Gender differences in adults with ADHD: A narrative review

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AUTHOR PREPUBLICATION DRAFT
Abstract

Certain characteristics of attention-deficit/hyperactivity disorder (ADHD) in children have long been known to differ by gender. What has not been as widely studied is whether gender is similarly associated with ADHD differences in adults. In this review, the relation between gender and adult ADHD prevalence, persistence, impairment, comorbidity, cognitive functioning, and treatment response was examined across 73 studies. Although gender was related to several characteristics and correlates of adult ADHD, it appeared that many of these gender differences may be at least be partially attributed to methodological artifacts or social and cultural influences, rather than fundamental differences in the expression of ADHD in men and women. We highlight how understanding the nature of the relation between gender and ADHD across the lifespan is complicated by a number of methodological difficulties, and offer recommendations for how emerging research and clinical practice can better incorporate gender into the conceptualization of ADHD in adulthood.

Keywords: Gender, sex, ADHD, attention-deficit/hyperactivity disorder, adult, prevalence, persistence, impairment, comorbidity, treatment
Gender Differences in Adults with ADHD: A Narrative Review

As attention-deficit/hyperactivity disorder (ADHD) is increasingly recognized to persist throughout the lifespan, research on the disorder in adulthood has accelerated. Although findings suggest that features and correlates of childhood ADHD persist into adulthood for many people (Barkley, 2015; Kessler et al., 2006), research in this area remains relatively new and a comprehensive and coherent picture of the defining characteristics of ADHD in adulthood is only beginning to emerge. One particular aspect of the adult diagnosis that remains unclear is the extent to which features of adult ADHD such as prevalence, impairment, comorbidity, and treatment response are moderated by individual characteristics. In particular, gender has been neglected as a potential moderator of the nature of ADHD in adulthood.

In this paper, we review the extant research on gender in relation to adult ADHD with the aim of illuminating what is known and what remains to be investigated. Given the current state of the literature, now appears to be a crucial time to review what is known about ADHD in adulthood through the lens of gender. Research on ADHD in adults has been growing rapidly, with 50% of the literature published in the last 5 years, and over 75% in the last 10 years. Despite this explosion of research into adults with ADHD, it is still the minority of studies that acknowledge the possibility of gender effects, and even fewer directly test for such effects. As the field moves toward a clearer understanding of the nature of ADHD in adulthood, it can be argued that the body of research has now matured to a point where a deeper understanding of potential moderators of the adult ADHD presentation must be considered. We are at a critical juncture in the emergence of this literature, and the time is opportune to take stock of what is currently known regarding gender effects in adults with ADHD, and what questions remain to be answered. We hope that addressing the question of gender at this point will prevent a future where the preponderance of studies on ADHD in adults do not address gender and conclusions are seriously confounded by the potential moderating effects of gender. It is the aim of this paper to help avert this outcome by consolidating existing research and providing guidance for future investigators of ADHD in adults.
A narrative, rather than quantitative, review was conducted due to the relative paucity of high quality studies of adult ADHD which have included gender as a variable of interest. For the purposes of this review, adults are defined as age 18 years and older. Although development is a process that continues throughout the lifespan and any firm demarcation of a boundary between life stages is arbitrary, both social norms (e.g., legal definitions, end of high school) and clinical research converge on 18 as the dividing line between adolescence and emerging adulthood (Arnett, 2000). In addition, we include findings from studies that treated ADHD as a categorical diagnosis and those that measure ADHD symptoms dimensionally. Finally, we recognize that sex as a biological category differs from gender as a social role. Gender was chosen as the construct of interest for this review because the majority of the research investigates males and females with ADHD based on behavioral differences. We examine gender differences in adults with ADHD with respect to persistence and prevalence, comorbidity, impairment and functioning, cognitive correlates, and treatment response. In addition, attention is given to the ways in which adult gender results are similar to those for children with ADHD and to highlighting areas where research with adults is most lacking. Finally, theoretical and methodological difficulties are discussed and used to as the basis for recommendations for how the much needed future studies might best investigate gender differences in adults with ADHD.

The Importance of Gender

Understanding the relation between gender and ADHD is important not only from theoretical and research perspectives, but also to facilitate clinical understanding of the experiences of individuals with ADHD. As a central aspect of identity, gender has implications across numerous domains of functioning including physical, interpersonal, scholastic and vocational performance (Hyde, 2014). For example, a recent meta-synthesis of 106 independent meta-analyses found an average effect size of gender of $d = 0.21$ across numerous domains, with some of the larger effects demonstrating that, on average, compared to men, women report greater reactivity to painful stimuli, concern with peer-attachment, and interest in interpersonal relationships (Zell, Krizan, & Teeter, 2015). For the clinician who regularly considers the impact of age, cognitive ability, life experience and other individual characteristics in assessing and
treated ADHD, we argue that the impact of gender is equally critical. Minde and colleagues’ (2003) finding of sex-linked patterns of parent and child ADHD diagnoses suggests that gender is important to understanding even fundamental characteristics of ADHD such as heritability. Further, gender differences in the prevalence of ADHD in childhood are well established (Arnett, Pennington, Willcutt, & DeFries, 2014; Biederman et al., 2002), and gender moderates a variety of characteristics of childhood ADHD including intellectual impairment, extent of hyperactive symptoms, and comorbidity with other disorders (Gaub & Carlson, 1997). Thus, it is not unreasonable to expect that gender also may moderate features of ADHD in adults, and that understanding the relation between gender and ADHD in adulthood is critical to improving both the quality of ADHD research and clinical practice.

It is important to note that, although there may be differences in the associated features, social impairments, or other characteristics of ADHD across men and women, this review is not an argument for construing ADHD as a different disorder in the two genders. In the same way that it is now well established that ADHD is the same disorder from childhood through adulthood, despite differences in the ways in which it may be expressed (e.g., Biederman, Faraone, Monuteaux, Bober & Cadogen, 2004; Owens, Cardoos, & Hinshaw, 2015), we believe that ADHD is the same disorder across genders, despite possible differences in its phenotypic display or correlated features. As will become apparent, a primary aim of this review is to argue that many apparent gender differences may be artifacts of underlying social and methodological issues.

**Methodological Approach**

Studies comparing adult men and women with ADHD were identified through a search of English language, peer-reviewed articles in PsycINFO using the following search terms: adult AND ADHD AND (gender OR sex). As the adult ADHD literature is comparatively young, to maximize the number of studies included, the literature search was not restricted by date. This resulted in 277 papers which, after omitting inappropriate studies (e.g., exclusively child-sample, no ADHD group), 132 remained. Given the lack of a definitive consensus regarding the appropriate criteria for the diagnosis of ADHD in adults (Kessler et al., 2010; McGough & Barkley, 2004), most investigators have elected to adapt for adults the...
Diagnostic and Statistical Manual for Mental Disorders criteria that were developed for children (DSM-IV; American Psychiatric Association, 2000). Although the publication of DSM-5 provided improvements to aid in diagnosing ADHD in adults (American Psychiatric Association, 2013), at the time of writing there were no published studies using DSM-5 that met criteria for inclusion in this review. Thus, we focused on studies that assessed DSM-III or DSM-IV ADHD symptoms, included both males and females, and compared at least one variable across gender. An additional four studies were identified in the references of the initially identified papers, for a total of 73 studies reporting gender differences on at least one variable in adults with ADHD.

The majority of the 59 studies that were omitted were eliminated primarily because results were presented across genders combined. Five were omitted due to exclusive use of ICD-10 criteria (Ehlis, Bähne, Jacob, Herrmann, & Fallgatter, 2008; Hinnenthal, Perwien, & Sterling, 2005; Rasmussen & Levander, 2009; Schlander, Schwarz, Trott, Viapiano, & Bonauer, 2007; Secnik, Swensen, & Lage, 2005), and two due to lack of clarity regarding how ADHD symptoms were assessed (Peterson & Grahe, 2012; Zetterqvist, Asherson, Halldner, Långström, & Larsson, 2013). The included studies ranged in publication date from 1994 to 2013, with the majority (68%) published after 2005, and 15% used DSM-III criteria for adult ADHD. There was heterogeneity in the size of the ADHD groups examined, ranging from 12 (Seri, Kofman, & Shay, 2002) to 858 (Ramtekkar et al., 2010), and in the gender balance of the samples, ranging from 36.1% male (Ebejer et al., 2012) to 88.1% male (de los Cobos et al., 2011).

There are significant challenges associated with conducting a review of this kind. Attempts to understand gender differences in the adult presentation of ADHD are complicated by the numerous and often complex differences between men and women that occur independent of ADHD status. In addition, there is always the potential for interactions of gender by ADHD symptom presentation. For example, in childhood ADHD, a gender paradox is often described whereby, although girls are less often diagnosed, when they are identified their levels of symptoms and impairment are often greater than those in boys (Hinshaw & Blachman, 2005). In conducting this review, we take the stance that conclusions regarding gender differences in adult ADHD symptoms require careful consideration of nondisorder-related
differences in males and females (e.g., differences due to biological functions or to social roles) and careful analysis of how gender may be differentially related to varying aspects of ADHD (e.g., prevalence vs. impairment).

Conclusions regarding adult ADHD are also complicated by the difficulties associated with assessing ADHD symptoms in adulthood. Unlike in the case of children with ADHD, it is less clear who should be relied on to report ADHD symptoms among adults. Parents and teachers are typically the informants for children’s symptoms, and are assumed to provide relatively objective assessments. However, life circumstances and privacy considerations often prevent the use of similar reporters for adults, and yet use of subjective, self-reports to assess adult ADHD symptoms is known to be problematic (Barkley, Knouse, & Murphy 2011; Zucker, Morris, Ingram, Morris, & Bakeman, 2002). Similarly, there are differing opinions on issues in adult ADHD assessment such as the value of diagnostic interviews, the criteria for demonstrating childhood onset, whether to adapt symptoms to be more appropriate for adults, and how to best combine reports from different reporters or from childhood and adulthood (Kooij et al., 2010). Different diagnostic procedures and decision rules are the norm, and they hinder our ability not only to compare results between studies, but also to accurately estimate persistence or to understand the links between adult ADHD symptoms and gender. We acknowledge these assessment and diagnostic issues as they are relevant throughout the review and will return to consideration of how they impact our understanding of gender differences in the discussion section of the paper.

Prevalence

The majority of research on gender differences in adult ADHD has addressed the prevalence of ADHD diagnosis and symptoms. Of the 24 studies reporting on gender differences in adult ADHD symptoms, half found significant differences, most showing greater ADHD prevalence in men. In studies conducted with large community samples, prevalence rates of ADHD diagnosis for males range between 2.1% (Bitter, Simon, Bálint, Mészáros, & Czobor, 2010) and 5.4% (Kessler et al., 2006), and between 1.1% (Bitter et al., 2010) to 3.2% (Kessler et al., 2006) for females. These rates are largely consistent with the childhood community prevalence estimates of approximately 4.2% in boys and 1.8% in girls (Cuffe,
Moore, & McKeown, 2005). Deviations from this pattern occur most often in samples at risk for other psychological difficulties (e.g., Cahill et al., 2012; de los Cobos et al., 2011). The generally higher rate of ADHD in males compared to females across childhood into adulthood is, however, not universally present, as one-third of the studies found increased prevalence in women (see Table 1).

Some nuance in gender prevalence rates is seen in the distribution of ADHD subtypes or presentations. In some studies, women were more likely than men to be diagnosed with the inattentive subtype of ADHD (e.g., Biederman et al., 2004) and less likely to be diagnosed with the combined subtype (Ramtekkar et al., 2010), which may reflect different proportions of the combined and inattentive symptoms in men and women. That is, it may not be that women experience more inattentive symptoms than men, but that they experience fewer hyperactive/impulsive symptoms and therefore are less likely than men to be diagnosed with the combined subtype. The higher rate of hyperactivity in women reported in a few studies is surprising and may be spurious considering the relative rarity and instability of the hyperactive-impulsive subtype (Lahey, Pelham, Loney, & Willcutt, 2005). It is important to acknowledge, however, that ADHD symptoms in these studies are assessed almost exclusively via self-report, raising the possibility of confounding due to gender differences in reporting biases.

Estimates of prevalence rates by gender also vary depending on whether the sample is derived from the community or referred for ADHD symptoms. Although the gender ratio in community samples appears to be relatively stable between childhood and adulthood (Bitter et al., 2010; Kessler et al., 2006; Cuffe et al., 2005), the gender difference in the prevalence rate of ADHD narrows from childhood to adulthood in clinical samples (Biederman et al., 2002; Bitter et al., 2010; Cahill et al., 2012; Robison et al., 2008). Unlike children, where gender ratios range from 10:1 to 3:1 in clinic versus community samples (Biederman et al., 2002), the gender ratios for adults range only from 1:1 to approximately 2:1 regardless of sample source. The large influence of referral source in childhood suggests that studies of clinic-referred samples of children represent only a distinct subset of children with ADHD, whereas research with clinic-referred adults with ADHD may be more representative.
Taken as a whole, studies suggest that, as in childhood, males continue to experience more symptoms of ADHD as adults than females, but the range of estimates of the male to female prevalence ratio narrows with age in clinic-referred samples. The apparent narrowing of the gender gap from childhood to adulthood may indicate that males are disproportionately less likely to be identified as meeting the diagnostic criteria for ADHD as they age, that females are disproportionately more likely to acquire ADHD diagnoses over time, or both.

**Persistence**

In contrast to prevalence, less research has investigated gender differences in the rate of persistence of ADHD from childhood into adulthood and the majority of gender-specific persistence estimates derive from retrospective self-reports of adults. Three large studies of retrospectively-reported ADHD symptoms have yielded rates of persistence from childhood to adulthood ranging from 36.3% in a nationally representative survey of 3,197 people (Kessler et al., 2005) to 55.3% in a community-based sample of 3,795 twins recruited through a national twin registry (Ebejer et al., 2012). The proportion of participants who reported that ADHD symptoms persisted into adulthood did not differ by gender in these studies. In contrast, single-gender, longitudinal studies of ADHD trajectories over time cumulatively provide some evidence for the possibility that gender does moderate persistence. In a 10-year follow-up of 214 young adult women, Hinshaw and colleagues (2012) found that approximately 60% of females with a childhood diagnosis continued to meet criteria for the same or different subtype of ADHD. Similarly, Biederman, Petty, Fried and colleagues (2010) found 62% ADHD persistence in an 11-year follow up of young adult females. In contrast, in the predominantly male sample of the Multimodal Treatment Study of Children with ADHD (MTA), 8 years after randomization (at an average age of 16.5 years), approximately 30% of the 434 boys continued to meet diagnostic criteria for ADHD (Molina et al., 2009). However, Biederman, Petty, Evans, Small, and Faraone (2010) found a persistence rate of 63% in young adult males in a 10-year follow-up. Several other, smaller studies also have investigated the persistence of ADHD symptoms into young adulthood, finding a range of estimates from 30% (Klein et al., 2012) to 66% (Barkley, Fischer, Smallish, & Fletcher, 2002).
Interpreting the research on gender differences in the persistence of ADHD is complicated by contrasting strengths and weaknesses among existing studies. The strongest evidence available either derives from samples including both genders but relying on retrospective self-reports of ADHD (Ebejer et al., 2012; Kessler et al., 2005) or on longitudinal, but single-gendered studies that rely on both self- and collateral reports (Hinshaw et al., 2012; Molina et al., 2009). The retrospective studies suggest a persistence rate of 36-55% that does not differ by gender, although single-gender studies suggest persistence rates of 30 to 60% for males and 60% for females, and again assessment challenges related to consistently evaluating symptoms whose nature changes over time and the reliance on self- versus collateral-reports of both childhood and adult symptoms likely contribute to these discrepancies.

**Impairment**

ADHD is significantly impairing in the lives of both children and adults. Adults with ADHD report lower educational and vocational achievement, social functioning, and self-care compared to adults without ADHD (Barkley, Murphy, & Fletcher, 2008; Kessler et al., 2006; Mannuzza et al., 2011). Thirteen studies have reported gender comparisons of this impairment (see Table 1). Of these studies, nine reported at least one aspect of impairment that differed by gender, with females being more impaired than males on six variables, males being more impaired than females on five variables, and no differences on another six variables (studies often reported on more than one impairment domain with differing results). There is considerable variability in the specific impairments assessed across studies, and, of course, any discussion of gender moderation of impairment is complicated by the fact that impairment is a requirement for the ADHD diagnosis and thus ceiling effects may exist. With these caveats in mind, we provide the following summary of what can be learned from the current research on gender differences in impairment in adult ADHD.

Several studies have compared self-reported histories of school functioning in adult men and women with ADHD. One study reports no gender differences (Babinski et al., 2011), two report greater recall of academic impairment in men (Biederman et al., 1994, Grevet et al., 2006), and one reports greater recall in women (Fedele et al., 2012). This failure to replicate findings may reflect that each study
defined academic success differently. In only two samples (Biederman et al., 1994; Biederman et al., 2004) were the same academic variables used: grade repetition, need for tutoring/extra help, and special class placement. Although the earlier study found some gender differences, the later study with a larger sample and better adult ADHD diagnostic criteria did not replicate this and found no differences between adult men and women in their recall of academic impairments. Similarly, a meta-analysis of academic achievement of people with ADHD across the lifespan found no gender differences (Frazier, Youngstrom, Glutting, & Watkins, 2007), nor did a more recent study measuring educational attainment among men and women with ADHD (Babinski et al., 2011). However, in college students with current symptoms of ADHD, Fedele and colleagues (2012) reported that, in contrast to a control group of non-ADHD individuals where women reported less educational impairment than men, women with ADHD reported greater educational impairment than men with ADHD. This difference remained after controlling for the symptom severity, suggesting that there may be something qualitatively different about the experience of ADHD and its impact on perceived academic performance among women.

Thus, although studies often report no gender difference in academic impairments associated with adult ADHD, this finding is not entirely consistent. One possible explanation for this variability is the manner in which impairment is assessed. When men and women with ADHD are compared on objective measures of achievement problems, such as repeated grades or grade point averages, there is little evidence of difference in their functioning (e.g., Biederman et al., 2004; Frazier et al., 2007). Although differences do sometimes appear on objective measures of broader aspects of academic performance (e.g., school suspensions, Grevet et al., 2006), these are likely confounded with gender differences in comorbid externalizing disorders. In contrast, when adults with ADHD are asked to report more subjectively on their impairment, women consistently rate themselves as more impaired than their male counterparts, not only with respect to academic performance (Fedele et al., 2012), but also on a wide range of indicators of impairments in life functioning including family relationships (Arcia & Conners, 1998; Minde, Eakin, Hechtman, Ochs, Bouffard, Greenfield, & Looper, 2003), sleep problems and somatic complaints, (Robison et al., 2008), global functioning (Biederman et al., 2004; Grevet et al., 2006), self-confidence,
anger, and number of assets (Arcia & Conners, 1998; however, for exceptions, see Babinski et al., 2011; Rucklidge, Brown, Crawford, & Kaplan, 2007). Thus, we conclude differences in the use of subjective versus objective assessments of impairment are the most likely explanation for the inconsistency of results regarding gender differences in impairment in adults with ADHD.

Consistent with this conclusion are results from studies of life stress in adults with ADHD. Garcia et al. (2012) asked participants to rate their affective responses to life events, whereas Friedrichs and colleagues (2012) asked participants only to endorse whether they had experienced various negative life events (e.g., "Have you sometimes during the last 12 months been on sick-leave with a medical certificate?"). Only Garcia et al. found an effect of gender: women with ADHD subjectively reported a greater impact of negative life events than men with ADHD, whereas Friedrichs et al. found no gender difference in the more objective rate of events. Also consistent with the potential importance of differentiating subjective and objective assessments of impairment is the lack of gender differences in children with ADHD on academic or social impairments (Barbaresi, Katusic, Colligan, Weaver, & Jacobsen, 2007). In childhood, impairment is almost exclusively measured based on parent or teacher reports (more objective measures), rather than using the child’s subjective self-perception (Biederman et al., 2005; Gaub & Carlson, 1997; Gerson, 2002). The greater subjective impairment found in women with ADHD also may be linked to the higher rate of mood disorders in females. Women with and without ADHD symptoms report more depressive and anxious symptoms than their male counterparts (Wilens et al., 2009), and these mood symptoms may leave women with ADHD with more distorted cognitions about and more vulnerability to the impairing effects of their ADHD compared to men with ADHD. Going forward, the relation between gender and the level of objectivity in impairment measures bears further investigation.

In sum, there is good evidence that men and women with ADHD experience similar levels of objective impairment, but that women with ADHD report a greater subjective experience of impairment due to their symptoms than do men with ADHD. This distinction appears to clarify what initially seems to be conflicting evidence regarding gender differences in adult ADHD impairment and may speak to the
apparent gender paradox whereby women appear more severely affected by the disorder despite the lower prevalence of ADHD symptoms in females.

**Comorbidity**

Most of the 11 studies of comorbidity report that women with ADHD, compared to men with ADHD, have higher lifetime prevalence rates of anxiety, depression, somatic symptoms, and bulimia. In contrast, lifetime rates of substance use disorders and problems with alcohol, as well as antisocial personality disorder and conduct disorder are higher in men with ADHD. Although five studies found no substantial evidence of gender differences in comorbid conditions in adults with ADHD (see Table 1), these studies were typified by methodological limitations including small samples and varying ADHD diagnostic procedures.

Interpretation of the specificity of these gender differences in comorbidity to ADHD is uncertain as only 3 of the 11 studies included comparison groups of adults without ADHD. In these studies, the evidence that ADHD confers a risk beyond gender in predicting the associated comorbid psychiatric is absent (Biederman et al., 2004; Minde et al., 2003) or equivocal (Babinski et al., 2011). Although from a clinical perspective comorbidities remain important even if their pattern is not specific to ADHD, conceptually it is impossible to know whether the associations found between gender and comorbidity are unique to ADHD or simply replicate general population patterns of differential gender prevalence of disorders. Regardless, comorbidities may have important explanatory power when understanding the subjective experiences of people with ADHD (e.g., as described above, comorbid mood disorders which are more prevalent among women may increase susceptibility to a subjective sense of impairment related to ADHD symptoms).

**Cognitive Functioning**

The linkage of ADHD to cognitive deficits in both childhood (Seidman, 2006) and adulthood (Woods, Lovejoy, & Ball, 2002) combined with the evidence of hormonal and biological influences on cognitive functioning (Bromberger & Kravitz, 2011) renders obvious the need to consider whether the pattern of cognitive deficits in adults with ADHD differs by gender. Fifteen studies were found that
compared males and females with ADHD on at least one measure of cognition, although few measures have been tested or replicated across multiple studies (see Table 1).

Many studies of cognition in adults with ADHD have focused on attentional processes, but most include only one gender or do not compare results between genders. Summarizing the available evidence in this domain, a meta-analysis by Bálint and colleagues (2009) reported that, as the proportion of men with ADHD increased in study samples, so did the magnitude of difficulties with sustained attention, suggesting that attention problems are more severe in men compared to women with ADHD. Although adult women with ADHD are more likely than men to be diagnosed with the inattentive subtype (Biederman et al., 2004), the results of this meta-analysis are consistent with the explanation offered earlier that this subtype difference may be more reflective of the absence of hyperactive/impulsive symptoms in women with ADHD, than of more severe inattention symptoms in women compared to men.

With regard to memory functioning, most studies of adults with ADHD report male vs. female differences (Table 1), however, intriguingly, the pattern of memory impairments appears related to symptom dimension or subtype, which vary between men and women. Illustrative of the complexities in this research, men with the inattentive subtype of ADHD made more errors of memory omission compared to men with the combined-subtype on a working memory task, but no such differences were seen in women with ADHD (Schweitzer et al., 2006). Subsequently, Valera and colleagues (2010) found decreased working-memory-related neural activity in males with ADHD compared to comparison males, but no such difference was observed in females. However, these findings are not entirely consistent with Schweitzer et al., as it was hyperactive/impulsive – not inattentive – symptoms that were related to decreased neural activity in men with ADHD, whereas inattentive – but not hyperactive/impulsive – symptoms were negatively related to neural activity in women. In summary, despite the centrality of cognitive symptoms in ADHD and clear evidence of cognitive deficits in samples of adults with ADHD not differentiated by gender (Bálint et al., 2009; Woods et al., 2002), the inconsistencies in results and limited use of similar measures or constructs across studies prevent even preliminary conclusions regarding possible gender differences for the majority of cognitive constructs,
Treatment

**Pharmacological treatment.** Investigations into pharmacological treatments for ADHD in adults have focused primarily on four medications: three stimulants (methylphenidate, mixed amphetamine salts, dexamphetamine) and one selective presynaptic norepinephrine inhibitor (atomoxetine). Fourteen studies have compared men and women’s response to these medications. In the 14 studies of stimulants, 7 found no gender differences in symptom reduction (Buitelaar et al., 2012; Paterson, Douglas, Hallmayer, Hagan, & Krupenia, 1999; Spencer et al., 2005; Spencer et al., 1995) and 3 failed to find gender differences in neuropsychological or functional outcomes (Buitelaar et al., 2012; Spencer et al., 2008; Riordan et al., 1999).

Four studies of response to stimulant medication did find gender differences, but were inconsistent. In one study, men were more likely than women to be rated as improved at a double-blind end point, although this difference disappeared by the end of an open-label follow-up (Buitelaar et al., 2011), and another found that women’s ADHD symptoms improved more than men’s (Weiss et al., 2010). The two other stimulant studies addressed rates of non-completion, and again, one found that men were more likely than women to discontinue (Sobanski et al., 2013), whereas another found the reverse (Kooij, 2013). Gender differences are more consistently found with atomoxetine, with three studies reporting indications of greater improvement in women compared to men. Notably, these gender differences were in areas such as emotional dysregulation, social life functioning (Robison et al., 2008), well-being (Spencer et al., 2006), and family functioning (Wietecha et al., 2012), but there is no evidence for gender differences in ADHD symptom improvement on atomoxetine.

In summary, although there is very good evidence for the efficacy of several pharmacological interventions in the treatment of ADHD in adults, possible gender differences in response to these medications have not been widely tested despite the importance of this question given known differences in pharmacokinetics and pharmacodynamics across males versus females (Anderson, 2008). However, we estimate that approximately one-third of adult ADHD medication studies do not report outcomes
Differentiated by gender, an omission which could easily impact the interpretation of this literature (Surman, Hammerness, Pion, & Faraone, 2013).

**Psychosocial treatment.** Of the 18 studies evaluating psychosocial treatments for adults with ADHD, 3 considered gender, although only in secondary or covariate analysis. In two of these studies, treatment response was not moderated by gender (Solanto et al., 2010; Zylowska et al., 2008) and the third study found that women, more than men, found home practice of techniques (i.e., mindfulness stress management) effective (Philipsen et al., 2007). Although at least 10 journal articles and one book chapter have been devoted to reviewing the research on psychosocial treatments for adults with ADHD, none of these summaries have mentioned gender differences. These have been missed opportunities to highlight the need for research into potential moderators, particularly gender, of psychosocial treatments for adults with ADHD. We note that the need for such research is particularly fueled by evidence that CBT is more effective in women than men for several other disorders (e.g., Donker et al., 2013; Felmingham & Bryant, 2012).

**General Discussion and Future Directions**

**Understanding Gender Differences.** One of the most prominent and puzzling findings that emerged in this review is the difference in the gender ratios of ADHD in children (more males than females by ratios up to 10 to 1) compared to adults (more males than females, but ratios up to only 2.73 to 1). There are three broad categories of explanation for this narrowing of the gap in male to female prevalence rate, and it is probable that all three contribute to some degree. First, there may truly be differences in the prevalence and course of ADHD in males and females; second, the apparent differences may be due to systematic referral or identification biases at either age; and third, the diagnostic criteria for ADHD may be biased or poorly specified for one gender and/or age group. These explanations summarize some of the core challenges facing all areas of ADHD research and are discussed below.

**True differences.** If the change reflects a true difference, this means that ADHD expression in males begins earlier and is more common than in females, and that symptoms are disproportionately more likely to abate in males compared to females, although for both genders the overall pattern seems to be a
reduction in the prevalence of ADHD (Ebejer et al., 2012). Supporting the explanation of true differences, Arnett and colleagues (2014) recently confirmed that boys have more childhood ADHD symptoms than girls, even after accounting for issues of selection bias, measurement invariance, and the possibility that a particularly types of symptoms (e.g., symptoms of Sluggish Cognitive Tempo) which better characterize ADHD in girls are missing from the diagnostic criteria. In a meta-regression, Simon, Czobor, Bálint, Mészáros, and Bitter (2009) found that when samples were predominantly male, ADHD prevalence was more likely to decrease as age increased. Somewhat surprisingly, rates of ADHD in predominantly female samples increased with age.

Also consistent with an explanation of true differences would be evidence of differential gender and change rates in inattentive versus hyperactive-impulsive symptoms. In studies with both clinic-referred and community children, hyperactivity-impulsivity symptoms steadily decreased over time, but inattention symptoms did not (Cohen, 1993; Hart, Lahey, Loeber, Applegate, & Frick, 1995). As hyperactive-impulsive symptoms are more characteristic of boys than girls with ADHD (Ramtekkar et al., 2010), an age-related reduction in hyperactive-impulsive symptoms would proportionately affect the prevalence of ADHD in adult men compared to women. Thus, it is possible that despite overall reductions in ADHD symptoms for both genders, with age, female ADHD remains relatively stable, by virtue of being less likely to be characterized by hyperactive-impulsive symptoms. Conversely, ADHD in males may decline due to reductions in the hyperactive-impulsive symptoms that are more likely to characterize their disorder. Finally, the possibility exists that, although ADHD has historically been conceptualized as a neurodevelopmental disorder which always emerges in childhood, there may be a subset of women who have an adult-onset form of ADHD. This possibility may previously have gone unrecognized due to the focus on childhood origins and presentations of the disorder. Obviously, this possibility remains entirely speculative.

**Referral or identification biases.** Findings that there are true gender differences in ADHD symptoms between males and females in population-based samples (Arnett et al., 2014) do not rule out the possibility that some of the observed variation in ADHD symptoms between genders can be
accounted for by biases in referral to clinical services. Males may be over-referred and over-diagnosed in childhood and/or females may be under-identified or referred in childhood. ADHD in young boys can be difficult to differentiate from gender normative levels of activity (Roberts, Milich, & Barkley, 2015). If both ADHD and gender normative activity levels are higher in young boys than girls (Sallis, Prochaska, & Taylor, 2000) and hyperactive-impulsive behaviors are particularly salient because of their impact on others such as parents and teachers, boys with normative levels of hyperactivity/impulsivity may be mistaken as having clinical levels, resulting in false positive ADHD diagnoses. In comparison, girls are more likely to have inattentive symptoms (Biederman & Faraone, 2004), which while still normatively atypical, may be less likely to be noticed or to trigger referral and diagnosis (Owens et al., 2015; see Ohan & Visser, 2009 for an alternative explanation). It is also the case that, even at the same level of ADHD symptoms, boys remain more likely than girls to be referred for treatment (Coles, Slavec, Bernstein, & Baroni, 2012), probably due to the increased prevalence of disruptive behaviours in boys compared to girls. Finally, differences in the use of objective (i.e., parent and teacher) vs. subjective (i.e., self) reports of ADHD symptoms across age are pervasive in the literature. These various forces may act on referral patterns and to the extent that research relies on clinical or referred samples, boys will be overrepresented and girls will be under-represented. Of course, this explanation is consistent with the noted differences in gender ratios across clinical and community samples (e.g., Gaub & Carlson, 1997; Gershon, 2002; Montes, García, & Ricardo-Garcell, 2007). For example, in contrast to the differential gender rates found in clinic samples, in a large sample of non-referred siblings of children with ADHD, Biederman and colleagues (2005) found no difference between rates of ADHD diagnoses in boys and girls.

A number of factors may converge to change this pattern of gender imbalance in adults with ADHD. Theoretically, no new cases of ADHD should develop in adulthood. If girls with ADHD are under-recognized in childhood and boys with ADHD are, if anything, over-diagnosed, there must be a greater proportion of adult women with previously undiagnosed ADHD than adult men. It is probable that some of the age-related narrowing of the gender ratio of ADHD prevalence is simply undiagnosed women “catching up” as they self-refer for assessment and treatment in adulthood. The strength of many referral
and identification biases may decrease as increased autonomy in adulthood reduces the importance of others’ recognizing and being disturbed by the symptoms in males and instead allows females to self-refer in response to distress and impairment related to ADHD. In our review, at least half of the studies using clinic-referred samples of adults with ADHD demonstrated greater prevalence among women compared to men, suggesting that, at least at clinically-significant levels, there is increased identification of ADHD in adult women compared to during childhood. We believe that the cumulative impairments associated with ADHD, combined with the increasing ability to self-determine, may facilitate self-referral and therefore increased identification of ADHD in the subset of people (primarily women) with undiagnosed childhood ADHD. In addition, previously unidentified ADHD may be detected when adult women seek help for comorbid conditions, particularly mood disorders, or when their children are diagnosed with ADHD. All of these effects would converge to increase the estimated prevalence of ADHD in adult women and narrow the gender ratio compared to childhood.

**Biased or poorly defined diagnostic criteria.** The third explanation for the narrowing gap in the gender prevalence ratio in adulthood is that age-related decreases in ADHD symptoms, particularly hyperactivity-impulsivity (Cohen, 1993; Hart et al., 1995), may be attributed to the use of DSM diagnostic criteria which are disproportionately appropriate for children compared to adults, and for males compared to females. We know that adults are impaired at levels of ADHD symptoms below diagnostic thresholds (Kooij et al., 2005; Owens et al., 2015), perhaps because the diagnostic criteria for ADHD were largely developed from samples of male children, and their use results in under-diagnosis and under-representation when applied to adults of both genders (Waite & Ivey, 2009). The reduction in gender disparity in ADHD prevalence over time may, therefore, be at least partly a function of a proportion of adult men no longer meeting diagnostic criteria because their adult difficulties with hyperactivity-impulsivity are not captured by DSM symptoms written to be descriptive of childhood (e.g., “often runs about or climbs excessively”). When an adult man is no longer squirming or climbing excessively, he may be less likely to see himself – and mental health professionals may be less likely to recognize him – as meeting the criteria for ADHD, despite difficulty with more developmentally-appropriate behaviours.
that are nonetheless symptomatic of ADHD (e.g., feelings of restlessness). Again, because ADHD in females is more often characterized by exclusively inattention problems, it is possible that these symptoms remain more descriptive across the life span (e.g., having difficulty focusing when being spoken to). Thus, the developmentally-limited description of symptoms may be more applicable to males and could explain the apparent decline of ADHD from childhood to adulthood for men compared to the relative lack of decline for women.

Beyond issues related to the age and gender-appropriateness of ADHD symptom descriptors, the substantial symptom overlap and comorbidity between ADHD and other psychological conditions also presents challenges. Barkley and Brown (2008) argue that many comorbid psychological disorders (e.g., mood, anxiety, substance use) may be caused at least in part by undiagnosed ADHD that can subsequently be difficult to disentangle, particularly due to poorly specified diagnostic criteria for adult ADHD.

**Impairment differences.** The review of gender differences in ADHD-associated impairments suggested that despite little objective evidence of greater difficulties for women in areas such as achievement or cognitive performance, women with ADHD do self-report greater levels of impairment (e.g., Fedele et al., 2012). This discrepancy highlights the importance of both subjective and objective assessments of psychosocial functioning, particularly for women. Several possible explanations can be offered for women’s greater sense of impairment. It may be that, consistent with the general population (Lynn, Pipitone, & Keenan, 2014), men with ADHD have less insight into the impact their ADHD exerts on their functioning than women with ADHD. Another hypothesis is that the perceived social consequences of ADHD damage women’s self-perceptions and feelings of competence to a greater extent than men's. We know that females with ADHD have more negative peer experiences and are perceived as more age- and gender-atypical than are males with ADHD (Mikami & Lorenzi, 2011), and given the possibility that ADHD is under-recognized in girls during childhood, this may place afflicted girls in the position of not being able to attribute their atypical behaviour to the disorder and instead assuming that their experiences of failure and rejection are reflections of personal shortcomings. This view of the self as
impaired may persist into adulthood for these women, even after ADHD identified. Although the stigma associated with ADHD is well documented (Wiener et al., 2012), it is not known whether this stigmatization or other social consequences of ADHD exact a greater toll on women's sense of their capability compared to men.

We also speculate that gender-specific social consequences may be exacerbated by stereotype threat in women with ADHD. Stereotype threat occurs when negative societal expectations about a particular group adversely impact group members' expectations for their own performance, which may, in turn, affect their actual performance (Steele & Aronson, 1995). In this case, stereotype threats related to both female gender and ADHD may be evoked when women are asked about negative life events, job or academic performance, or relationship difficulties. In contrast to men with ADHD, women with ADHD may be responding to the double threat of both the societal stereotype that women are less capable than men (Van Loo Rydell, 2013) and the negative stereotypes associated with the socially undesirable nature of individuals with ADHD (Wiener et al., 2012). Thus, although both men and women with ADHD may be objectively more impaired than adults without ADHD, women with ADHD may be doubly susceptible to a heightened subjective sense of impairment. An increased perception of personal and social impairments in women with ADHD, in addition to the objective difficulties associated with ADHD, may also be driving higher rates of treatment seeking for adult women compared to men. Research manipulating the activation of ADHD and gender stereotypes in men and women with and without ADHD would be useful in evaluating this possibility, along with studies contrasting the roles of objective and subjective measures of ADHD associated difficulties and impairment.

**Sampling and measurement issues.** We have noted throughout this review the importance of distinguishing results obtained from clinic versus community samples of adults with ADHD and considering the subjective versus objective measurement of symptoms. However, there are numerous challenges associated with ascertaining appropriate samples and ensuring accurate measurement of men and women’s ADHD symptoms and correlates. As an example, recruitment of representative samples of adults with ADHD is hindered by the disproportionate likelihood of individuals with ADHD, particularly
men, experiencing the types of problems that remove them from both community and most clinic samples (e.g., involvement with the criminal justice system, substance use difficulties). Up to half of the adults in prison screen positive for childhood ADHD (Rösler et al., 2004), and at least 14% of incarcerated males (Young et al., 2010) and 10% of incarcerated females (Rösler, Retz, Yaqoobi, Burg, & Retz-Junginger, 2009) report ADHD symptoms. This suggests that some non-trivial proportion of adults with past and current ADHD is entering the criminal justice system. And, of course, this is a non-random subgroup that is lost to most research on adult ADHD as they are likely to have more severe symptoms, to exhibit comorbid antisocial behaviours, and to be male (Cahill et al., 2012). Importantly, the females in this severe subgroup are particularly likely to be atypical compared to their same-gender, non-ADHD peers. How this attrition and other factors (e.g., over-reliance on younger adult samples, increased identification of adult ADHD in families with a child with ADHD) affect research samples is unclear, but it is probable that they exert an impact on estimates of prevalence and gender ratios.

In addition, very little is known about ADHD in older adults, or the developmental trajectory of the disorder beyond early adulthood. Of the 133 studies initially identified and examined for this review (itself only a subset of the adult ADHD literature), only 8 had samples with a mean age above 40, and only 1 had a mean age above 50, at 50.7. As seen in Table 1, the over-representation of younger adults prevents consideration of possible changes in ADHD presentation across the full range adulthood. The relations among gender, aging, and cognitive functioning or decline are complex even in the non-ADHD population (Dunkin, 2009), as are relations among gender, aging, and other aspects of functioning including not only physical health, but psychological and social adjustment (Kryspin-Exner, Lamplmayr, & Felhoffer, 2011). Combined with what is known about aging and gender in the general population, it is reasonable to hypothesize that ADHD and gender may have additive and/or interactive effects on cognitive and other aspects of functioning among older adults.

Assessment of ADHD across development poses challenges and there is an urgent need for validated and age-appropriate tools for use in adulthood (e.g., the BAARS-IV; Barkley, 2011). Despite the fact that all of the papers in this review assessed DSM-defined symptoms of ADHD, a wide variety of
assessment tools and diagnostic decision rules were used. How these variations contribute not only to the evidence of differential rates of persistence seen in males vs. females, but to other gender differences as well, remains to be seen. For example, evidence such as that from Faraone and Biederman (2005) shows that whether ADHD is defined narrowly or broadly (i.e., whether or not sub-threshold levels are included) influences gender differences in the prevalence of ADHD symptoms. In addition, an understanding of the comparability of assessment tools used at different ages is an obvious requirement for a lifespan understanding of ADHD. The literature also would be enhanced by the use of more precise terminology and operational definitions to avoid confusion in the identification and measurement not only of symptoms, but of related difficulties in adult ADHD. For example, it may be more helpful to discuss differences in grade level achieved rather than more broadly defined, composite variables such as educational impairment or school functioning.

In most studies presented in this review, participants rated their own ADHD symptoms on questionnaires designed to map onto the DSM criteria, although the use of clinical interviews, questionnaires developed specifically for a given study, and alteration of items to be more appropriate for use with adults was not uncommon. The reliance primarily on self-reported symptoms to determine ADHD status, without inclusion of more objective measures, is problematic given evidence that adults with ADHD have difficulties with self-awareness (Barkley, 2011). Further complicating matters is conflicting evidence that self-awareness varies by gender. For example, Barkley and colleagues (2011) reported greater disagreement between women and other informants than between men and other informants regarding current ADHD symptoms, yet Zucker, and colleagues (2002) reported the opposite.

In addition, the method for determining ADHD diagnostic status was not consistent across studies. Most papers treated ADHD as a diagnostic category, and used at least partial DSM-IV guidelines to determine diagnostic status. However, some studies took a dimensional approach to ADHD symptoms, and a few studies included ADHD groups based on DSM symptoms but dichotomized based on other standards (e.g., scores +2SD above the mean). Similarly, although DSM-5 no longer recognizes discrete subtypes of ADHD, the majority of research reviewed did consider subtypes and in several instances
gender differences appeared specific to one ADHD subtype or symptom dimension. How conclusions from this review are complicated by variability in diagnostic and subtyping procedures is unclear, but undoubtedly this variability works to obscure our understanding of gender differences in adult ADHD.

In the same way that this review has argued for further consideration of gender in research of adults with ADHD, the moderating effect of other demographic characteristics such as race, ethnicity, or culture may be equally important in developing a comprehensive understanding of adult ADHD. The impact of characteristics such as race have not been tested in the adult ADHD literature, despite evidence of importance of race in research on childhood ADHD (Nigg, 2012). Not only may similar effects extend to adults with ADHD, these other demographic characteristics may interact with gender. The absence of information in this realm highlights the urgent need for future research to investigate and consider demographic moderators and their combinations.

**Improving how gender is addressed in adult ADHD research.** Although the number of studies of adults with ADHD that include and report on both genders is increasing, statistical and methodological issues still impede our ability to be more confident regarding the nature of gender differences in adult ADHD. In preparing this review, we noted with regret that many, if not most, studies of adults with ADHD include both men and women, yet the vast majority do not comment on gender except with regard to sample composition. Although some of these studies did not have the power to analyze men and women separately, approximately half of the studies that were excluded from the review because they did not test gender differences were sufficiently powered to find at least moderate gender effects. Although it is possible that these studies yielded null gender results that were not reported, the lack of inclusion of this information is unfortunate and will limit future reviews or meta-analyses of gender effects in adult ADHD. When it is considered, gender is often treated as a covariate or in ancillary analyses, rather than a variable of primary interest and, as a result, the gender findings are undiscovered or ignored. Taken as a whole, the studies in this review demonstrate that, at the very least, it cannot be assumed that the subjective or objective experiences of adults with ADHD are the same for men and women. In addition, from a statistical perspective, treating gender as a covariate may yield main effects that are difficult to
interpret and may obscure gender moderation. Reporting effects that occur above and beyond the effects of gender may be statistically accurate, but this information is difficult to transfer to clinical practice, where an individual’s gender remains an important part of the clinical picture that cannot be treated as a nuisance variable.

A further difficulty in the literature is the reporting of results with genders combined, usually driven by practical concerns related to relatively small samples rather statistical or theoretical rationales. We suspect that much of the lack of gender sensitive research can be attributed to practical difficulties of recruitment or from a desire to confront those who have denied the existence of ADHD by establishing the validity of the disorder in adulthood and in both genders. However, these factors have resulted in neglected questions of differences in the quality, associated features, and experiences of adults with ADHD, including not related to only gender, but also differences associated with stage of life, race, culture, or socioeconomic status. Moving forward, we urge researchers to a default position of recruiting sufficient numbers of both male and female participants and consistently testing and thoroughly reporting gender differences or interactions of gender with other variables, unless strong theoretical or statistical rationales can be presented to the contrary. Such an approach will not only allow each study to advance our understanding of gender and adult ADHD, but will also permit comparison of results across studies and the conduct of meta-analyses.

**Conclusion**

This review illustrates sufficient evidence of gender differences in adult ADHD in prevalence, comorbidity, psychosocial impairment, and potentially cognitive functioning, that parity across genders should not be assumed. Further, as this paper focused exclusively on intrapersonal characteristics of adults with ADHD, greater work is needed to address potential gender differences in the interpersonal characteristics of adults with ADHD (Johnston, Mash, Miller, & Ninowski, 2012; Rucklidge, et al., 2007; Williamson & Johnston, 2013). We conclude that there is an abundance of conflicting evidence regarding gender differences in many areas of adult ADHD research, and much of the discrepancy may be attributable to referral or diagnostic biases combined with assessment, methodological and statistical
challenges that currently work to obscure estimates of true gender effects in both child and adult populations. As the nature of these biases and problems shifts over the course of development (e.g., other vs. self-initiated referrals; lack of diagnostically sensitive symptom descriptions in adulthood; differential attrition across the genders), so too do observed gender effects. The most compelling conclusion from our discussion of the limitations of the existing research is the need, going forward, for more studies that address gender differences and similarities in the biological, psychological, and/or social functioning of adults with ADHD. To conduct such studies will require incorporation of relevant theoretical frameworks, adequate representation of both genders in samples, and attention to biases in samples and assessment methods. We view this review as a useful starting point for this future research and hopefully, as an instigation to shift both our beliefs about and our methods pertaining to the study of gender in adults with ADHD.
Acknowledgements

This research was supported by the University of British Columbia. We thank our lab colleagues who offered comments.
References


Table 1. Studies Reporting on Gender Differences in Adult ADHD Outcomes

<table>
<thead>
<tr>
<th>Authorship</th>
<th>N</th>
<th>Gender ratio of ADHD (M:F)</th>
<th>ADHD Sample Drawn from Community?</th>
<th>Method of Assessment</th>
<th>Mean Age</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biederman et al., 2004</td>
<td>434</td>
<td>1:1</td>
<td>No</td>
<td>SCID/KSADS</td>
<td>38</td>
<td></td>
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<td>Bitter et al., 2010</td>
<td>3,529</td>
<td>2:1*</td>
<td>Yes</td>
<td>Screener/interview</td>
<td>35</td>
<td></td>
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<tr>
<td>Cahill et al., 2012</td>
<td>3,962</td>
<td>2:3*</td>
<td>No</td>
<td>Coolidge Correctional inventory</td>
<td>34</td>
<td>Sample of inmates</td>
</tr>
<tr>
<td>Das et al., 2012</td>
<td>2,091</td>
<td>1:1</td>
<td>Yes</td>
<td>ADHD Self-report Screener</td>
<td>51</td>
<td>Sample in treatment for cocaine use</td>
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<tr>
<td>De los Cobos et al., 2011</td>
<td>125</td>
<td>M&gt;F*†</td>
<td>No</td>
<td>DSM-IV checklist and WURS</td>
<td>32</td>
<td></td>
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<tr>
<td>De Zwaan et al., 2012</td>
<td>1,655</td>
<td>1:1</td>
<td>Yes</td>
<td>ASRS and WURS</td>
<td>43</td>
<td></td>
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<td>Du Paul et al., 2001</td>
<td>1,209</td>
<td>1:1</td>
<td>Yes</td>
<td>YARS</td>
<td>22</td>
<td></td>
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<td>Ebejer et al., 2012</td>
<td>3,795</td>
<td>2.2:1*</td>
<td>Yes</td>
<td>DSM Checklist</td>
<td>32</td>
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<td>Faraone et al., 2005</td>
<td>966</td>
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<td>Yes</td>
<td>Telephone interview</td>
<td>43</td>
<td>When a broad definition of ADHD was used: M&gt;W*</td>
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<td>Fayyad et al., 2007</td>
<td>11,422</td>
<td>1.5:1*</td>
<td>Yes</td>
<td>DIS, ACDS, interview</td>
<td>18-44</td>
<td>Sample from 10 countries</td>
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<td>Fedele et al., 2012</td>
<td>874</td>
<td>M&lt;F*†</td>
<td>No</td>
<td>CSS</td>
<td>College</td>
<td>Sample recruited from disability services and mental health clinics</td>
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<td>Author(s) (Year)</td>
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<td>Gender Ratio</td>
<td>Adult ADHD Questionnaire</td>
<td>Gender Difference</td>
<td>Additional Notes</td>
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<tr>
<td>Friedrichs et al., 2012</td>
<td>17,899</td>
<td>1:1</td>
<td>Yes</td>
<td>DSM questionnaire</td>
<td>34</td>
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<td>Grevet et al., 2006</td>
<td>219</td>
<td>1:1</td>
<td>No</td>
<td>Adapted KSADS</td>
<td>34</td>
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<td>Haberstick et al., 2008</td>
<td>3,896</td>
<td>M&gt;F†</td>
<td>Yes</td>
<td>CSS</td>
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<td>3,199</td>
<td>1.7:1*</td>
<td>Yes</td>
<td>ADHD rating scale</td>
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<tr>
<td>Kooij et al., 2005</td>
<td>1,813</td>
<td>M=F†</td>
<td>Yes</td>
<td>Adapted ADHD-IV</td>
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<td>Lara et al., 2009</td>
<td>43,772</td>
<td>M=F†</td>
<td>Yes</td>
<td>CIDI Interview</td>
<td>18-44</td>
<td></td>
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<td>McClernon et al., 2011</td>
<td>40</td>
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<td>CAARS, SCID, CAADID</td>
<td>32</td>
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<td>Millstein et al., 1997</td>
<td>149</td>
<td>M=F†</td>
<td>No</td>
<td>DSM-III interview</td>
<td>37</td>
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<td>Montes et al., 2007</td>
<td>210</td>
<td>1:2.5* (clinical)</td>
<td>Both</td>
<td>FASCT self-report and observer</td>
<td>28</td>
<td>Sample of psychiatric outpatients and non-clinical individuals</td>
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<td>Murphy et al., 1996</td>
<td>720</td>
<td>M=F†</td>
<td>Yes</td>
<td>DSM checklist</td>
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<td>Ramtekkar et al., 2010</td>
<td>9,380</td>
<td>2.73:1*</td>
<td>Yes</td>
<td>Interview, SWAN</td>
<td>18-30</td>
<td></td>
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<tr>
<td>Robison et al., 2008</td>
<td>515</td>
<td>1:1.2*</td>
<td>No</td>
<td>CAARS, WRAADDS</td>
<td>Unknown</td>
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</table>

Sample self-referred
Sample from 10 countries conducted by WHO (follow-up of previous WHO study)
Gender difference restricted to inattention symptoms
Males recalled more childhood ADHD
Sample involved in a trial of Atomoxetine
GENDER DIFFERENCES IN ADULTS WITH ADHD

<table>
<thead>
<tr>
<th>Authorship</th>
<th>N</th>
<th>Impairment</th>
<th>Gender differences in Impairment</th>
<th>Subjective or Objective Measurement?</th>
<th>ADHD Sample Drawn from Community?</th>
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<tr>
<td>Wilens et al., 2009</td>
<td>107</td>
<td>M=F†</td>
<td>Combined</td>
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<td>37</td>
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<td>Sample recruited from community and ADHD clinic referrals</td>
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<td>Arcia &amp; Conners, 1998</td>
<td>74</td>
<td>A, S</td>
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<td>Subj</td>
<td>No</td>
<td>32</td>
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<td>Babinski et al., 2011</td>
<td>87</td>
<td>E, S</td>
<td>Ns</td>
<td>Subj</td>
<td>No</td>
<td>23</td>
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<tr>
<td>Biederman et al., 1994</td>
<td>128</td>
<td>E, G</td>
<td>M&gt;F (E)</td>
<td>Obj</td>
<td>No</td>
<td>39</td>
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<td>Biederman et al., 2004</td>
<td>434</td>
<td>E, G</td>
<td>M&gt;F (E)</td>
<td>Obj</td>
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<td>38</td>
<td>No interactions between gender and ADHD.</td>
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<td>G</td>
<td>ns</td>
<td>Obj</td>
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<td>884</td>
<td>A, S, D, E</td>
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<td>Subj</td>
<td>Yes</td>
<td>College</td>
<td>Participants were oversampled for ADHD</td>
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<td>Minde et al., 2003</td>
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<td>Subj</td>
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<td>Mean Age</td>
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<tr>
<td>Babinski et al., 2011</td>
<td>87</td>
<td>M, SU</td>
<td>ns (M)</td>
<td>No</td>
<td>23</td>
<td>Substance use difference found with marijuana</td>
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<td></td>
<td></td>
<td></td>
<td>M&gt;F (SU)</td>
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<td>Grevet et al., 2006</td>
<td>219</td>
<td>M, SU, Anx, Ex</td>
<td>F&gt;M (Anx)</td>
<td>No</td>
<td>34</td>
<td>Substance use difference found with alcohol</td>
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</table>
### GENDER DIFFERENCES IN ADULTS WITH ADHD

<table>
<thead>
<tr>
<th>Author</th>
<th>N</th>
<th>Gender</th>
<th>Gender Differences</th>
<th>ADHD Sample</th>
<th>Mean Age</th>
<th>Comments</th>
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<tr>
<td>Katz et al., 1998</td>
<td>75</td>
<td>M</td>
<td>F&gt;M</td>
<td>No</td>
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<td>McGillivray et al., 2009</td>
<td>80</td>
<td>M, Ex, Anx</td>
<td>ns</td>
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<td>Millstein et al., 1997</td>
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<td>M, SU, Ex, Anx, O</td>
<td>M&gt;F (Ex, SU)</td>
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<td>Minde et al., 2003</td>
<td>102</td>
<td>M, SU, Anx, Ex</td>
<td>ns</td>
<td>No</td>
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<tr>
<td>Wilens et al., 2009</td>
<td>107</td>
<td>M, SU, Anx, Ex</td>
<td>F&gt;M (M, Anx)</td>
<td>Yes</td>
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<td>Wilens et al., 2011</td>
<td>229</td>
<td>SU</td>
<td>ns</td>
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Participants were oversampled for ADHD

### Cognitive Variables

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<th>Mean Age</th>
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<tr>
<td>Barkley et al., 2001</td>
<td>168</td>
<td>T</td>
<td>ns</td>
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<td>Biederman et al., 1994</td>
<td>128</td>
<td>EF, IQ</td>
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<td>Boonstra et al., 2010</td>
<td>98</td>
<td>I, P, Fl, WM, SS</td>
<td>ns</td>
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<td>Ernst et al., 1998</td>
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<td>F-18 DOPA Ratio</td>
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<td>Yes</td>
<td>37</td>
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Participants were oversampled for ADHD
<table>
<thead>
<tr>
<th>Study</th>
<th>Gender</th>
<th>Task</th>
<th>Result</th>
<th>Evidence</th>
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<tr>
<td>Hanlon et al., 2009</td>
<td>Yes</td>
<td>PPI</td>
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<td>Hermens et al., 2004</td>
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<td>CNS Arousal</td>
<td>M&lt;F (CNS)</td>
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<td>Autonomic hypo-arousal</td>
<td>M&lt;F (Hypo-arousal)</td>
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<td>Holdnack et al., 1995</td>
<td>No</td>
<td>RT</td>
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<tr>
<td>Katz et al., 1998</td>
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<td>WM, LTM</td>
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<td>Montes et al., 2010</td>
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<td>Murphy et al., 2001</td>
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<td>Nigg et al., 2005</td>
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<td>Robison et al., 2008</td>
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<td>WM</td>
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<td>Seri et al., 2002</td>
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<td>Valera et al., 2010</td>
<td>No</td>
<td>Brain Activation</td>
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<td>WM</td>
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</table>

**Note:** † = The study commented on gender similarity/difference in prevalence, but did not provide sufficient information to calculate the ratio; M= Male; F = Female; SCID = Structured Clinical Interview for DSM-IV; KSADS = Schedule for Affective Disorders and Schizophrenia for School-Age Children; ASRS = Adult ADHD Self-Report Scale; WURS = Wender Utah Rating Scale; YARS = Young Adult Rating Scale; DIS = Diagnostic Interview Schedule for DSM-IV;
ACDS = Adult ADHD Clinical Diagnostic Scale; CSS = Current Symptom Scale; ADHD-IV = ADHD Rating Scale – IV; CIDI = WHO Composite International Diagnostic Interview; CAARS = Conners Adults ADHD Rating Scale; CAADID = Conners Adult ADHD Diagnostic Interview for DSM-IV; FASCT = Friederichsen, Almeida, Serrano, Cortés, Test; SWAN = The Strengths and Weaknesses of ADHD-Symptoms and Normal-Behavior; WRAADS = Wender-Reimherr Adult Attention Deficit Disorder Scale; The ADHD prevalence ratio is determined based on how each study defined their ADHD variable (e.g., diagnostically or dimensionally); A=Monetary assets, S = social functioning, E=current or past educational functioning, D=Daily living, L=Stressful life events, I=Injury, G= global functioning; Subj = Subjective measurement; Obj = Objective measurement; M=Mood Disorders, SU=Substance Use, Ex=Externalizing Disorders, Anx=Anxiety Disorders, O=Other Disorders; T=Time perception, EF=Executive Functioning, WM=Working Memory, IQ=Wechsler Full Scale IQ, IN=Inhibition, P=Planning, Fl=Fluency, SS=Set Shifting, PPI=Prepulse Inhibition, CNS = Central Nervous System, RT = Reaction Time, LTM=Long-term Memory.