

An Examination of ADHD Symptomology in Females: Implications for Public Health Practice

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Abstract

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder with a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning and development. ADHD has several negative implications on mental and physical health, social relationships, education, and employment. The impact and outcomes of ADHD on girls/women as well as factors leading to delayed diagnosis are a combination of social expectations and lack of knowledge/education around symptom presentation in women and girls. This paper will address the public health problem of how inadequate recognition and support for women with ADHD leads to heightened risks of negative health outcomes, compounded by low self-esteem and reliance on harmful coping mechanisms. Limited access to mental health resources, exacerbated by financial constraints and societal misconceptions, further exacerbates these challenges, impacting various aspects of their lives and well-being.

A systematic review was conducted to address the questions: *How do the symptoms of ADHD with a higher prevalence in girls/women impact early recognition and diagnosis of ADHD in females?* and *What implications do these gender specific symptoms have on future research and clinical practice?* In total, twelve articles were identified in which ADHD symptoms were found to be more prevalent in females than males. Symptoms from this review can be divided by symptoms related to emotional regulation (n=4), symptoms of hyperactivity/impulsivity or inattention (n=3), and symptoms that are a direct example of EF impairments (n=6). These symptoms, their impacts,

and common themes found through the literature and possible implication of this data are explored and discussed.

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1.0 Background

1.1 Attention-Deficit/Hyperactivity Disorder (ADHD)

Attention-Deficit/Hyperactivity Disorder (ADHD) is categorized as a neurodevelopmental disorder with a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning and development (American Psychiatric Association, 2022).

Data from the 2016-2019 National Survey of Children's Health suggests approximately 6 million children in the United States (9.8%) have received an ADHD diagnosis at some point in their life. Of the 6 million children 12.0% were Black, 10.9% White, 7.5% Hispanic, and 2.6% Asian. The same data was used to estimate that 5.3 million children (8.7%) have a current diagnosis of ADHD with 8.4% living in urban/suburban areas and 10.7% in rural (U.S. Department of Health, 2023). Diagnostic interview data of 3,199 adults aged 18 to 44 found a 4.4% rate of ADHD with a higher prevalence in males (5.4%) compared to females (3.2%) (U.S. Department of Health, 2023).

In 2021 the World Federation of ADHD released an updated statement, incorporating 208 articles published over the previous 20 years. It found that people with ADHD are at increased risk for "obesity, asthma, allergies, diabetes mellitus, hypertension, sleep problems, psoriasis, epilepsy, sexually transmitted infections, abnormalities of the eye, immune and metabolic disorders" (Faraone et al., 2021). Faraone et al. (2021) found individuals with undiagnosed ADHD are at increased risk for "low quality of life, substance use disorders, accidental injuries, educational underachievement, unemployment, gambling, adolescent pregnancy, difficulties socializing, delinquency, suicide, and premature death" (Faraone et al., 2021).

1.1.1 Prevalence

The National Institute of Mental Health reports the prevalence of children ever diagnosed with ADHD increased by 42% between 2003 (7.8%) and 2011 (11.0%) (U.S. Department of Health, 2023). The National Health Interview Survey reported prevalence of ADHD to be 10.2% in boys and 4.3% in girls from 2002-2003 and 13.6% in boys and 5.4% in girls from 2011-2012 (U.S. Department of Health, 2023). Based on the 1997-1998 National Health Interview Survey (NHIS) prevalence of ADHD in children 18 and younger was estimated to be 6.1% [ages 4-11(5.2%), ages 12-17 (7.2%)]; 9.0% in boys; and 3.1% in girls. By 2015-2016 reported prevalence was estimated to be 10.2% [age 4-11 (7.7), age 12-17 (13.5%)]; 14% in boys; and 6.3% in girls (U.S. Department of Health, 2023). A study of 37,609 participants ages 4 to 17 found a prevalence of ADHD to be 10.20% in 2017 to 2018, 10.08% in 2019 to 2020, and 10.47% in 2021 to 2022 (Li et al., 2023). Experts cite the refining of the diagnostic criteria, as well as an increase in awareness and familiarity with ADHD, as the biggest contributors to steady increases in ADHD diagnoses in the United States (Abdelnour et al., 2022).

1.2 ADHD in the DSM

The Diagnostic and Statistical Manual of Mental Disorders (DSM) contains the descriptions, symptoms and other criteria used by healthcare professionals across the world as the authoritative guide to the diagnosis of mental disorder (American Psychiatric Association, 2013). The grouping of symptoms that would eventually be named Attention-Deficit/Hyperactivity Disorder first appeared in the second edition of the DSM (DSM-II) in 1968 and was thought to be

an affliction of boys in childhood (Epstein and Loren, 2013). It was known as *Hyperkinetic Reaction of Childhood*, a diagnosis that focused on the symptoms of excessive motor activity. In 1980 the DSM-III brought a new focus to the disorder, centering difficulties with attention, impulsivity and hyperactivity. It was at this time the disorder was renamed *Attention Deficit Disorder (ADD) with/without Hyperactivity* (Epstein and Loren, 2013). Seven years later (1987) the term *Attention Deficit/Hyperactivity Disorder (ADHD)* was introduced in the DSM-III-R and *ADD without Hyperactivity* was removed (Epstein and Loren, 2013). In 1994, the DSM-IV removed the term *Attention Deficit Disorder (ADD) with Hyperactivity*, leaving a possible diagnosis of *ADHD with one of three subtypes: predominantly inattentive, predominantly hyperactive-impulsive or combined*. It was also at this time “adult ADHD” was introduced to the DSM, further highlighting ADHD as a lifetime developmental disorder, opposed to one of childhood (Epstein and Loren, 2013). In 2013 the DSM-V further expanded criteria to be better applied across the lifespan with the goal of capturing more adults. This edition also removed the chapter: “Diagnosis Usually First Made in Infancy, Childhood or Adolescence”, moving ADHD to the “Neurodevelopmental Disorders” chapter (American Psychiatric Association, 2013). The latest edition, DSM-V-TR was released in 2022, adding “prevalence is higher in special populations such as foster children or correctional settings” to the ADHD section (American Psychiatric Association, 2022).

1.3 ADHD and The Media

In January of 2002 experts tried to warn of the rapidly spreading misinformation about ADHD. The World Federation of ADHD published an International Consensus Statement to voice

concerns over the “periodic inaccurate portrayal” of ADHD, fearing the “inaccurate stories rendering ADHD as myth, fraud, or benign condition may cause thousands of sufferers not to seek treatment for their disorder” (Barkley et al., 2002). These experts stressed that “ADHD should be depicted in the media as realistically and accurately as it is depicted in science” otherwise it will continue to perpetuate the myth that the “disorder is not valid or real or consists of a rather trivial affliction.” (Barkley et al., 2002).

While experts had provided overwhelming scientific evidence of the legitimacy of ADHD, media reports centered on conspiracies and misinformation (Barkley et al., 2002; Stolzer, 2007). Media outlets reported that providers and teachers were in the pockets of “Big Pharma,” giving them an incentive to have as many children on medication as they could (Stolzer, 2007). Works such as: *There is No Such Thing as Psychiatric Disorder/Diseases/Chemical Imbalance (2006) and The ADHD Fraud and How Psychiatry Makes “Patients” of Normal Children* by Fred Baughman; *The ADHD Epidemic in American (2007)* by J.M Stolzer help capture the messaging on ADHD in the early 2000s. Americans were led to believe ADHD was an excuse and that “individuals themselves” were “to be blamed for their condition” and behaviors (Mueller et al., 2012). Today the rise in ADHD diagnosis is thought to be a result of expanded criteria and public awareness of ADHD, rather than a sign of over-diagnosis (Abdelnour et al., 2022).

Currently conversations and information around ADHD, especially its presentation in females, are popular on social media, with #ADHD having 11.4 billion views on TikTok. This has further increased awareness and impacted diagnosis rates (Abdelnour et al., 2022). The COVID-19 pandemic and associated shutdowns had a unique impact on people with undiagnosed ADHD, rendering many of their coping skills and mechanisms useless, leaving them struggling to adjust to new ways of life significantly more than their peers (Segenreich, 2022). Individuals with ADHD

were found to have higher prevalence of psychiatric symptoms during lock down, as well more negative impacts on social life and quality of life as a result of remote learning/working (Segenreich, 2022). This has impacted rates of people seeking out information, testing, and a diagnosis of ADHD and its popularity on social media (Segenreich, 2022; Abdelnour et al., 2022).

1.4 Diagnosis, Treatment and Management

1.4.1 Diagnosis

Longitudinal research suggests “adolescents’ self-reported ADHD symptoms fluctuate substantially within persons from day to day”, complicating recognition and diagnosis of ADHD (Schmid et al, 2020). During an assessment for ADHD, providers use the DSM-V guidelines in conjunction with information gained through interviews (with patients, parents, partners and teachers), cognitive performance tests, and life history to make a diagnosis of ADHD. Interviews allow for a rounded perspective on childhood behaviors and challenges. Some providers complete a Neuropsychological Evaluation to help determine the exact pathology of the behaviors present in their patients’ lives. Others will run cognitive tests on working memory, executive functions, visual, spatial, and reasoning skills (Centers for Disease Control and Prevention, 2023; Substance Abuse and Mental Health Services, 2016; U.S. Department of Health, 2023).

1.4.1.1 Diagnostic Criteria

The DSM-V states “Symptoms must persist for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and

academic/occupational activities” (American Psychiatric Association, 2013). These symptoms must be present before age 12; be present in two or more settings (such as at home, school or work; with friends or relatives; in other activities); have evidence that the symptoms interfere with, or reduce the quality of, social, school, or work functioning; and symptoms are not better explained by another mental disorder and do not happen only during the course of schizophrenia or another psychotic disorder (American Psychiatric Association, 2013).

1.4.1.1.1 Hyperactivity/Impulsivity

Six or more of the following symptoms of hyperactivity-impulsivity must be identified for individuals ages 16 and younger and five or more for individuals ages 17 and older:

- Often fidgets with or taps hands or feet, or squirms in their seat.
- Often leaves the seat in situations when remaining seated is expected.
- Often runs about or climbs in situations where it is not appropriate (adolescents or adults may be limited to feeling restless).
- Often unable to play or take part in leisure activities quietly.
- Is often “on the go” acting as if “driven by a motor”.
- Often talks excessively.
- Often blurts out an answer before a question has been completed.
- Often has trouble waiting their turn.
- Often interrupts or intrudes on others (e.g., butts into conversations or games)

1.4.1.1.2 Inattention

Six or more of the following symptoms of inattention must be identified for individuals ages 16 and younger and five or more for individuals age 17 and older.

- Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or with other activities.
- Often has trouble holding attention on tasks or play activities.
- Often does not seem to listen when spoken to directly.
- Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., loses focus, side-tracked).
- Often has trouble organizing tasks and activities.
- Often avoids, dislikes, or is reluctant to do tasks that require mental effort over a long period of time (such as schoolwork or homework).
- Often loses things necessary for tasks and activities (e.g. school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones).
- Is often easily distracted
- Is often forgetful in daily activities.

1.4.2 Treatment and Management

ADHD impacts an individual throughout their lifetime, but with certain tools ADHD can be managed and allow an individual to live a fulfilling successful life. The most effective approach is with multimodal therapeutic approaches such as pharmaceutical therapy; behavioral therapy; cognitive behavioral therapy; coaching; family therapy; marital therapy; classroom intervention; work/classroom accommodations; and parental coaching (Drechsler et al., 2020). Parents often need specialized help to overcome negative feelings such as frustration, blame, and anger toward and around their child that developed before a child's diagnosis (Drechsler et al., 2020).

Psychotherapy without parental involvement is not effective for managing ADHD and its associated behaviors in children, although it may help with anxiety or depression that occur as a result of untreated ADHD (Department of Health, 2023). Individuals who spent prolonged time undiagnosed often need therapy targeting development of “a sense of personal control over life events to mitigate the feelings of helplessness” and to begin breaking down a lifetime of feeling like a failure (Rucklidge, 2010). Both stimulants (Adderall, Ritalin) and non- stimulants (Wellbutrin) can be prescribed either alone or in conjunction with each other (Department of Health, 2023). Stimulants are thought to help increase free dopamine and norepinephrine in the brain by disrupting the reuptake of these neurotransmitters (Cleveland Clinic, 2022).

1.4.3 Impact of Diagnosis and Management

In a perfect world when an individual is diagnosed with ADHD they would also be given treatment and taught skills on how to manage their ADHD symptoms. An official diagnosis allows for parents to request accommodations at school, such as extended test times and allowing them breaks or times to move around (Centers for Disease Control and Prevention, 2023). Similarly, adults can request reasonable accommodations at their places of employment; for example, requesting a desk in a location with little distractions or the approval of the use of headphones while working (Centers for Disease Control and Prevention, 2023). A diagnosis can positively impact individuals, acting as an opportunity for a release of guilt and help with self-forgiveness (Fleischmann and Fleischmann, 2012). French et al. (2023) found better academic outcomes for individuals who receive treatment for their ADHD when compared to undiagnosed/untreated individuals (French et al., 2023).

Increased control over ADHD symptoms results in “reduced negative feedback, peer rejection and increases in academic performance, self-esteem, and parental relationships” possibly reducing the long term social and mental implications of ADHD (Houmann et al., 2023). Early interventions such as: parental training in behavioral management; behavioral interventions in the class room; organizational and emotional regulation skills training provide ADHD children with the tools to overcome and manage impairments with executive functioning (Centers for Disease Control and Prevention, 2023).

1.5 The ADHD Mind

1.5.1 Executive Function

Experts agree impairments related to ADHD stem from deficits with Executive Function (EF). EF is the brain’s ability to control/influence the processes in the brain that activates, integrates and manages brain functions. Today ADHD is understood to limit an individual’s control over and awareness of three main functions of EF: Working memory; Inhibition Control (self-control/self-restraint); and Cognitive Flexibility (Amen, 2013; Barkley, 2015; Swanson, 2003).

Deficits in working memory can be verbal (self-speech, internal speech, inner monologue) or non-verbal (ability to picture things, organize). This creates difficulties with keeping track of items, multitasking, following instructions or multiple steps. This can present as difficulties with multiple step math equations or planning and shopping for meals. ADHD’s impact on self-speech

and visual imagery complicates an individual's control over self-soothing and regulation of strong emotions (Amen, 2013; Barkley, 2015; Diamond, 2013; Swanson, 2003).

Struggles with inhibition control can have attentional, behavioral and emotional implications. Individuals with ADHD struggle with resisting distractions and staying on task (attentional); stopping themselves from doing something they know they should not (behavioral); and regulating their emotions and responses (emotional). These can present as appearing to not pay attention in conversations or class; shouting out answers in class; interrupting or finishing someone's sentence; often feeling overwhelmed with emotion; quickness to anger or frustration (Amen, 2013; Barkley, 2015; Diamond, 2013; Swanson, 2003).

Cognitive flexibility describes the ability to task switch/ "switch gears" and adapt to new/unexpected situations. Individuals with ADHD are often described as rigid or "black and white" thinkers. Effective higher level executive functioning (problem solving, time-management, decision making planning and organization) hinge on the successful execution of the lower levels EF (Amen, 2013; Barkley, 2015; Diamond, 2013; Swanson, 2003).

When and how executive dysfunction presents in an individual is often influenced by level of interest in and excitement about a task or activity (Bjerrum et al., 2017). When an individual with ADHD finds a task uninteresting their brain responds with increased executive function impairments such as poor motivation and reading skills, forgetfulness, procrastination, and difficulties in starting and completing tasks (Bjerrum et al., 2017). Completing tasks that require organization, attention and prioritization use a lot of energy for ADHD brains, often leaving the individual exhausted after completing the task (Bjerrum et al., 2017).

1.5.2 The Brain

Research suggests impairments to EF related to ADHD likely stem from differences/deficiencies in: brain structure (gray matter volume, delayed development, enhanced cortical thinning); neural networks communication; and neurotransmitter absorption/reuptake.

Structural difference may be found in the Frontal Lobe (social behavior, judgment, communication, problem solving); Prefrontal cortex (movement attention, cognition, emotion, motivation; affective and cognitive components of executive control); Basal Ganglia (motivation, reward processing, goal-directed behavior, motor control and learning); Cerebellum (motor control, cognitive and emotional processes); Limbic Region (influences emotion and motivation) (Gehricke et al., 2017; Ziegler et al., 2016).

Neurotransmitters are involved in updating reward expectation, holding information and cognitive flexibility. Dopamine and Noradrenaline (arousal, vigilance and attention, planning and initiation of motor response, reaction to novelty, processing of rewards), Norepinephrine (arousal modulation, cognitive processing), 5-HT (management of depression, anxiety, and sleep; emotional regulation) GABA (motor control, behavioral inhibition) Glu Learning (memory) are the main neuro transmitters associated with ADHD. There is less dopamine in ADHD brains resulting in impairments to the dopamine reward path-way making it harder to maintain motivation especially for a small or not immediate reward (Blum, 2008; Ziegler et al., 2016).

ADHD may alter connection between the prefrontal cortex and other areas of the brain leading to poor planning, distractibility, impulsivity and forgetfulness. Deficiency in the Cognitive-executive network (executive function, working memory, selective and sustained attention; regulating emotion; planning of motor activity); Cortico-limbic network; Cortico-striatal thalamic; Default mode network; Dorsal attentional network; Motor network; Ventral attentional

network; and Visual network have been associated with ADHD (Blum et al., 2008; Ziegler et al., 2016).

1.6 Undiagnosed ADHD

Research exploring the impacts of undiagnosed ADHD can be categorized by: health related risks; links to offending behaviors; and impacts on daily activity (French et al., 2023). Concern around physical health is most often related to the higher frequency of accidental injuries in ADHD individuals (French et al., 2023). Research suggests the prevalence of undiagnosed ADHD among the UK prison population ranges from 35% to 43% and found increased rates of imprisonment, aggression, criminality and substance abuse in those with undiagnosed ADHD (French et al., 2023). Untreated ADHD can result in increased rates of depression, anxiety and suicidality (French et al., 2023).

1.6.1 Economic Impact

Worldwide ADHD costs hundreds of billions of dollars each year. ADHD has been found to have an associated societal costs across the lifespan equating to \$15,664 per person totaling to approximately \$12.76 billion in 2019 alone (Sciberras et al., 2020). The estimated economic burden of raising a child with ADHD (\$15,036), was five times higher when compared to the cost for a child without ADHD (\$2,848) (Sciberras et al., 2020). The annual estimated excess cost of a child with ADHD is \$19.4 billion a year for children and \$13.8 billion among adolescents (Schein et al., 2022). Estimated direct healthcare costs for children are \$5.9 billion and \$4.0 billion for

adolescents while associated caregiving cost are \$2.7 billion in children and \$1.6 billion for adolescents (Schein et al., 2022).

1.6.2 Implications for Childhood and Adolescence

ADHD childhood and adolescence are marked by academic failure, rejection by peers, low self-esteem, and difficulties at home or on outings with caregivers (Harpin, 2005). Children with undiagnosed ADHD have increased rates of mental stress, impacting how they view and interact with themselves and the world around them. ADHD impacts social skills and adaptability, leaving undiagnosed children with the feeling of “being an alien, being different” and often finding themselves not invited to parties and to play (French et al, 2023); (Harpin, 2005). Adolescents with ADHD may experience a distorted sense of self, increased family conflict “severe lack of friendships,” increased risk for dropping out of school, and academic failure (Harpin, 2005).

1.6.3 ADHD Households

The behavioral, emotional, and sleep complications associated with ADHD impact successful functioning and mental well-being of the household and all members in it (Penner-Goeke, 2023; Harpin, 2005). Parents and siblings both, willingly and/or unknowingly, make accommodations for an ADHD child’s executive dysfunction while bearing the brunt of emotional, in some cases physical, outbursts (Harpin, 2005). This can foster resentment in both siblings and parents toward the ADHD child. The behavioral implications of ADHD negatively impact parental marital functioning; parent-child relationships; parenting effectiveness and parenting stress (Penner-Goeke, 2023; Harpin, 2005). Furthermore, ADHD has been found to have formal

heritability ranging from 80% to 90%, greatly increasing the likelihood more members of the household have ADHD and complicating the household dynamic (Grimm et al., 2020; Young et al., 2020).

1.6.4 Daily Impacts

Daily impacts of ADHD can include difficulties with social situations, money, education, work, and driving (French et al., 2023). The visual and mental inattentiveness and/or impulsivity associated with ADHD put individuals at increased risk of traffic violations, as well as being found at fault in fatal and non-fatal accidents (French et al., 2023). Newly licensed drivers with ADHD were found to have a crash hazard 36% higher than that of their neuro-typical peers (Curry et al., 2017). Individuals with ADHD are more likely to have chronic unemployment issues, be fired from a job, and quit a job impulsively (Barkley, 2008). Impairments to executive function causes difficulties with “getting up in the morning, preparing to leave the house for work, arriving at work on time, and being productive on the job”, making it difficult to obtain and maintain jobs (U.S. Department of Health, 2023). Analysis on 1,196,744 Swedish graduates from 1998-2008 found "Individuals with ADHD had annually on average 17 percent lower income, more days of unemployment, and a higher likelihood of receiving disability pension, compared to controls." (Jangmo et al., 2021). These differences in these rates were found to be partly impacted by educational attainment (Jangmo et al., 2021). Impulsivity and EF impairments put individuals with ADHD at increased risk of overspending and debt (Koerts et al., 2021). Individuals with ADHD score significantly lower on tests of financial judgement than neuro-typical peers (Koerts et al., 2021).

1.6.5 Substance Misuse

ADHD adolescents most commonly misuse alcohol, marijuana, and nicotine (Banaschewski et al., 2018). Research suggests children with ADHD are at an elevated risk for developing Substance Use Disorders (SUD) compared to their neuro-typical peers (Banaschewski et al., 2018). In 2020, The International Collaboration on ADHD and Substance Abuse found approximately 1 in 6 adult treatment-seeking SUD patients also had ADHD. Individuals with comorbid ADHD and SUD had higher rates of other psychiatric disorders, “including antisocial personality disorder, major depression, borderline personality disorder, and hypomanic episode” (Van de Glind et al., 2020). Researchers from the National Institute of Health found that ADHD was present in “38% of adolescent boys and girls with cannabis use disorder” (Banaschewski et al., 2018).

Some suggest the “demoralization and failure” associated with ADHD contributes to early substance use and later development of SUDs in people with ADHD (Banaschewski et al., 2018). For many individuals with ADHD, substance use is a form of self-medicating (Banaschewski et al., 2018). Substance use helps individuals deal with racing thoughts, negative self-image, and restlessness by helping to alter moods, sleeping patterns, and thoughts in their head (Banaschewski et al., 2018). Some studies have found reported improvement with inattention and EF with nicotine use, adding another layer to the addition/dependency on nicotine products (Banaschewski et al., 2018).

1.7 ADHD and at Risk Groups

The mistrust of the healthcare system and research institutions held by many marginalized groups as well as the stigmas associated with ADHD influences an individual's ability and willingness to seek out diagnosis and treatment (Bazargan, 2021; Mueller et al., 2012). This mistrust has been earned due to a combination of systematic racism and discrimination resulting in inferior quality care; as well as numerous unethical research projects conducted on African Americans, Native Americans, Hispanic-Latinos and Asian Americans (Griffith et al., 2021).

Direct exposure to trauma is associated with increased ADHD symptoms, putting those populations with increased historical and/or intergenerational trauma at greater risk (Lefler et al., 2015). Data on the rates and unique impacts of ADHD on Black Indigenous and Persons of Color (BIPOC) communities are limited, in part because ADHD continues to be underdiagnosed in BIPOC populations even when socioeconomic status and adverse events are controlled for (Abdelnour et al., 2022). BIPOC youth are disproportionately more likely to have their ADHD misdiagnosed as Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD) (Abdelnour et al., 2022). Differing social and behavioral norms across cultures may impact if parents view behaviors as “abnormal” and if/when they bring their child for testing (Hamed et al., 2015). Research including a range of stakeholders (parents, clinicians, etc.) found a “lack of support from school/healthcare/family members, cultural barriers, limited resources, limited access, and treatment concerns” to be barriers to treatment initiation and/or adherence in Black and/or Latinx children (Kamimura-Nishimura et al., 2023). Similarly, research must be conducted on the presentation and impacts of ADHD on trans and non-binary people. Research shows the recognition of ADHD is influenced by perceived gender roles but researchers have yet to explore its impact on the recognition and diagnosis of ADHD in trans and non-binary populations.

Exploratory research suggests ADHD may have a higher prevalence in transgender populations, but substantially more research needs to be conducted before significant associations can be made (Cheung et al., 2018).

1.8 ADHD in Girls/Women

Research as early as 1997 warned of the widening gap in knowledge on gender differences in ADHD. For 30 years we have known the misinterpretation of and internalization of girl's behaviors and thoughts contribute to less referrals for assessment (Young et al., 2020). Even so the only qualifiers on gender found under ADHD in the DSM-V is: "ADHD is more frequent in males than in females in the general population, with a ratio of approximately 2:1 in children and 1.6:1 in adults. Females are more likely than males to present primarily with inattentive symptoms" (American Psychiatric Association, 2013). A lack of recognition, research and understanding of ADHD in girls has resulted in a gender gap in diagnosis rates of ADHD. Many girls are never diagnosed and the ones that do receive an ADHD diagnosis significantly later in life than their male counterparts (Attoe and Climie, 2023).

1.8.1 History

Historically ADHD research was conducted on boys, greatly limiting our understanding of and ability to recognize ADHD in girls and women, thus contributing to a cultural and professional misunderstanding of ADHD's presentation in girls and women (Arnold, 1996). In 1979 researchers began exploring ADHD's presentation in girls and women, although the first conference on gender

differences in ADHD was not held until 1994 (Arnold,1996). During this conference, it was agreed that the girls had been virtually excluded in the testing, diagnostic and symptomatology of ADHD research (Arnold,1996). In 1997 the first meta-analysis exploring ADHD in girls was published by Gaub & Carlson (1997) finding girls with ADHD “displayed greater intellectual impairment, lower levels of hyperactivity, and lower rates of other externalizing behaviors” when compared to their male peers with ADHD (Gaub and Carlson, 1997).

In 1999 J. Biederman et al. published a study comparing 144 girls with ADHD to neurotypical children and boys with ADHD, finding “prototypical core symptoms of the disorder” in girls as well as “high levels of comorbid psychopathology, and dysfunction in multiple domains” (Biederman et al., 1999). In 2014 Quinn and Madhoo completed a PubMed search on articles published between 2002 and 2012, finding 41 articles published between that explored ADHD in women. This review found attitudes adults held about children with ADHD varied based on gender; girl’s symptoms are considered “subthreshold” for diagnosis because they more often have the inattentive subtype; and females develop better coping strategies that mask/hide their symptoms (Quinn and Madhoo, 2014).

1.8.2 Overlooked, Undertreated and Mistreated.

Gender differences in ADHD symptoms, presentation, and impairments are believed to be a combination of biological, environmental, and social factors. Research suggests brain structure and hormonal differences may explain why some studies find gender differences in their results (Haimov-Kochman & Berger 2014). Research suggests a referral bias, “where girls are less often than boys referred by teachers for further evaluation and treatment” which contributes to females receiving a diagnosis later in life (Isaksson et al., 2016). This largely stems from adults (parents,

providers, teachers) missing or wrongly assigning meaning to girls' behaviors and traits (Isaksson et al., 2016).

Academic underachievement is one of the most cited reasons children are referred to/ brought in for ADHD testing (Biederman et al., 2002). Biederman et al. found girls with ADHD were less likely to have a learning disorder and are less likely to manifest problems in school. Research from Isaksson et al. 2016 found teacher scores to be significantly lower than parental scores when rating symptom presence in young girls (Isaksson et al., 2016). Research shows parents and teachers require higher scores of impairments/symptoms in girls, to recognize symptoms of ADHD in girls and refer them to testing (Young et al., 2020).

Most of the well-known symptoms of ADHD reflect the external behaviors of the hyperactive-impulsive subtype, which is more common in boys (Young et al., 2020). Research suggests girls more often have inattentive/combined ADHD, resulting in more internalized symptoms (Biederman et al., 2002). This can include emotional dysregulation, time blindness, racing thoughts, and rejection sensitive dysphoria, which are more difficult to observe than hyperactive behaviors, like yelling out and interrupting class. Inattention symptoms may be easier to observe and/or have greater impacts in less structured educational environments, such as high school or college, possibly contributing to females receiving a later diagnosis (Slobodin & Davidovitch, 2019). Gender-related behavioral expectations, and the meaning we assign to a girl's behavior help explain why girl's ADHD behaviors are often overlooked. Girls are more likely to develop socially adaptive behaviors such as compliance, increased resilience, and masking to avoid social repercussions (Young et al., 2020). These behaviors allow girls to appear to socialize successfully but can come at great mental and emotional cost to girls by suppressing the real versions of themselves and their personalities (Young et al., 2020).

Girls with ADHD are at an increased risk for comorbid mental health conditions, especially anxiety and depression (Young et al., 2020). Girls and women are more likely to develop anxiety and depression as a result of and/or as a way to cope with ADHD impairments (Young et al., 2020). Providers have been primed to diagnose anxiety or depression in girls who present with symptoms such as memory issues and distractibility. Often girls are diagnosed with a comorbid condition first and only diagnosed with ADHD after impairments persist through the treatment/improvement of comorbid conditions (Young et al., 2020); Attoe and Climie, 2023). Furthermore, it is thought that symptoms of comorbid conditions can make recognition of ADHD symptoms more difficult. For example, a woman with ADHD may rarely be late but only because their anxiety has the greater influence over her mind/actions resulting in leaving them leaving 30 minutes early for everything (Young et al., 2020; Attoe and Climie, 2023).

1.8.2.1 Hormonal Role

ADHD's symptom severity is impacted by menstrual cycles and the hormonal changes associated with puberty, pregnancy, postpartum and menopause (Antoniou et al., 2021; Young et al., 2020). It is believed the decline of estrogen and dopamine during these events results in increased impairment for girls and women with ADHD (Antoniou et al., 2021). Studies suggest women experience less impairment during the first two weeks of their menstrual cycle, as estrogen is increasing. During the third and fourth weeks of the cycle (the lunar phase) estrogen production drops and ADHD symptoms can worsen and cause greater impairments (Antoniou et al., 2021). Increases in estrogen due to pregnancy may provide temporary decreases in symptom severity, but as estrogen plummets in the postnatal period so does dopamine resulting in depressive moods (Antoniou et al., 2021). During peri-menopause and menopause ADHD impairments become more severe with the decrease in progesterone and estrogen (Antoniou et al., 2021). It is suggested that

clinicians pay extra attention to individuals with ADHD going through hormonal changes and understand the implication it may have on presentation, treatment and outcomes (Young et al., 2020).

Premenstrual dysphoric disorder (PMDD) is an extreme psychological form of premenstrual syndrome (PMS) resulting in debilitating symptoms during the lunar phase (after ovulation) of a woman's cycle (Naik et al., 2023). Symptoms may include lack of control over thoughts, emotions and reactions; easily irritated and quick to anger; severe fatigue; low-self-esteem; physical symptoms; and decreased coordination. One study found 45.5% of women with ADHD have a comorbid diagnosis of PMDD (Naik et al., 2023). A higher prevalence of PMDD and Post-Partum Depression (PPD) has been found in women with ADHD when compared to the general population (Farangis et al., 2021).

1.8.3 Mother-Daughter Link

In studies ranging from 1997 to 2019, women often describe “difficult childhoods marked by a sense of self-hatred and self-destruction arising from difficulty in family relations” (Attoe and Climie, 2023). Studies found an ADHD diagnosis in a daughter put their mothers at higher likelihood of also receiving an ADHD diagnosis, and for there to be greater conflict between mothers and daughters with ADHD (Young et al., 2020). ADHD impairments (e.g., emotional dysregulation; aggression and poor working memory) experienced by both and/or either the mother and daughter have a bidirectional effect on their relationship. (Young et al., 2020).

1.8.4 COVID-19 Pandemic

During the COVID-19 pandemic, women/mothers often became the de facto care giver, problem solver, and house manager as the world shut down and remote learning/work began. These increased demands, in combination with the increased disruptions with everyone at home, made ADHD symptoms unbearable for many women (Engel-Yeger, 2022). It was found that women with ADHD experienced higher rates of anxiety and stress, and subsequent lower quality of life than neuro-typical women during the COVID-19 pandemic (Engel-Yeger B, 2022).

1.9 Implications of Un-Recognized ADHD in Females

Women with ADHD have been found to be at higher risk for adverse outcomes such as “greater mental health impairment, severe mental illness and admissions to in-patient psychiatric hospitals” as adults when compared to males with ADHD (Young et al., 2020). Research found 70% to 75% of individuals with ADHD will have at least one other comorbid mental health condition (Engel-Yeger, 2022). Research conducted with a nationally representative sample (n=12,262) found those with clinical ADHD were more likely to experience clinical eating disorders, bingeing and/or purging and/or restrictive behaviors (Bleck et al, 2015). In girls with ADHD, depression may present as: irritability; reduced interest in activities that were previously enjoyed; sleep disturbances; decreased ability to concentrate; indecisiveness; agitation or slowness of thinking; fatigue or loss of energy; and feelings of worthlessness or inappropriate anger (Centers for Disease Control and Prevention, 2023). As result of societal and internal pressure and/or

expectations, girls and women with ADHD are at increased risk for developing low self-esteem and engaging in maladaptive coping mechanisms (Young et al., 2020; Attoe and Climie, 2023).

1.9.1 Development of Negative Self-Image and Self-Esteem

Attoe and Climie's (2023) review categorized the impacts of undiagnosed ADHD in women by difficulties with: social-emotional wellbeing; relationships; and feelings of control. This review found that women with undiagnosed ADHD have notably lower self-esteem and self-efficacy and increased difficulties in "social relations and identity formation" (Attoe and Climie, 2023). Girls with undiagnosed ADHD develop a negative self-image after enduring a childhood "filled with misunderstandings, self-blame and rejection" (Attoe and Climie, 2023). As they age, their opinions of themselves worsen as they continue to struggle with the increasing demands of life (Barra et al., 2021). Women with undiagnosed ADHD spend their lives comparing themselves to their peers and attribute their struggles with academics, socializing, and emotion regulation as a moral failing and a fault of their own, often expressing feelings of "inadequacy and weakness" (Attoe and Climie, 2023). When women with ADHD succeed they often attribute it to external causes (luck), and but attribute failure to internal flaws (character flaw). For example, one woman remembered "in graduate school, when I got an A or A+, I'd immediately feel like "oh, that was because it was an easy class" but when she did poorly reported thinking "I'm supposed to be able to do, but still I can't do it." (Attoe & Climie, 2023).

1.9.2 Reliance on Maladaptive Coping Mechanisms

Individuals with ADHD have been found to employ less adaptive stress coping strategies and used significantly more maladaptive strategies than that of their neuro-typical peers (Barra et al, 2021). Girls with ADHD will compensate for their symptoms by developing a number of maladaptive, emotion-oriented coping strategies such as being overly cautious, almost obsessive-compulsive, and investing more compensatory effort (Attoe and Climie, 2023; Merkt and Gawrilow, 2016). Use of these mechanisms throughout childhood results in a “vicious cycle in which stress perception and ADHD symptomatology trigger and reinforce each other.” (Barra et al, 2021). Maladaptive coping strategies and continued exposure to stress often evolves into a “continuation of negative experiences and interactions in adulthood.” (Rokach & Clayton, 2023).

1.9.3 Improvements with Diagnosis, Treatment and Management Skills

The early flagging, diagnosis, and treatment of girls with ADHD, regardless of their academic struggles, has lifelong implications on quality of life (Holmes et al, 2010). Women with ADHD have expressed their frustrations around not being diagnosed and treated earlier, with one stating “I think that if I had known a little bit earlier, maybe that would have helped me to make sense of why things seemed harder, at an earlier age” (Attoe and Climie, 2023). Development of a deep negative-self-image can be prevented or altered when treatment and management are introduced and reduce the of symptoms and negative implications of ADHD in a girl’s life (Morley & Tyrrell, 2023). Women have reported that receiving a diagnosis “positively impacted self-esteem” and enabled them to “view themselves less critically” (Attoe & Climie, 2023). It provides them with an explanation for their constant struggling; allows them to start making

accommodations, and changes expectations for themselves (Morley & Tyrrell, 2023; Attoe & Climie, 2023). One woman describes the impact of a diagnosis by saying “I plan things differently, I’m aware that I might struggle with certain things, and I don’t beat myself up if I can’t do things” (Morley & Tyrrell, 2023). Another expressed, “I thought I was lazy, I thought I was useless...so hearing that it wasn’t just me and there is something else going on, I guess, yeah, it was a huge relief” (Morley & Tyrrell, 2023).

1.10 Public Health Problem

Not only are women with ADHD more at risk for negative health outcomes and life events, but those risks are compounded by the development of low-self-esteem and reliance on maladaptive coping mechanisms to make up for executive function deficits (Young et al., 2020). The increased time women spend undiagnosed exposes them to increased negative interactions, events and outcomes further reinforcing the development of negative self-esteem, and use of maladaptive coping mechanisms (Attoe & Climie, 2023).

Females with un-recognized ADHD, who appear to be functioning at the same level as their neuro typical peers, are often putting twice the effort in to their school work, careers, and relationships (Oscarsson et al., 2022). Continued reliance on maladaptive coping mechanisms and well as constantly putting in high levels of effort leads many women with ADHD to states of burnout (Oscarsson et al., 2022). Burnout is a psychological syndrome characterized by “overwhelming exhaustion, feelings of cynicism and detachment from the job, and a sense of ineffectiveness and lack of accomplishment” and impacts an individual’s ability to perform at their job (Maslach & Leiter, 2016). When these feelings are compounded with low self-esteem it has

devastating impacts on a women's ability to function not only in work but all areas of her life as well as her happiness and sense of fulfillment (Oscarsson et al., 2022).

Recognition of ADHD symptoms and level of impairment is dependent on the life circumstance and genetics of the individual in question (Eng et al., 2023). Those with financial and physical access to mental health services may receive treatment for their comorbid anxiety and depression, limiting the reinforcing loop of ADHD symptoms and stress triggering and reinforcing each other. Individuals with little access to mental health resources, such as those living in rural areas and/or on Native American reservations, may be at increased risk (Morales, 2020; O'Keefe, 2021). Even those with health insurance often find it does not cover or reimburse for the specialized mental health providers and/or testing involved in an ADHD diagnosis and the subsequent treatment (Hamed, 2015). Low income women are "constantly under suspicion" for being bad mothers, meaning people are quick to assign behavioral problems with their children to bad parenting as opposed to brain deficiencies caused by ADHD (Wilder et al. 2009).

Inadequate recognition and support for women with ADHD lead to heightened risks of negative health outcomes, compounded by low self-esteem and reliance on harmful coping mechanisms. Limited access to mental health resources, exacerbated by financial constraints and societal misconceptions, further exacerbates these challenges, impacting various aspects of their lives and well-being.

2.0 Methods

2.1 Research Questions

A critical literature review was conducted to address the following research question: *How do the symptoms of ADHD with a higher prevalence in girls/women impact early recognition and diagnosis of ADHD in females?* A secondary research question is: *What implications do these gender specific symptoms have on future research and clinical practice?* This review addresses these questions by conducting full text analysis on research articles that found symptoms of ADHD that appear at higher rates in girls and women with ADHD compared to males with ADHD. This review also acknowledges the role researchers and media have played in perpetuating this public health problem; this will be discussed in further detail as implications of this review.

2.2 Search Process

On September 26th, 2023, I conducted a literature search with a University of Pittsburgh Health Science research librarian using the PubMed database. I limited search results to English-language peer-reviewed journal articles published in the United States from 2000 up to the date of the search. The DSM-IV was published in 1994 and by 1997 there had been recognition of significant and growing discrepancies in the understanding and recognition of ADHD between boys and girls (Young et al., 2020). The year 2000 was chosen as a start date for the search because it was the year the DSM-IV-TR was published, which reflects our modern understanding of

ADHD. Furthermore, this was the first edition of the DSM published after research had clearly identified disparities around the recognition and diagnosis of ADHD in women. Due to the influence cultural beliefs/values can have on the recognition and referral of ADHD, studies were limited to only in the United States (Hamed et al., 2015).

Search terms consisted of phrases related to: Attention Deficit Hyperactivity Disorder; females/girls/women, symptomatology and gender differences. With the help of the research librarian, publications and abstracts were exported to EndNote, checked for duplicates, and finally exported to excel document created for single person literature reviews. The exact search terms on PubMed can be viewed in Table 1 of Appendix A.

2.3 Review Process

In total 349 abstracts were reviewed; 72 abstracts were included in full text review and a total of 12 articles were retained for full text analysis. Abstracts were sent to review if they did not meet exclusion criteria and if their research question/s explored gender differences of ADHD symptoms and presentation. Full text articles were included in the analysis if they did not meet an exclusion criterion; if the research question/s explored gender differences of ADHD symptoms, and results found symptoms with a higher prevalence in females with ADHD.

2.4 Exclusion Reasons

In total (337) articles were excluded for the following reasons. Fifty-six studies were not about ADHD and eleven did not cover ADHD symptomatology. Twenty articles were excluded because they explored the experience of ADHD in males and/or their results only found symptoms with significantly higher prevalence in men. Including an analysis of behaviors and symptoms typical of male ADHD presentation would be counterproductive when trying to emphasize the unique presentation of ADHD in females. Fifty articles were excluded because they explored ADHD's relationship with comorbid conditions. Seventeen articles were excluded because they explored risk factors related to the development / severity of ADHD. Experts have not yet found significant biological difference between either neuro-typical and neuro-divergent brains or males with ADHD and females with ADHD that can be used for diagnostic purposes (Chen et al., 2023). Forty-two articles were excluded that explored gender differences through biological factors such as brain-imaging or genetics. Seventeen articles were excluded that focused on genetic, epigenetic and early life events that contribute to the development and/or severity of an individual's ADHD. Twelve articles studied and reported the prevalence and incidence of ADHD. Thirty-two studies related to the referral for and testing of ADHD were excluded. Twenty-five animal studies and twenty-five studies conducted outside of United States were excluded. Thirty-three studies were excluded because they explored the impacts and life outcomes of women with ADHD. Seven studies were excluded because they explored gender's role in treatment success. Finally, six were excluded because they were a meta-analysis or reviews, for a total exclusion of 337 articles.

The PRISMA flowchart of study selection can be viewed on the next page, Figure 1.

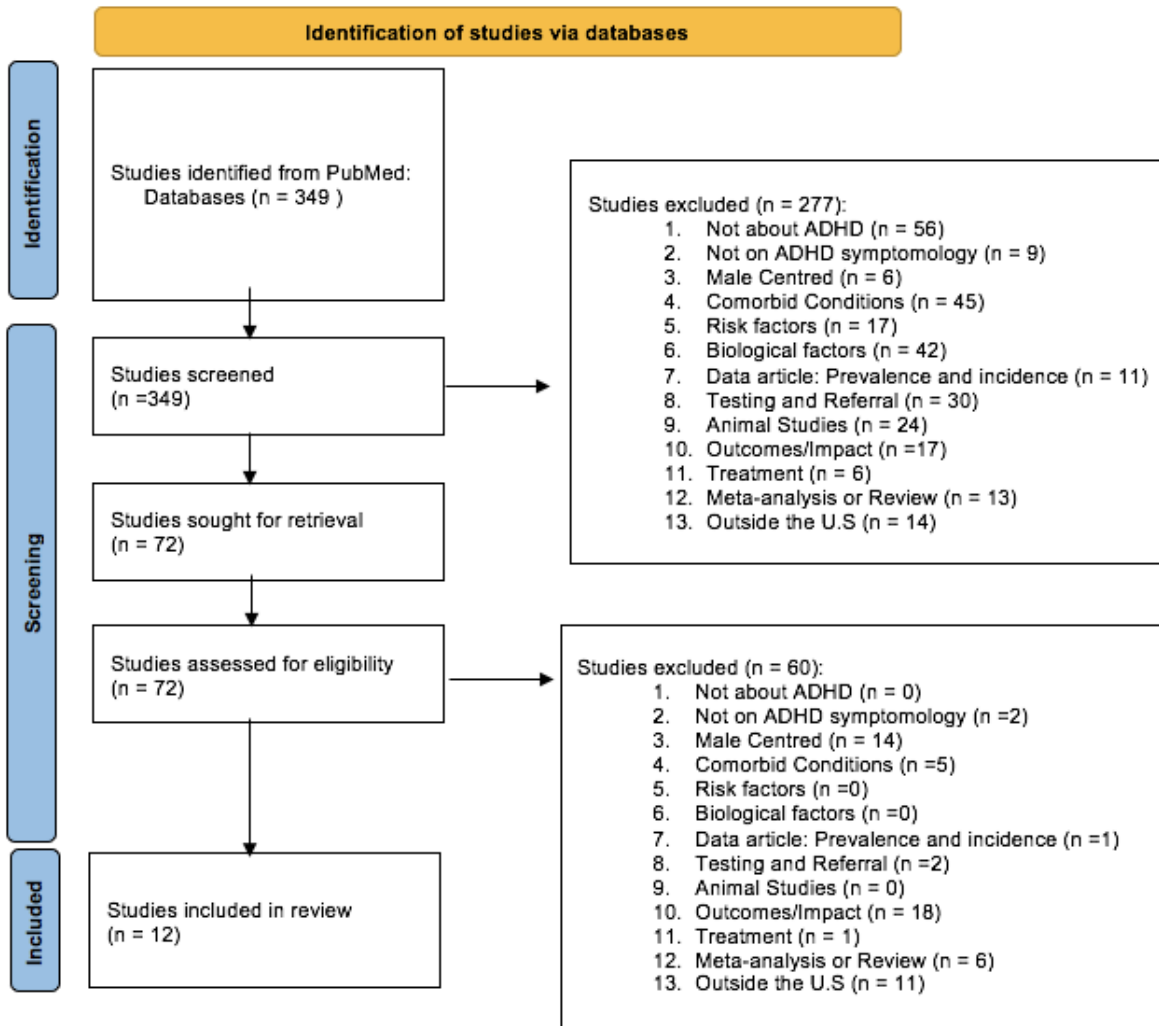


Figure 1 PRISMA Flow Chart

3.0 Results

In total 12 articles were included for final analysis because they addressed the primary research question: “*How do the symptoms of ADHD with a higher prevalence in girls/women impact early recognition and diagnosis of ADHD in females?*” as well as the secondary research question: “*What implications do these gender specific symptoms have on future research and clinical practice?*”

Symptoms from this review can be divided by symptoms related to emotional regulation (n=4), symptoms of hyperactivity/impulsivity or inattention (n=3), and symptoms are a direct example of EF impairments (n=6).

3.1 Emotional Regulation

Symptoms related to emotional regulation included increased rates of internalizing problems (Schneider et al., 2005); emotional insight difficulties (emotional lability, irritability, anxiety, and depression) (Welkie et al., 2021); emotional dysregulation (De Ronda et al., 2023); and aggression (Abikoff et al., 2002).

Schneider et al. (2005), found that men with higher levels of ADHD symptoms exhibited elevations in externalizing symptoms while women reported elevations in internalizing problems. Women with high levels of ADHD symptoms experienced increased symptoms of self-devaluation (interpersonal discomfort, lack of trust, avoidant of interpersonal contact and tendency to be self-defeating), low-self-esteem and being dissatisfied with one’s self-image (Schneider et al., 2005).

De Ronda et al. (2023), found that ADHD children, regardless of gender, have higher levels of emotional dysregulation in childhood when compared to their neuro-typical peers. As male participants aged, executive dysfunction, irritability and anxiety began to decrease and more closely reflected their neuro-typical peers. Conversely, it was found that girls with ADHD had persistently higher levels of negative emotional symptoms throughout their childhoods into adolescences compared to their male ADHD and neuro-typical peers. The authors attributed this to sexually dimorphic patterns of brain development, gender socialization, and referral/diagnostic biases, suggesting the use of mood-related screening tools to identify girls who are most at risk of developing ADHD (De Ronda et al., 2023).

Researchers found that when comparing boys with ADHD to those without the ADHD children expressed higher scores of aggression, verbal aggression and out-of-chair behaviors. The same was not true for females with ADHD, who were found to have scores typical of their female neuro-typical peers. These aggressive behaviors are disruptive to the classroom, and in line with public's understanding of ADHD, making parents and teachers more likely to address/report on these behaviors (Abikoff et al., 2002). Researchers suggested the fact girls showed these symptoms at similar rates as their neuro-typical peers contributes to the lack of recognition of ADHD in females. Unlike other studies, researchers did not find a relationship between anxiety and behavior suppression suggesting "sex differences in externalizing and rule-breaking behaviors play a role in sex-differential identification and referral," offering possible pushback to the theory girls are underdiagnosed because their anxiety keeps their ADHD symptoms at bay (Abikoff et al., 2002).

Welkie et al. (2012) explored emotional insight difficulties by measuring emotional regulation strategies and behavioral responses to emotion difficulties in both men and women with ADHD. ADHD in women was associated with greater difficulties with the acceptance of emotions,

engaging in goal-directed behavior, emotional awareness, and limited access to emotional regulation strategies (Welkie et al., 2021). The study then found difficulties in those areas may mediate the association between ADHD and depression more so in women with ADHD than their male counterparts (Welkie et al., 2021).

3.2 Hyperactivity/Impulsivity and Inattention

Eng et al. (2023) found that for girls with ADHD, depression and inattention remain stable across puberty but hyperactivity symptoms decrease, suggesting as girls age their symptoms of hyperactivity may no longer be observable. Conversely, Fedele et al. (2012) found that rates of hyperactivity and inattention were higher in college aged women with ADHD when compared to their neuro-typical counterparts. Women in this study also reported higher rates of impairments in areas such as home life, social life, education, money, daily life, than college aged men with ADHD (Fedele et al., 2012). Newcorn et al. (2001) found girls with comorbid anxiety are less impulsive than those with ADHD only, concluding there are "important differences in the nature of ADHD symptoms in girls and boys" (Newcorn et al., 2001).

3.3 Examples of EF Impairments

The following examples of EF impairments were identified in the review: sequential tasks (Crasta et al., 2021); delay discounting (Rosch and Mostofsky, 2021); response control (Seymour

et al., 2016); response inhibition, preparation, working memory and planning/shifting (O'Brien et al., 2010); oculomotor response and inhibition (Mahone et al., 2009).

O'Brien et al. (2010) found girls had higher levels of motor overflow and significantly more difficulties with inhibition, response preparation, working memory, and planning/shifting than both boys with ADHD and neuro-typical peers. Crasta et al. (2021) found only girls with ADHD were slower than their neuro-typical peers on sequential tasks (heel-toe tapping, hand pronation-supination, and finger sequencing) and showed greater discounting of playing a preferred game compared to boys with ADHD (Rosch and Mostofsky, 2021).

Seymour et al. (2016) found girls with ADHD, but not boys, were able to exhibit some functioning response control under minimal cognitive load but impairments began as cognitive loads increased. The boys with ADHD in this study were found to have impairments even when cognitive load is minimized, possibly suggesting for girls with ADHD the “increase in cognitive load via increased working memory demands results in greater inhibition difficulties” compared to boys with ADHD (Seymour et al, 2016). Girls with ADHD were found to have significantly longer visually guided saccades (VGS) latencies, possibly “impeding development of skills dependent on rapid and efficient cognitive control of behavior” (Seymour et al., 2016).

4.0 Discussion

A critical literature review was conducted to address the primary research question: “*How do the symptoms of ADHD with a higher prevalence in girls/women impact early recognition and diagnosis of ADHD in females?*” and the secondary research question: “*What implications do these gender specific symptoms have on future research and clinical practice?*” A total of 12 articles were included in the review because their results found symptoms that appear significantly more in girls and women when compared to men with ADHD.

All twelve of the articles framed undiagnosed ADHD in women as public health problem and emphasized that more research must be conducted to gain a better insight on the presentation of ADHD in girls and women. Three of the more recently published articles by De Ronda et al. (2023); Eng et al. (2023); and Crasta et al. (2021) explored time and age as mediating factors in the relationship between ADHD presentation and gender. Results from these studies suggest differences in the rates in which boys and girls experiencing certain brain development milestones and puberty may have positive and negative impacts on ADHD presentation. One article found that “aging and possible maturation effects” may predicate changes in ADHD symptoms (Eng et al., 2023). Age differences and puberty status should be considered in evaluations for ADHD and when doing research on ADHD (De Ronda et al., 2023; Eng et al., 2023; Crasta et al., 2021).

The final theme through the articles related to the differences in ADHD rates found in clinical and community populations. Girls who have receive an early diagnosis are more likely to have extreme cases of ADHD and to show hyperactive symptoms. It has been suggested that sampling from a clinical population (ie. individuals with an official diagnosis) may skew or impact the generalizability of study results on gender, as girls often go undiagnosed (Mahone et al. 2009).

Mahone et al. 2009 accounted for this in their methods by over sampling subtypes less common within each sex (i.e., girls with Combined subtype and boys with Inattentive subtype) (Mahone et al., 2009).

Symptoms from this review were grouped by: emotional regulation (n=4), symptoms of hyperactivity/impulsivity or inattention (n=3), and symptoms are a direct example of EF impairments n=(6). The studies on hyperactivity/impulsivity show similar results to past studies in that they found girls displayed more traits of inattentive ADHD. Conversely, Fedele et al. (2012) found in their research that hyperactivity was higher in college age girls compared to male college students with ADHD and neuro-typical females (Fedele et al., 2012). The possible mediating role of age and time found by De Ronda et al. (2023); Eng et al. (2023); Crasta et al. (2021) may provide an explanation for these varying results. Eng et al. (2023) found the “Best predictor for understanding ADHD and its impairment was the individual child” and their life history, suggesting symptoms presentation and impairments is likely dependent on the life situation of an individual child and their genetics opposed to gender alone (Eng et al., 2023).

Multiple areas of the public health field have, and continue to, fail women with ADHD. Historically, ADHD diagnosis rates were impacted by ADHD’s increased presence in the news cycle (Barkley et al., 2002; Segenreich, 2022; Abdelnour et al., 2022). ADHD’s current renewed popularity in the media is an opportunity for clinicians and public health professionals to directly communicate with the population and work towards reducing misinterpretation of results and spread of misinformation by the media. While warnings of the dimorphic gender presentation of ADHD began in 1997, the three versions of the DSM (DSM-IV-TR; DSM-V, DSM-V-TR) published since then do very little to address or highlight the disparities. The current DSM states “is more frequent in males than in females in the general population” with no further discussion

of the barriers to diagnosis faced by women. The DSM could introduce the addition of referral triggers. These are behaviors that are not an identified symptom of ADHD but known behaviors associated with ADHD that should “trigger” adults to seek testing for a child. Referral triggers for girls can include; nail biting, repeated injuries, oppositionality (Young et al., 2020). If the DSM clearly divides symptoms to be used for diagnosis and behaviors that could be “referral triggers” it could provide public health officials with a clear set of guidelines when educating parents and teachers on ADHD in girls. Early screening measures could be used in schools and clinician offices to flag young girls so they can be closely observed/monitored for ADHD throughout their education. Screening tools targeting girl’s presentation of ADHD would measure externalizing and internalizing symptoms, sleep difficulties, social problems, cognitive performance, and physiological measures of behavioral and attention regulation (Arnett et al., 2013).

4.1 Limitations

While this literature synthesis provides greater insight into girls’ and womens’ experience of ADHD there are several limitations. Only one database, PubMed, was searched, potentially missing useful and insightful studies from other journals. The search was limited to English-only publications from the USA but found 25 articles published outside the country. Research from outside of the USA could provide insightful data on society/culture's influence over identifying ADHD symptoms in girls. International research may also provide insight on successful referral and diagnostic practices that may be implemented in the U.S. to address the public health problem.

The significant lack of research on and misunderstandings around ADHD in girls/women are compounded when exploring women who live in intersectionality. My search resulted in only

a handful of studies that explored race as a factor between ADHD and gendered symptoms, none of which met criteria to make it to the final review. Most of the articles included focused on girls and adolescents (under 18) with ADHD. This further highlights the out lack of understands around ADHD presentation's adult women and limits the degree to which the symptoms found in the review can aid in identifying behaviors of ADHD in adult women.

4.2 Future Research

Future research should consider the new findings highlighting age's role in ADHD gender differences, working into their study designs or exploring it in the discussion. A similar analysis should be conducted on studies outside of the United States to explore the impacts of cultural differences on the presentation/prevalence of specific ADHD symptoms in females. Lastly 42 articles were excluded because they did not address my research question but did explore the biological factors involved in the gender differences of ADHD. The symptoms associated with these biological factors should be further explored to further the fields understanding of gender differences in ADHD symptoms, presentation, and recognition.

5.0 Conclusion

The literature clearly demonstrates that ADHD can be observed differently in girls and boys, likely due to a combination of socialization, biological differences, and societal expectations. ADHD has lifelong implications for girl and women that are exacerbated when ADHD is undiagnosed or untreated (Young et al., 2020). A better scientific and researched-based understanding of how ADHD presents in girl/women is the first step to overcoming the public health problem of under- and mis- diagnosis. The next is ensuring this information is depicted through the dissemination process to better educate the public on the presentation of ADHD in females and increase their ability to flag behaviors as signs and symptoms of ADHD in girls/women. This can be accomplished by educating providers and teachers on the presentation of ADHD in girls, so they can flag behaviors and suggest testing. Researchers can include a summary of their findings, generalizability, and implications in an accessible language, intended for non-academic readers. While progress and accessible language section still only benefits those who have access to journal articles, which is a small percentage of the American population. For the foreseeable future media will always impact America's perception and understanding of health topics, so perhaps the best way for research to ensure their work is interpreted correctly is for researchers to share their views/findings directly with the public through the media and social media sites.

Appendix A PubMed Search Strategy

Database: PubMed

Date searched: September 26th, 2023

Search developer(s): Helena M. VonVille, Erin K. Brady

Limit to English: Yes

Date Range: 2000-2023

Appendix Table 1 PubMed Search

1	attention deficit disorder with hyperactivity/
2	(adhd or (attention adj1 deficit) or ((hyperactivity or hyperkinesis or hyperkinetic) adj1 (disorder or syndrome))).ti,ab,id.
3	1 or 2
4	exp human females/
5	(female* or girl or girls or woman or women).ti,ab,id.
6	4 or 5
7	3 and 6
8	symptoms/ or acting out/ or body rocking/ or diagnostic criteria/ or distractibility/ or externalizing symptoms/ or hyperactivity/ or insomnia/ or internalizing symptoms/ or "positive and negative symptoms"/ or psychiatric symptoms/ or restlessness/ or tics/ or exp behavior disorders/ or exp eating disorders/ or hypersomnia/ or intrusive thoughts/ or social functioning/ or symptom checklists/
9	((acting adj1 "out") or anorexia or bulimia or (body adj1 rocking) or diagnostic or distractibility or externaliz* or hyperactiv* or impairment or impulsivity or inattention or insomnia or internalizing or restlessness or tics or (behavior adj1 disorders) or (eating adj1 disorders) or hypersomnia or (intrusive adj1 thoughts) or (social adj1 (functioning or skills)) or symptom*).ti,ab,id.
10	8 or 9
11	7 and 10
12	gender socialization/ or human sex differences/ or gender roles/
13	((gender or sex) adj1 (bias or differences or identification or role or roles or socialization)).ti,ab,id.
14	12 or 13
15	11 and 14
16	limit 15 to all journals
17	16 not ((albanian or arabic or bulgarian or catalan or chinese or croatian or czech or danish or dutch or estonian or farsi iranian or finnish or french or georgian or german or greek or hebrew or hindi or hungarian or italian or japanese or korean or lithuanian or malaysian or

	nonenglish or norwegian or polish or portuguese or romanian or russian or serbian or serbo croatian or slovak or slovene or spanish or swedish or turkish or ukrainian or urdu) not English).lg.
18	17 not (afghanistan or africa or african or albania or algeria or andorra or angola or anguilla or antarctic or antarctica or antigua or antilles or arab or arabia or argentina or armenia or aruba or ashmore or asia or atoll or australia or austria or azerbaijan or bahamas or bahrain or baker or balkan or baltic or bangladesh or bank or barbados or barbuda or belarus or belgium or belize or benin or bermuda or bhutan or bissau or bolivia or bosnia or botswana or bouvet or brazil or britain or british or brunei or burkina or burundi or caicos or caledonia or cambodia or cameroon).lo.
19	18 not (cartier or cayman or chad or channel or chile or china or christmas or cocos or colombia or comoros or congo or cook or coral or costa or croatia or cuba or curacao or cyprus or czech or czechoslovakia or democratic or denmark or djibouti or dominica or dominican or ecuador or egypt or emirates or england or equatorial or eritrea or estonia or ethiopia or europa or europe or falkland or faroe or faso or fiji or finland or france or french or futuna or gabon or gambia or gaza or germany).lo.
20	19 not (ghana or gibraltar or glorioso or greece or grenada or grenadines or guam or guatemala or guernsey or guiana or guinea or guyana or haiti or heard or herzegovina or holy or honduras or hong or howland or hungary or iceland or india or indies or indonesia or iran or iraq or ireland or israel or italy or ivory or jamaica or jan or japan or jarvis or jordan or kazakhstan or keeling or kenya or kingdom or kiribati or kitts or kong or korea or kosovo or kuwait or kyrgyzstan or lanka or laos).lo.
21	20 not (latvia or lebanon or leone or lesotho or liberia or libya or liechtenstein or lithuania or lucia or luxembourg or macao or macau or macedonia or madagascar or malawi or malaysia or maldives or mali or malta or marino or martinique or mauritania or mauritius or mayen or mayotte or mexico or micronesia or miquelon or moldova or monaco or mongolia or montenegro or montserrat or morocco or mozambique or myanmar or namibia or nauru or navasa or nepal or netherlands or nevis or nicaragua or niger or nigeria or niue or norway).lo.
22	21 not (oman or pakistan or palau or palestine or palmyra or panama or papua or paraguay or peoples or peru or pierre or pitcairn or poland or polynesia or portugal or principe or qatar or republic or reunion or romania or russia or rwanda or sahara or salvador or saudi or scandinavia or scotland or sea or see or senegal or serbia or seychelles or sierra or singapore or slovak or slovakia or slovenia or solomon or somalia or spain or spratly or sri or sudan or surinam or suriname).lo.
23	22 not (svalbard or swaziland or sweden or switzerland or syria or taiwan or tajikistan or tanzania or thailand or tibet or timor or tobago or togo or tokelau or tome or tonga or trinidad or tunisia or turkey or turkmenistan or turks or tuvalu or uganda or ukraine or uruguay or ussr or uzbekistan or vanuatu or vatican or venezuela or verde or vietnam or vincent or wales or wallis or yemen or yugoslavia or zambia or zealand or zimbabwe).lo.

Appendix B Characteristics of Selected Publication

Appendix Table 2 Characterstitics of Selected Publications

Reference	n (with ADHD)	n (neuro-typical)	Sample
Abikoff et al. (2002)	502 (99 girls)	x	age 7-10
Crasta et al. (2021)	70	48	age 8-17
De Ronda et al. (2023)	264 (76 girls)	153 (56 girls)	age 8-18
Eng et al. (2023)	849 (323 female) [Year 1]	x	age 7 - 18 years
Fedele et al. (2012)	164 (92 women)	710 (374 women)	college age women
Mahone et al. (2009)	60 (24 girls)	60 (29 girls)	age 8-12
Newcorn et al. (2001)	579 c	x	age 7-9
O'Brien et al. (2010)	56 (26 girls)	90 (42 girls)	age 8-13
Rosh and Mostofsky (2016)	65 (19 girls)	55 (15 girls)	age 8–12
Schneider et al. (2005)	52	x	undergraduate students (under age 20)
Seymour et al. (2016)	119	138	age 8-12
Welkie et al. (2021)	172	730	age18-25

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