [23] found that adults with ADHD were more likely to experience marital difficulties and dissatisfaction with personal, professional, and social lives. These social challenges can exacerbate feelings of isolation and in adequacy among mothers with ADHD, contributing to heightened stress and emotional distress.

The economic burden of ADHD on affected individuals and society at large is substantial. [38] estimated the annual economic burden of ADHD on adults in the United States to be $122.8 billion, encompassing unemployment costs, productivity losses, and healthcare expenses. Excess cost of $2.26 billion was found among men and $1.20 billion among women, attributable to lost wages, healthcare costs, overall productivity and effects of education and judicial system [1]. Individuals with ADHD have been shown to have poorer work performance, less job stability, lower occupational status, and increased absence days [1]. Moreover, [23] reported a reduction in income of $8,900 to $15,400 annually for individuals diagnosed with ADHD, highlighting the financial strain associated with the condition. They struggle more with impulsive buying and financial decisions [7]. These economic challenges not only impact individual financial stability but also have broader implications for societal productivity and healthcare expenditures.

In summary, ADHD in women not only affects their own health and well-being but also has far-reaching consequences for their children, families, and society as a whole, underscoring the importance of early diagnosis, intervention, and support. The evidence presented underscores the significant and multifaceted impact of ADHD on mothers, encompassing physical health, mental well-being, parenting dynamics, social relationships, and economic stability. Addressing the complex interplay of ADHD symptoms, comorbidities, and social-economic factors requires a comprehensive and integrated approach that incorporates targeted interventions, support services, and policy initiatives. By recognizing and addressing the challenges faced by mothers with ADHD, it becomes possible to enhance their well-being, improve family functioning, and mitigate the broader societal impacts of the condition.

Practice Implications

Gender bias in ADHD referrals and diagnosis, presentation symptomology differences, and cultural or socialization differences by gender need to be recognized and addressed using multi-pronged strategies. We need more training and education on differential presentation of ADHD among girls vs. boys, a clear criterion for referrals, including a reassessment of behaviors warranting consideration for ADHD referrals. All parents, especially those with girls need to learn about ADHD symptomatology, and comorbidity. They need to advocate with providers for thorough assessment of symptoms and proper diagnosis and subsequent treatment. It could save years of mental health, social, and academic consequences.

Healthcare Professional Training and Awareness

Primary care providers, including pediatricians and nurse practitioners, play a crucial role in diagnosing ADHD and should receive adequate training to recognize symptoms in females (CHADD, n.d.). We need more training for healthcare professionals on ADHD symptom presentation in both young girls and adult females. This includes awareness education and updated diagnostic criteria for girls and females in various healthcare settings, such as obstetrics/gynecology, pediatrics, midwifery, nursing, general practice, and mental health.

A consensus meeting in the United Kingdom of healthcare professionals who specialize in the care of girls and adult females with ADHD, recently discussed symptom presentation, criteria for referral, assessment protocols, treatment modalities, and the establishment of collaborative efforts among multiple agencies to ensure comprehensive care for females with ADHD. The experts underscored the importance of abandoning outdated biases and clinician predispositions within the realm of mental health diagnosis for ADHD [50].

They emphasized that clinicians should refrain from exclusively seeking the stereotypical disruptive behavioral components of ADHD and instead, incorporate an understanding of the internalized presentation commonly observed in female patients. This approach is crucial for supporting a more nuanced and developmentally challenging manifestation of ADHD in females [50].

Addressing bias within the healthcare sector, particularly within the realm of mental health, is a matter of paramount importance. Gender bias, whether overt or unconscious, permeates various facets of healthcare. Research has illuminated the existence of unconscious biases among physicians [27] particularly concerning individuals with mental health concerns. While this phenomenon may not be as pronounced among psychiatrists, it underscores the critical need for general practitioners and other healthcare providers to possess both knowledge and empathy when confronted with patients presenting mental health complaints, ensuring patients receive appropriate referrals to specialists [27]. When female patients exhibit symptoms of ADHD, healthcare providers often are challenged with a shortage of current information pertaining to gender-specific symptomatology, which may inadvertently contribute to bias and gender disparities when managing individuals with mental health conditions.

Education for teachers and school counselors

It is imperative to provide teachers and school counselors with appropriate up-to-date information on ADHD and its prevalence differences in males and females to discern the prevalent symptoms of ADHD in girls. This is essential to discern prevalent symptoms of ADHD in girls, thereby mitigating the potential over-referral of male students and the inadvertent oversight of ADHD symptoms in female counterparts. Symptoms such as inattentiveness, depression, anxiety, obsessive-compulsive disorder, and perfectionist behavior can hide ADHD symptoms and delay diagnosis, impacting outcomes in adulthood, including socio-economic status, pregnancy, and motherhood [34].

Integrate ADHD assessment into Prenatal and Postnatal Care

The primary intervention for mothers would be to include some mental health assessment, perhaps by collaborating or partnering with mental health clinicians, or integrating assessment of ADHD and other mental health comorbidity conditions during prenatal and postnatal care visits. Current postnatal care typically focuses on the child, with limited attention to maternal mental health beyond postpartum depression, and mothers receiving care the first six weeks post childbirth [49]. Having an ADHD diagnosis increases the risk for both postpartum depression and anxiety disorders, highlighting the

critical need for ADHD screening to be included in postpartum maternal care [3]. Including screening for ADHD symptoms during postnatal visits can aid in early identification and support for mothers experiencing ADHD-related challenges. This intervention is particularly vital for females from lower socioeconomic backgrounds who may face barriers to accessing healthcare services.

In conclusion, addressing gender bias, enhancing professional training and awareness, educating teachers and school counselors, and integrating ADHD monitoring into prenatal and postnatal care are essential steps to mitigate underdiagnosis of ADHD in adult females. By implementing these strategies, we can improve outcomes for females struggling with undiagnosed or underdiagnosed ADHD and promote their overall well-being across the lifespan.

Research Implications

Prompt identification and diagnosis in the early stages can enhance the quality of life for females, leading to improvements in education, economic prospects, social and family relationships, as well as fostering heightened self-awareness and self-esteem. Thus, it is vital to have comprehensive validated assessment tools that incorporate common female phenotypes and work well with high accuracy and precision in female cases.

The spectrum of ADHD symptoms is inherently diverse, yet the available body of research and literature often falls short in elucidating this complexity to clinicians. Clinical practice has predominantly centered around recognizing the overt and hyperactive manifestations of ADHD, which are more readily observable in males and a specific subset of females who exhibit pronounced external symptoms. Conversely, there remains a notable shortage of research focusing on internalized ADHD symptoms and the expansive breadth of ADHD's clinical presentation. This knowledge gap underscores the need for a more comprehensive understanding of ADHD's multifaceted nature amongst healthcare professionals. Addressing gender bias within the realms of mental health, particularly among diagnosing clinicians, should entail a fundamental paradigm shift from solely evaluating overt externalizing behaviors to a holistic assessment of individuals' lifelong functional impairments. To achieve a more equitable diagnostic framework, it is recommended to incorporate the operationalization of emotional dysregulation, internalizing symptomatology, as well as indicators of trauma and self-harm, alongside traditional behavioral criteria. This approach holds the potential to enhance diagnostic accuracy and facilitate the transition from subthreshold conditions to formal diagnosis [25].

There are various assessment tools for screening of ADHD in children and adults. However, there are currently no gender-specific assessment tools for ADHD. Assessment tools like the Behavior Assessment System for Children -3 (BASC-3) and the Conners Comprehensive Behavior Rating Scales for children (CBRS) involve parent and teacher rating forms, with some including self-reports.

Assessment tools for adults like the Adult ADHD Self-report Scale (ASRS) involving self reports, and the Conners Adult ADHD Rating Scales (CAARS) involving self-report, observations, and interviews are common tools used to screen for adult ADHD. With no existing gender-specific ADHD assessment tools coupled with existing bias among teachers, parents, and clinicians, this underscores the significance of abandoning a one-size-fits-all diagnostic approach and implementing more gender-specific criteria in the evaluation of ADHD in girls and women.

Study limitations

This review was limited by lack of data from healthcare professionals, as ADHD is not seen as a

primary mental health disorder for females, and thus diagnostic information and symptoms are not recorded in patients' medical records to access for research studies. Second, patients may not be willing to participate as they have not been diagnosed with ADHD or do not want to acknowledge mental health symptoms, that is associated stigma. Third, clinicians may have limited time and capacity to accurately assess ADHD symptoms. Limited access or quality of healthcare, particularly among low-income minorities, would limit the data available as more females with ADHD are unreported.

Study Strengths

This review increases awareness of ADHD prevalence in females and the factors associated with undiagnosed cases in females. It also highlights the tendency to overlook ADHD in girls during childhood, resulting in a rise in undiagnosed adult females with ADHD symptoms. This study also brings special attention to the negative effects of undiagnosed ADHD among mothers. The results show that there is a common misconception that ADHD is a male centered mental health disorder. Public health professionals can enhance their awareness of the presence of ADHD in females, recognize the diversity in gender differences in symptomatology, address gender bias and gender and racial disparities, and promote education for clinicians on female ADHD for earlier and more effective diagnosis.

Anticipated results show that ADHD is drastically under-detected in females. We anticipate an increase in ADHD diagnosis in females which may be accompanied by a decrease or similar results in postpartum depression. This is due to symptoms commonly associated with postpartum depression that may be related to females trying to cope with undiagnosed ADHD symptoms as well as the beginning of motherhood and the effects of comorbidity with ADHD. The anticipated increase in ADHD diagnosis rates should be met with resources for females, including mothers with ADHD. These resources may include referrals to healthcare providers who can prescribe medication, referrals to psychological counseling, and support groups which can provide necessary social support, and education about what ADHD is and coping mechanisms [26].

We conclude that females are commonly under-referred, underdiagnosed, and undertreated with ADHD, resulting in significant health, social, and economic impacts. The findings call for much greater effort and investments to educate and train teachers, parents, and healthcare and mental health providers in different realms to be more sensitive and vigilant in screening for and diagnosing ADHD among females. Greater investments, training, research, and systems need to be in place. Funding this research would provide the development of necessary education and training for healthcare providers, resulting in better outcomes in females with ADHD.

Acknowledgments

We would like to acknowledge Averi Devish, Keri Pappas, Peggy Harper, and Adrianne Medina, colleagues at the School of Health Sciences, University of South Dakota for their valuable contributions during the initial stages of this paper.

References

1. Adamou M, Arif M, Asherson P, Aw TC, Bolea B, Coghill D, Guðjónsson G, Halmøy A, Hodgkins P, Müller U, Pitts M, Trakoli A, Williams N, Young S. (2013). "Occupational Issuesof Adults with ADHD", *BMC Psychiatry, BioMed Central, 13-59l.* https://www.ncbi.nlm.nih.gov/

pmc/articles/PMC3599848/._doi: 10.1186/1471-244X-13-59

2. American Psychiatric Association. (n.d.). What is ADHD? https://www.psychiatry.org/patients-families/adhd/what-is-adhd
3. Andersson, A., Garcia-Argibay, M., Viktorin, A., Ghirardi, L., Butwicka, A., Skoglund, C.,Madsen, K. B., D'onofrio, B. M., Lichtenstein, P., Tuvblad, C., & Larsson, H. (2023). "Depression and anxiety disorders during the postpartum period in women diagnosed with attention deficit hyperactivity disorder", *Journal of Affective Disorders*, 325, 817-823. https://doi.org/10.1016/j.jad.2023.01.069
4. Andrews, A., McCabe, M. and Wideman-Johnston, T. (2014), "Mental health issues in theschools: are educators prepared?", *The Journal of Mental Health Training, Education andPractice*, 9, 261-272. https://doi.org/10.1108/JMHTEP-11-2013-0034
5. Ayano, G., Tsegay, L., Gizachew, Y., Necho, M., Yohannes, K., Abraha, M., Demelash, S., Anbesaw, T., & Alati, R. (2023). "Prevalence of attention deficit hyperactivity disorder in adults: Umbrella review of evidence generated across the globe", *Psychiatry Research*, 328, 115449. https://doi.org/10.1016/j.psychres.2023.115449.
6. Balázs J, Győri D, Horváth LO, Mészáros G, Szentiványi D. (2018) "Attention-deficit hyperactivity disorder and nonsuicidal self-injury in a clinical sample of adolescents: the role of comorbidities and gender", *BMC Psychiatry*. 18(1):34. doi: 10.1186/s12888-018-1620-3.
7. Bangma, D. F., Tucha, L., Fuermaier, A. B. M., Tucha, O., & Koerts, J. (2020). "Financialdecision-making in a community sample of adults with and without current symptoms of ADHD", *PLoS One*, 15(10), e0239343. https://doi.org/10.1371/journal.pone.0239343
8. Bartelt, K., Piff, A., Vitek, G., & Barkley, E. (2023). "Maternal ADHD Correlated withIncreased Risk of Postpartum Depression", *Epic Research*. https://epicresearchblob.blob.core.windows.net/cms-uploads/pdfs/maternal-adhd-correlated- with-increased-risk-of-postpartum-depression.pdf.
9. Beheshti, A., Chavanon, M. L., Schneider, S., & Christiansen, H. (2021). "ADHD overdiagnosis and the role of patient gender among Iranian psychiatrists", *BMC Psychiatry*, 21(1), 514. https://doi.org/10.1186/s12888-021-03525-3
10. Board AR, Guy G, Jones CM, Hoots B. (2020). Trends in stimulant dispensing by age, sex, stateof residence, and prescriber specialty - United States, 2014-2019. Drug Alcohol Depend. 1;217:108297. doi: 10.1016/j.drugalcdep.2020.108297.
11. Canadian ADHD Resources Alliance (CADDRA). (2022). https://www.caddra.ca/overview/.
12. Centers for Disease Control and Prevention. (2023). "Attention-Deficit / Hyperactivity Disorder (ADHD): Data & Statistics" https://www.cdc.gov/ncbddd/adhd/facts.html#Types CHADD. (n.d.). "Professionals Who Diagnose and Treat ADHD." https://chadd.org/about- adhd/professionals-who-diagnose-and-treat-adhd/
13. Chronis-Tuscano A, Molina BS, Pelham WE, Applegate B, Dahlke A, Overmyer M, Lahey BB. (2010). Very early predictors of adolescent depression and suicide attempts in children with attention-deficit/hyperactivity disorder. Arch Gen Psychiatry.67(10):1044-51. doi: 10.1001 archgenpsychitry.2010.127.
14. Dalsgaard S, Østergaard SD, Leckman JF, Mortensen PB, Pedersen MG. (2015). Mortality inchildren, adolescents, and adults with attention deficit hyperactivity disorder: a nationwide

cohort study. Lancet. 30;385(9983):2190-6. doi: 10.1016/S0140-6736(14)61684-6.

15. Da Silva, A. G., Malloy-Diniz, L. F., Garcia, M. S., & Rocha, R. (2020). "Attention- deficit/ hyperactivity disorder and women." In J. Renno Jr., G. Valadres, A. Cantilino, J. Mendes-Ribeiro, & R. Rocha (Eds.), Women's mental health (pp. 215-219). *Springer Nature Switzerland*.https:// doi.org/10.1007/978-3-030-29081-8_15
16. Franke, B., Michelini, G., Asherson, P., Banaschewski, T., Bilbow, A., Buitelaar, J. K., Cormand, B., Faraone, S. V., Ginsberg, Y., Haavik, J., Kuntsi, J., Larsson, H., Lesch, K. P., Ramos-Quiroga, J. A., Réthelyi, J. M., Ribases, M., & Reif, A. (2018). "Live fast, die young? A review on the developmental trajectories of ADHD across the lifespan", *European Neuropsychopharmacology*, 28(10), 1059-1088. https://doi.org/10.1016/j.euroneuro.2018.08.001
17. Fuller, T. E., Lewis, D. A., & Agbeyaka, S. K. (2016). "Attention-deficit/hyperactivity disorder casts a long shadow: findings from a population-based study of adult women with self-reported ADHD", *Child: Care, Health & Development*, 42(6), 918-927. https:// doi- org.usd.idm.oclc.org/10.1111/cch.12380
18. Gómez-Benito, J., Vijver, F. J. R. de, Balluerka, N., & Caterino, L. (2015, October 29). " Cross-cultural and gender differences in ADHD among young adults", *Journal of Attention Disorders*.https://pubmed.ncbi.nlm.nih.gov/26515894/.
19. Hinshaw SP, Owens EB, Zalecki C, Huggins SP, Montenegro-Nevado AJ, Schrodek E, Swanson EN. (2012). Prospective follow-up of girls with attention-deficit/hyperactivity disorder into early adulthood: continuing impairment includes elevated risk for suicide attempts and self-injury. *Journal of Consult Clinical Psychology*. 80(6):1041-1051. doi: 10.1037/a0029451.
20. Isaksson, J., Ruchkin, V., & Lindblad, F. (2016). Unseen and Stressed? "Gender Differences in Parent and Teacher Ratings of ADHD Symptoms and Associations With Perceived Stress in Children With ADHD", *Journal of Attention Disorders*, 1-5. https:// doi.org/10.1177/1087054716658381
21. Jones, H., Eddy, L., Rabinovitch, A., Snipes, D., Wilson, S., & Parks, A., et al. (2018). " Attention-deficit/hyperactivity disorder symptom clusters differentially predict prenatal health behaviors in pregnant women", *Journal of Clinical Psychology*, 74(4), 665-679. https:// doi.org/10.1002/jclp.22538
22. Joseph, H. M., Khetarpal, S. K., Wilson, M. A., & Molina, B. S. G. (2022). "Parent ADHD Is Associated With Greater Parenting Distress in the First Year Postpartum", Journal of Attention Disorders, 26(9), 1257-1268. https://doi.org/10.1177/10870547211066488.
23. Katzman, M. A., et al. (2017). "Adult ADHD and Comorbid Disorders: Clinical Implications ofa Dimensional Approach", *BMC Psychiatry, BioMed Central*. https://www.ncbi.nlm.nih.gov/pmc/ articles/PMC5567978/.
24. Li, T., Mota, N. R., Galesloot, T. E., Bralten, J., Buitelaar, J. K., IntHout, J., Arias Vasquez, A.,& Franke, B. (2019). "ADHD symptoms in the adult general population are associated with factors linked to ADHD in adult patients", *European Neuropsychopharmacology*, 29(10), 1117-1126. https://doi.org/10.1016/j.euroneuro.2019.07.136
25. Littman, E. B., & Wagenberg, B. (2023, July 26). "Gender Differences in ADHD and TheirClinical Implications", *Psychiatric Times*, 40(7). https://www.psychiatrictimes.com/.

26. Mayo Clinic Staff. (2019, June 22). "Adult attention-deficit/hyperactivity disorder (ADHD)",Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/adult-adhd/diagnosis-treatment/drc 20350883.

27. Meidert, U., Dönnges, G., Bucher, T., Wieber, F., & Gerber-Grote, A. (2023, August 12). "Unconscious Bias among Health Professionals: A Scoping Review", *International Journal of Environmental Research and Public Health,* 20(16), 6569. https://doi.org/10.3390/ijerph20166569

28. Meza, J. (2017). "ADHD, Self-Harm, and Suicide", *Attention Magazine*.https://chadd.org/attention -article/adhd-self-harm-and-suicide/

29. Mowlem, F., Agnew-Blais, J., Taylor, E., & Asherson, P. (2019). "Do different factors influence whether girls versus boys meet ADHD diagnostic criteria? Sex differences among children with high ADHD symptoms", *Psychiatry Research*, 272, 765-773. https://doi.org/10.1016/ j.psychres.2018.12.128

30. Murray AL, Taut D, Baban A, Hemady CL, Walker S, Osafo J, Sikander S, Tomlinson M, Toit SD, Marlow M, Ward CL, Fernando A, Madrid B, Van Thang V, Tuyen HD, Dunne M, Hughes C, Fearon P, Valdebenito S, Eisner M. (2022). "Associations Between ADHD Symptoms and Maternal and Birth Outcomes: An Exploratory Analysis in a Multi-Country Cohort of Expectant Mothers", *Journal of Attention Disorders* (14):1882-1894. doi: 10.1177/10870547221105064.

31. National Institute of Mental Health. (2022). "Attention-Deficit/Hyperactivity Disorder."https:// www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd.

32. Owens, E., & Hinshaw, S. (2020). "Adolescent mediators of unplanned pregnancy amongwomen with and without childhood ADHD", *Journal of Clinical Child & Adolescent Psychology*, 49(2), 229-238. https://doi.org/10.1080/15374416.2018.1547970

33. Owens, E. B., Zalecki, C., Gillette, P., & Hinshaw, S. P. (2017). Girls with childhood ADHD as adults: Cross-domain outcomes by diagnostic persistence. *Journal of Consulting and Clinical Psychology, 85*(7), 723–736. https://doi.org/10.1037/ccp0000217

34. Quinn PO, Madhoo M. (2014). "A review of attention-deficit/hyperactivity disorder in womenand girls: uncovering this hidden diagnosis", *Primary Care Companion for CNS Disord*ers. 16 (3):PCC.13r01596. doi: 10.4088/PCC.13r01596.

35. Peterson, R. K., Duvall, P., Crocetti, D., et al. (2023). "ADHD-related sex differences in frontal lobe white matter microstructure and associations with response control under conditions of varying cognitive load and motivational contingencies", *Brain Imaging and Behavior*, 17, 674–688. https://doi.org/10.1007/s11682-023-00795-1

36. Poulton, A. S., Armstrong, B., & Nanan, R. K. (2018). "Perinatal Outcomes of Women Diagnosed with Attention-Deficit/Hyperactivity Disorder: An Australian Population-BasedCohort Study", *CNS Drugs*, 32, 377–386. https://doi.org/10.1007/s40263-018-0505-9

37. Russell J, Franklin B, Piff A, Allen S, Barkley E. (2023). "Number of ADHD Patients Rising, Especially Among Women." *Epic Research.* https://epicresearch.org/articles/number-of-adhd patients-rising-especially-among-women.

38. Schein, J., Adler, L. A., Childress, A., Gagnon-Sanschagrin, P., Davidson, M., Kinkead, F., Cloutier, M., Guérin, A., & Lefebvre, P. (2022). "Economic burden of attention- deficit/ hyperactivity disorder among adults in the United States: a societal perspective", *Journal of*

Managed Care & Specialty Pharmacy, 28(2), 168-179. https://doi.org/10.18553/jmcp.2021.21290

39. Shalaby, N., Sengupta, S., & Williams, J. B. (2023). "Large-Scale Analysis Reveals Racial Disparities in the Prevalence of ADHD and Conduct Disorders", *medRxiv*, 10.25.23297549.https://doi.org/10.1101/2023.10.25.23297549
40. Shi, Y., Hunter Guevara, L. R., Dykhoff, H. J., et al. (2021). "Racial Disparities in Diagnosis of Attention-Deficit/Hyperactivity Disorder in a US National Birth Cohort", *JAMA Network Open*,4 (3), e210321. https://doi.org/10.1001/jamanetworkopen.2021.0321
41. Slobodin, O., & Crunelle, C. L. (2019, June 26). "Mini Review: Socio-cultural influences on the link between ADHD and SUD", *Frontiers in Public Health*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6606733/.
42. Snare, J. (2022, June 28). "Data. The National Patient-Centered Clinical Research Network." https://pcornet.org/data/.
43. Solberg, B. S., Halmøy, A., Engeland, A., Igland, J., Haavik, J., & Klungsøyr, K. (2018). "Gender differences in psychiatric comorbidity: a population-based study of 40,000 adults withattention deficit hyperactivity disorder", *Acta Psychiatrica Scandinavica*, 137(3), 176-186. https://doi.org/10.1111/acps.12845
44. Song, P., Zha, M., Yang, Q., Zhang, Y., Li, X., & Rudan, I. (2021). "The prevalence of adult attention-deficit hyperactivity disorder: A global systematic review and meta-analysis", *Journal of Global Health*, 11. https://doi.org/10.7189/jogh.11.04009
45. Stibbe T, Huang J, Paucke M, Ulke C, Strauss M. (2020). "Gender differences in adult ADHD: Cognitive function assessed by the test of attentional performance", *PLoS One*. 15(10):e0240810. doi: 10.1371/journal.pone.0240810. PMID: 33057383;
46. Viking, T., Nilsson, M. S., & Wernersson, I. (2023). "Interprofessional learning through discussions of troubled sex/gender in mental health care: a case study", *The Journal of Mental Health Training, Education, and Practice.* Vol. 18 No. 3, pp. 205-216. https://doi.org/10.1108/JMHTEP-03-2021-0032
47. Visser SN, Danielson ML, Bitsko RH, Holbrook JR, Kogan MD, Ghandour RM, Perou R, Blumberg SJ. (2014). "Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003-2011", *Journal of the American Academy of Child and Adolescent Psychiatry*.53(1):34-46.e2. doi: 10.1016/j.jaac.2013.09.001
48. Woods, K. E., Mazursky-Horowitz, H., Thomas, S. R., Dougherty, L. R., & Chronis-Tuscano, A. (2021). "The Unique Effects of Maternal ADHD Symptoms and Emotion Dysregulation on Parenting Behavior", *Journal of Attention Disorders*, 25(5), 672–684. https://doi.org/10.1177/1087054719829820
49. World Health Organization. (2013). "11 postnatal care of the mother and newborn - NCBI Bookshelf. " https://www.ncbi.nlm.nih.gov/books/NBK304191/.
50. Young, S., Adamo, N., Ásgeirsdóttir, B. B., et al. (2020). "Females with ADHD: An expert consensus statement taking a lifespan approach providing guidance for the identification and treatment of attention-deficit/ hyperactivity disorder in girls and women", *BMC Psychiatry*, 20,404. https://doi.org/10.1186/s12888-020-02707-9