Article

Self-Reported Adult ADHD Symptoms: Evidence Supporting Cautious Use in an Assessment-Seeking Sample

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Abstract

Objective: Self-report symptom inventories are commonly used in adult ADHD assessment, and research indicates they should be interpreted with caution. This study investigated one self-report symptom inventory for adult ADHD in a clinical sample. **Method**: Archival data were used to evaluate diagnostic utility of the Conners Adult ADHD Rating Scale—Self-Report: Long Version (CAARS-S:L) in a sample of 122 adults seeking ADHD assessment. **Results**: Overall, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) estimates for the ADHD Index and other CAARS-S:L scales demonstrated weak accuracy. Anxiety and depression were the most common diagnoses present when a false positive on the ADHD Index was observed. PPV and specificity for the ADHD Index were higher in males compared to females. **Conclusion**: The CAARS-S:L may be useful for screening purposes in some cases, but should not be the main method used for diagnostic purposes. Clinical implications of findings are discussed. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

adult ADHD, self-report, adult ADHD assessment, CAARS

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by difficulties with inattention, disorganization, hyperactivity, and impulsivity that interfere significantly with functioning (American Psychiatric Association [APA], 2013). ADHD onsets during childhood, but problems can persist throughout adulthood (APA, 2013). Indeed, adult ADHD is now widely recognized due to longitudinal research on children with ADHD aging into adulthood and subsequent changes reflected in the Diagnostic and Statistical Manual of Mental Disorders (currently, DSM-5) (Lange et al., 2010; Lovett & Harrison, 2021).

The demand for ADHD assessment in adults has more than doubled in recent years (e.g., Oehrlein et al., 2016). This increased demand for ADHD testing in adults, in addition to rising need for mental health services in response to the COVID-19 pandemic (Byrne et al., 2021), could play a major role in the overreliance on self-report symptom inventories for diagnostic purposes. This overreliance may be particularly relevant in settings where providers are overburdened and have less time to conduct comprehensive psychological assessments.

Problems With Self-Report ADHD Symptom Inventories in Adults

There are many issues associated with self-report ADHD symptom inventories. Primarily, they should not serve as the sole basis for an ADHD diagnosis (Lovett & Harrison, 2021; Nelson & Lovett, 2019; Paris et al., 2015). Adults may experience symptoms of other disorders that can outwardly appear very similar to ADHD (Alexander & Harrison, 2013). ADHD symptoms such as concentration difficulties and restlessness are also commonly experienced by individuals without ADHD and can sometimes be better explained by other factors (Huang et al., 2020; Lewandowski et al., 2008). Self-report symptom inventories frequently do not distinguish between ADHD symptoms and symptoms of other diagnoses, especially depression, anxiety, posttraumatic stress, or bipolar disorders (Van Voorhees et al., 2011).

Next, adults may be prone to seek an ADHD diagnosis for secondary gains (Harrison et al., 2023; Suhr et al., 2022), such as access to stimulant medication (e.g., Pella et al., 2012) and/or disability accommodations in school and/or at work (e.g., Harrison, 2017). Seeking assessment for

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secondary gains is associated with an increased risk for malingering of symptoms (Binder, 1992). Self-report inventories are susceptible to manipulation by examinees who inaccurately report symptoms (e.g., Harrison et al., 2007; Johnson & Suhr, 2021). Although best practices recommend use of a symptom validity and/or performance validity measure in adult ADHD assessment (e.g., Lovett & Harrison, 2021), as few as 3% of ADHD evaluations incorporate symptom or performance validity measures (Nelson et al., 2019). Thus, overreliance on self-report inventories may increase false positives related to malingering.

In addition, self-report adult ADHD symptom inventories have demonstrated sensitivity and specificity shortcomings (e.g., Harrison et al., 2019), which are further complicated by the non-specificity of some common ADHD symptoms (i.e., these symptoms are not specific to only ADHD, and may be experienced in other disorders; Alexander & Harrison, 2013; Lewandowski et al., 2008; Van Voorhees et al., 2011). For example, Van Voorhees et al. (2011) found a self-report ADHD symptom inventory failed to differentiate ADHD symptoms from depression- and anxiety-related attention issues in adults. Other studies have documented similar high false positive rates attributed to the high sensitivity and lower specificity of ADHD self-report measures (20-67% false positive rate; Harrison et al., 2019; McCann & Roy-Byrne, 2004). If thorough follow-up testing is not conducted after a false positive—perhaps because the assessor is unaware of this issue (e.g., Lovett & Harrison, 2021), or if the self-report symptom inventory is incorrectly used to validate an ADHD diagnosis (e.g., Paris et al., 2015)—the individual would be inaccurately diagnosed with ADHD. The specificity of self-report ADHD symptom inventories has also been shown to be poor. Kooij et al. (2008) found an adult ADHD self-report symptom inventory missed nearly 30% of ADHD cases and concluded adults with ADHD may tend to underreport their symptoms on these instruments.

Potential for Overreliance on Self-Report ADHD Symptom Inventories in Adults

Despite the myriad of potential issues, ADHD self-report inventories are ubiquitous and easy for providers to use. As a result, some providers may rely heavily on them when assessing adults for ADHD, perhaps even due to a lack of knowledge and awareness of instrument shortcomings (e.g., Lovett & Harrison, 2021). This notion was underscored by Murphy (2012) who reported ADHD is often diagnosed using only self-report methods, as well as other researchers suggesting self-report screening measures are consistently used as diagnostic measures when they should not be (e.g., Harrison et al., 2013, 2019; Paris et al., 2015).

Settings in which providers are overburdened due to limited time and heavy caseloads may be more likely to utilize self-report symptom inventory in lieu of a more thorough assessment of adult ADHD (Weis et al., 2019). For example, requests for ADHD evaluations in primary care settings have increased in recent years (Huang et al., 2020) and primary care physicians are encouraged to use screening instruments as a first step in evaluation for adult ADHD (e.g., Mao & Findling, 2014); however, Adler et al. (2009) surveyed 400 primary care physicians and found only 13% of their sample received thorough clinical training in adult ADHD. Also, 66% of their sample reported they did not feel very or extremely knowledgeable about adult ADHD. This lack of awareness of appropriate assessment procedures for measuring ADHD in adults may be another factor contributing to overreliance on self-report symptom inventories (e.g., Harrison et al., 2013). Further, best-practice comprehensive adult ADHD assessment takes time, which is often limited in primary care settings (e.g., Caverly & Hayward, 2020).

Financial burden and provider availability may be additional barriers to optimal adult ADHD assessment (Weis et al., 2019). Because of these barriers, there has been a recent proliferation of online services touting ADHD assessment and potential diagnosis from licensed providers, albeit after just one telehealth session which may include only a self-report symptom inventory and/or a brief (approximately 30 min) interview about symptoms (e.g., *ADHD Online* [ADHDOnline.com], *Klarity* [KlarityADHD.com], *Done* [DoneFirst.com]).

Sex Differences in ADHD

Further complicating reliance on self-report ADHD measures is emergent literature on sex differences in ADHD, particularly how ADHD symptoms may be experienced and/or reported differently by males and females. Although most research on sex differences in ADHD has been conducted in children, much can be learned from these studies and applied to adults. Diagnostic criteria for ADHD were first conceptualized largely based on the behavior of young boys (Littman et al., 2021). Indeed, some researchers suggested the higher prevalence of ADHD in males compared to females (i.e., 4:1 ratio in childhood; Ramtekkar et al., 2010) reflects bias of the diagnostic criteria. While less pronounced than in childhood, the imbalance between sexes in ADHD diagnosis persists in adulthood with an estimated ratio of 2.4:1 males to females diagnosed with ADHD (Willcutt, 2012).

Underdiagnosis of ADHD in females may be in part due to differences in symptom presentation. Some females tend to exhibit fewer hyperactive/impulsive symptoms than males, and instead exhibit more inattentive symptoms, which may be covert and challenging to assess (Biederman

et al., 2004; Fedele et al., 2012). Other researchers have argued ADHD symptomatology is largely similar between males and females (Rucklidge, 2008). Additional research implied that while underlying symptoms may be similar between sexes, the manifest behaviors may present differently for males and females. For example, females may be more likely to demonstrate hyperactive/impulsive symptoms through excessive talking compared to males (e.g., Biederman et al., 2004). Symptoms may also have different consequences for females (e.g., strained interpersonal relationships, differences in emotional expression; Hinshaw, 2002) that hold potential for misinterpretation in an assessment setting. Relatedly, patients and clinicians may misinterpret symptoms/consequences in females for other diagnoses (e.g., anxiety, depression) or personal shortcomings (Williamson & Johnston, 2015).

Associated features of ADHD, rather than core symptomatology, may also differ between sexes. Females with ADHD exhibit more language delays, cognitive delays, and executive functioning difficulties compared to males with ADHD (Rucklidge, 2008; Stibbe et al., 2020). The extant literature remains unclear regarding the extent to which ADHD self-report symptom inventories can overcome potential sex-based differences in ADHD presentation. Vildalen et al. (2019) found females reported more severe ADHD symptoms than males when using the Adult ADHD Self-Report Scale. In contrast, Stibbe et al. (2020) suggested there were no differences between males and females in self-reported symptoms when using the Conners' Adult ADHD Rating Scale. Taken together, findings imply that more research is needed to clarify potential sex differences in responses to self-report ADHD inventories.

The Current Study

The current study is a data-driven investigation into the diagnostic accuracy of a self-report symptom inventory commonly used in adult ADHD assessment. Specifically, we investigated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the Conners' Adult ADHD Rating Scale—Self-Report: Long Version (CAARS-S:L; Conners et al., 1999) in an adult ADHD assessment-seeking clinical sample. The primary aim was to determine the diagnostic accuracy of the ADHD Index and other CAARS-S:L scales. The secondary aim was to further examine the false positive cases and report on the diagnoses (if any) those participants were ultimately assigned. This secondary aim has important implications for differential diagnosis between ADHD and other adult psychopathology in clinical practice. Finally, the tertiary aim was to compare males versus females in the diagnostic accuracy of the ADHD Index to broaden the growing body of literature on sex differences in ADHD.

Method

Participants and Procedure

The current study tested archival data of adults seeking ADHD assessment. One hundred and twenty-two adults were included in analyses. Participants were included if they were (1) at least 18 years of age, (2) consented to research participation at the time of their assessment, and (3) completed a comprehensive, multimodal assessment battery for ADHD, including the CAARS-S:L. All data were collected at two outpatient assessment clinics in Upstate New York. One clinic was associated with a university (i.e., training clinic associated with a clinical psychology doctoral program; $n = 35$), and the other clinic was an assessment-focused private practice ($n = 87$). Participants ranged in age from 18 to 67 years ($M = 23.0$ years, $SD = 7.81$). The sample comprised approximately equal number of males ($n = 59$, or 48.8%) and females ($n = 62$, or 50.8%; $n = 1$ identified their sex as "other"). Most participants identified as White/Caucasian ($n = 92$; 75.4%), and the remainder of the sample identified as Asian ($n = 14$; 11.5%), biracial ($n = 10$; 8.2%), Latinx ($n = 4$; 3.3%), and Black/African American ($n = 2$; 1.6%). The base rate of ADHD in the sample was 22.1% (i.e., 27 out of 122 participants were ultimately diagnosed with ADHD). Of the 27 participants diagnosed with ADHD, 12 of them were female (44.4%). All ADHD diagnoses were made following a multimodal psychological assessment battery and process used in our clinics, which included the following steps: (1) an unstructured clinical interview (which included a review of childhood and current symptoms, medical history, psychiatric history, and educational history), (2) a self-report ADHD symptom inventory (CAARS-S:L), (3) cognitive testing (WAIS-IV), (4) academic achievement testing (WIAT-4 or WRAT-5), (5) performance-based tasks (Paced Auditory Serial Addition Test [PASAT], Test of Variables of Attention [TOVA]), and (6) various psychiatric symptom inventories and/or personality assessments (e.g., MCMI-IV, MMPI-3, Beck Depression Inventory Second Edition [BDI-II], etc.). Prior to making an ADHD diagnosis for each case, all assessment data were summarized, reviewed, and discussed among the members of the assessment clinics. All diagnostic accuracy analyses in the current study were based on the diagnoses given to participants via the procedures described above and conducted by a group of advanced doctoral-level psychology trainees and a licensed psychologist with expertise in ADHD assessment.

Measures

The CAARS-S:L (Conners et al., 1999), a 66-item self-report instrument that measures ADHD symptoms, was the primary measure in the current study. Participants rate each item on a

4-point scale (0 = *not at all or never* to 3 = *very much or always*). The CAARS-S:L encompasses four primary subscales (Inattention/Memory Problems, Hyperactivity/Restlessness, Impulsivity/Emotional Lability, and Problems with Self-Concept) and four composite scales (DSM-IV Inattentive Symptoms, DSM-IV Hyperactive-Impulsive Symptoms, DSM-IV ADHD Symptoms Total, and ADHD Index). The ADHD Index is identified by the test manual as the best CAARS-S:L scale for detecting adults at risk for ADHD (Conners et al., 1999). Therefore, we used this scale as our primary measure for diagnostic accuracy analyses. CAARS-S:L scores are T-scores ($M = 50$, $SD = 10$), with scores above 65 indicating clinically significant problems.

Data Analysis

Only cases with complete data for all variables of interest were included in analysis, resulting in no missing data. We calculated the sensitivity (i.e., true positive rate), specificity (i.e., true negative rate), PPV, and NPV for the ADHD Index. Sensitivity was calculated by dividing the number of true positive cases by the total number of true positive plus false negative cases, multiplied by 100. Specificity was calculated by dividing the number of true negative cases by the total number of true negative plus false positive cases, multiplied by 100. PPV (i.e., likelihood of having ADHD diagnosis when scale was elevated) was calculated by dividing the number of true positive cases by the total number of true positive cases plus false positive cases, and multiplying by 100. NPV (i.e., likelihood of *not* having ADHD diagnosis when scale was *not* elevated) was calculated by dividing the number of true negative cases by the total number of true negative cases plus false negative cases, and multiplying by 100.

Next, we used an ANOVA with post-hoc tests to evaluate differences among diagnostic groups in ADHD Index scores (i.e., ADHD diagnosis, non-ADHD diagnoses, no diagnosis assigned). Subsequently, we determined which non-ADHD diagnosis, if any, each of these false positive ADHD cases was assigned. We then calculated sensitivity, specificity, PPV, and NPV for each of the seven other CAARS-S:L scales to determine which scales demonstrated the best diagnostic accuracy for ADHD in our sample. Lastly, we tested differences between males and females on the ADHD Index using an independent samples *t*-test. We also calculated separately the diagnostic accuracy of the ADHD Index in males and females and compared these estimates.

Results

Diagnostic Accuracy of ADHD Index

Sensitivity, Specificity, NPV, and PPV of ADHD Index in Identifying Participants With ADHD. Fifty-one of 122 participants (41.8%) had CAARS-S:L profiles depicting an elevated score on the ADHD Index. Fifteen of these 51 participants (29.4%) were diagnosed with ADHD (true positive cases), while 36 of them (70.6%) were not diagnosed with ADHD (false positive cases). Of the 71 participants *without* elevated scores on the ADHD Index (58.2%), 12 of them (16.9%) were diagnosed with ADHD (false negative cases), and 59 of them (83.1%) were not diagnosed with ADHD (true negative cases). Accordingly, the sensitivity (i.e., true positive rate) of the ADHD Index was 55.6%, specificity (i.e., true negative rate) was 62.1%, PPV was 29.4%, and NPV was 83.1% (see Table 1). Notably, the ADHD Index exhibited weak sensitivity and weak specificity for ADHD in adults.

Differences in ADHD Index Scores Among Three Diagnostic Groups. Next, we evaluated group differences in ADHD Index scores among (1) participants with ADHD, (2) participants with non-ADHD diagnosis, and (3) participants who were assigned no diagnosis. A one-way ANOVA demonstrated a significant group difference in ADHD Index scores among participants with ADHD ($M = 63.35$, $SD = 8.62$), participants with non-ADHD psychopathology ($M = 63.48$, $SD = 10.16$), and participants with no diagnosis ($M = 57.14$, $SD = 9.16$), $F(2,119) = 3.805$, $p = .025$. Post-hoc multiple comparison tests (Tukey's HSD) revealed a significant difference in ADHD Index scores between participants with non-ADHD diagnoses ($M = 63.48$, $SD = 10.16$) and participants with no diagnosis ($M = 57.14$, $SD = 9.16$), $t(97) = 2.70$, $p = .022$. All other pairwise comparisons were non-significant.

Diagnostic Accuracy of Other CAARS-S:L Scales

Table 1 presents the sensitivity, specificity, PPV, and NPV of each of the CAARS-S:L scales based on the diagnosis ultimately assigned to individual participants. Across all CAARS-S:L scales, NPV was consistently higher than PPV. NPV was highest for DSM-IV Inattentive Symptoms, indicating that a participant without an elevated score on this scale had a 100% chance of not being diagnosed with ADHD in our sample. The DSM-IV ADHD Total Symptoms Scale also had a strong NPV for identifying ADHD, such that a participant without an elevated score on this scale had a 90.6% chance of not being diagnosed with ADHD. PPV was very low across all scales. PPV was highest for Hyperactivity/Restlessness, such that an individual with an elevated score on this scale had a 36.1% chance of truly having ADHD. Sensitivity was highest for DSM-IV Inattentive Symptoms, followed by DSM-IV ADHD Total Symptoms, demonstrating these two scales were best for discerning participants with ADHD. Specificity was highest for Impulsivity/Emotional Lability and Hyperactivity/Restlessness Scales, implying that these two scales were best for detecting participants without ADHD. The ADHD

Table 1. Sensitivity, Specificity, PPV, and NPV of Each CAARS-S:L Scale for Identifying ADHD.

CAARS-S:L scale	Sensitivity	Specificity	PPV	NPV
ADHD index	0.556	0.621	0.294	0.831
Inattention/memory problems	0.667	0.379	0.234	0.800
Hyperactivity/restlessness	0.481	0.758	0.361	0.837
Impulsivity/emotional lability	0.259	0.768	0.241	0.785
Problems with self-concept	0.185	0.558	0.106	0.707
DSM-IV inattentive symptoms	10.00	0.200	0.262	10.00
DSM-IV hyperactive/ impulsive symptoms	0.630	0.653	0.340	0.861
DSM-IV ADHD total symptoms	0.889	0.305	0.267	0.906

Note. PPV = positive predictive value; NPV = negative predictive value; CAARS-S:L = Conners' Adult ADHD Rating Scale, Self-Report, Long-Version.

Index did not outperform the other CAARS-S:L scales, contrary to findings reported in the manual.

Final Primary Diagnosis Assigned for False Positive Cases

Table 2 displays descriptive data following further investigation into the 36 false positive cases on the ADHD Index (i.e., those cases in which the ADHD Index score was elevated but did not receive an ADHD diagnosis after multimodal assessment). Most of these false positive cases were diagnosed with other non-ADHD disorders (34 out of 36 cases, or 94.4%). Individuals were most likely to be diagnosed with an anxiety disorder (12 out of 36, or 33.3% of false positive cases) or a unipolar mood disorder (12 out of 36, or 33.3% of false positive cases), followed by a bipolar mood disorder (5 out of 36, or 13.9% of false positive cases).

Sex Differences in Diagnostic Accuracy of ADHD Index

An independent samples *t*-test was conducted to determine if males and females differed on ADHD Index scores. This test revealed there was a significant difference in ADHD Index scores between males ($M = 58.88$, $SD = 10.34$) and females ($M = 65.68$, $SD = 8.50$), such that females reported significantly higher scores on the ADHD Index, $t(119) = -3.90$, $p < .001$, $d = 0.72$. To clarify, this significant difference in ADHD Index scores between males and females reflects all participants, whether an ADHD diagnosis was present or not. A majority of the false positive cases on the ADHD Index were female participants, with female participants accounting for 24 of the 36 false positive cases (66.7%). We then examined differences in diagnostic accuracy for the ADHD Index between males and females (see Table 3). Most notably, specificity and PPV were stronger for the ADHD Index in males compared to females, albeit still weak overall. Sensitivity and NPV for the ADHD Index were comparable between males and females.

Table 2. Ultimate Primary Diagnoses Given to Participants With False Positive Elevations on CAARS-S:L ADHD Index ($n = 36$).

Ultimate diagnosis given	*n*	% of false positive cases
Anxiety disorder	12	33.3%
Generalized anxiety disorder	(9)	
Social anxiety disorder	(1)	
Panic disorder	(1)	
Other/unspecified anxiety disorder	(1)	
Unipolar mood disorder	12	33.3%
Major depressive disorder	(6)	
Persistent depressive disorder	(6)	
Bipolar mood disorder	5	13.89%
Bipolar I disorder	(2)	
Bipolar II disorder	(1)	
Cyclothymic disorder	(1)	
Other/unspecified bipolar disorder	(1)	
Neurocognitive disorder	1	2.78%
Mild neurocognitive disorder d/t TBI	(1)	
Obsessive-compulsive and related disorders	1	2.78%
Obsessive-compulsive disorder	(1)	
Personality disorders	1	2.78%
Borderline personality disorder	(1)	
Specific learning disorder	1	2.78%
w/ impairment in reading	(1)	
Trauma- and stressor-related disorders	1	2.78%
Posttraumatic stress disorder	(1)	
No diagnosis given/none	2	5.56%

Discussion

Overall, the majority of CAARS-S:L scales, including the ADHD Index, demonstrated weak diagnostic accuracy when discerning adults with ADHD, further supporting the need for comprehensive follow-up testing when conducting ADHD assessments in adults (e.g., Bottini et al., 2019). ADHD Index scores for participants with ADHD *did not differ* significantly from those with non-ADHD diagnoses or no diagnosis. Based on PPV, the ADHD Index had only

Table 3. Sensitivity, Specificity, PPV, and NPV of CAARS-S:L ADHD Index for Identifying ADHD in Male Versus Female Participants.

Sex of participant	ADHD Index			
	Sensitivity	Specificity	PPV	NPV
Males	0.533	0.727	0.400	0.821
Females	0.583	0.520	0.226	0.839

Note. PPV = positive predictive value; NPV = negative predictive value; CAARS-S:L = Conners' Adult ADHD Rating Scale, Self-Report, Long-Version.

about a 30% chance of correctly identifying an individual with ADHD in our sample. Our finding is concordant with PPV estimates of the ADHD Index in similar investigations (e.g., Harrison et al., 2019). Although the ADHD Index exhibited weak diagnostic accuracy overall, its specificity and NPV were higher than its sensitivity and PPV. The NPV for the ADHD Index was higher compared to other indices, resulting in an 83.1% chance that an individual without an elevated score on the ADHD Index truly did not have ADHD in our sample. These results imply that the ADHD Index may function better at *ruling out* ADHD when encountering a non-elevated score, but additional studies are needed to support this notion.

Although the CAARS-S:L test manual cites the ADHD Index as the best scale for identifying adults at risk for ADHD (Conners et al., 1999), our findings suggest the DSM-IV ADHD Symptoms Total Scale and the DSM-IV Inattentive Symptoms Scale may be better for screening purposes given they demonstrated the highest sensitivity values. These high sensitivity values indicate these two scales tended to be elevated among individuals who truly had ADHD (i.e., were diagnosed with ADHD after multimodal assessment), and the high NPVs for these scales indicated that participants were unlikely to have ADHD when these scales were not elevated. Thus, if an individual's CAARS-S:L profile depicts an elevation on DSM-IV ADHD Total Symptoms or DSM-IV Inattentive Symptoms, further testing to discern whether ADHD is present is likely needed. However, if an individual's CAARS-S:L profile does not depict elevations on these scales, the individual may be less likely to have ADHD and testing for other potential diagnoses may be needed. These findings are in line with existing literature evidencing adults with ADHD tend to report inattentive symptoms more so than hyperactive symptoms (Solanto et al., 2012). It is also important to note inattention symptoms are often characteristic of other, non-ADHD disorders, such as anxiety and depression (Huang et al., 2020; Van Voorhees et al., 2011), and thus further assessment attuned to differential diagnosis is warranted, even when an individual has a high score on the DSM-IV ADHD Total Symptoms and/or DSM-IV Inattentive Symptoms Scales.

The scales with the highest specificities were the Impulsivity/Emotional Lability Scale and the Hyperactivity/Restlessness Scale. The moderately high specificities indicate these scales tended to correctly mark those *without* ADHD when *not* elevated. No specific CAARS-S:L scale emerged with an especially strong PPV; rather, all scales had PPVs that were quite low (i.e., the strongest was Hyperactivity/Restlessness with a PPV = .361). Lack of strong PPVs for any CAARS-S:L scales implies that *none of the scales* determined an ADHD diagnosis at an adequate rate of success when elevated.

Overall Utility of the CAARS-S:L in Adult ADHD Assessment

Our findings add to the growing body of literature regarding the CAARS-S:L's inconsistent diagnostic accuracy (e.g., Harrison et al., 2019; Stewart & Liljequist, 2015). Broadly, the general pattern observed for the CAARS-S:L scales in our study was a high NPV with lower sensitivity, specificity, and PPV. All scales demonstrated very low PPV, and most demonstrated low sensitivity, except for the DSM-IV ADHD Symptoms Total and DSM-IV Inattentive Symptoms Scales.

In combination with other research (Harrison et al., 2019; Taylor et al., 2011) and guidelines (e.g., Paris et al., 2015), our findings support the notion that the CAARS-S:L should not be used as the sole measure assigning an adult with a diagnosis of ADHD. If the CAARS-S:L is used, it should be done so in the context of a multimodal assessment (Bottini et al., 2019; Huang et al., 2020; Taylor et al., 2011). Even still, diligent care should be taken when examining scores on all scales with the recognition that many CAARS-S:L scales exhibit deficient diagnostic accuracy for adult ADHD. Our findings provide further empirical evidence that questions the widespread reliance on self-report measures for adult ADHD assessment.

Final Diagnoses of False Positive Cases on ADHD Index

In line with previous research (e.g., Harrison et al., 2019; McCann & Roy-Byrne, 2004), the ADHD Index exhibited a high false positive rate in assessing adult ADHD in the current study (70.5% cases with an elevated score on the ADHD Index were not ultimately diagnosed with ADHD). While a range of conditions were identified, false positives on the ADHD Index were most frequently diagnosed with anxiety disorders (33.3%) or depressive disorders (33.3%). Researchers have suggested anxiety and depressive disorders may be commonly misidentified as ADHD (e.g., Lovett

& Harrison, 2021; Van Voorhees et al., 2011). Interestingly, the third most diagnosed condition when the ADHD Index was elevated was a bipolar mood disorder (13.89%), which supports prior research indicating an overlap between these conditions, most likely due to similar cognitive and behavioral symptoms (Barden et al., 2023). Given an elevation on the ADHD Index, assessors should conduct additional testing to rule out other conditions, focusing especially on anxiety, depressive, and bipolar disorders. Accurate differential diagnosis can prevent misdiagnosis and mitigate the financial burden of therapy or harmful medication side effects (Graham et al., 2011; Huang et al., 2020).

Sex Differences in ADHD Index

We also found sex differences in the diagnostic accuracy of the ADHD Index. First, females reported significantly higher scores on the ADHD Index in comparison to males, which is consistent with recent research (Slobodin & Davidovitch, 2019; Vildalen et al., 2019). Next, no sex differences emerged in the sensitivity and NPV for the ADHD Index, but greater specificity and PPV for males were observed. Although PPV was still low for males, it was greater than the ADHD Index documented in the combined sample with both females and males. These findings suggest the ADHD Index is better able to *accurately* detect clinically significant ADHD symptoms in males than in females.

Despite reporting greater ADHD symptoms, most females were ultimately not diagnosed with ADHD. Indeed, females accounted for the majority of the false positive cases on the ADHD Index in our sample (two out of every three false positive cases were female participants). In general, females may experience more ADHD-*like* symptoms that are ultimately better accounted for by other factors, such as mood disorders, anxiety disorders, and social stressors compared to males (Ahmad et al., 2019; Williamson & Johnston, 2015). Thus, if ADHD testing solely involved the use of a self-report symptom inventory, it seems likely that many females with other, non-ADHD psychopathology would be incorrectly identified as having ADHD.

A further complicating factor, however, is the literature suggesting females with ADHD tend to experience more of the internalizing and inattentive symptoms of ADHD, compared to males (Antoniou et al., 2021; Littman et al., 2021; Williamson & Johnston, 2015). Thus, if these subtler or less overt symptoms of ADHD are incorrectly attributed to other psychopathology, a different problem of misdiagnosis has occurred. Certainly, this still does not suggest we should diagnose based on self-report symptoms, but rather, highlights a potential broader deficiency in recognizing the differential ways ADHD may present in males versus females (Hinshaw, 2002; Littman et al., 2021; Williamson & Johnston, 2015).

Clinical Implications

In light of the current literature, our findings have several important implications for the assessment of adult ADHD. First and foremost, clinicians should not utilize self-report measures in isolation to diagnose ADHD. The limited diagnostic accuracy, in addition to overlapping symptomatology with other psychiatric conditions, presents too great a risk for misidentification of or failure to identify ADHD. Instead, clinicians should utilize self-report measures solely for their intended purpose: screening. That is, a brief and easy-to-complete measure that may inform whether further assessment is warranted. Nevertheless, these screening measures should be employed with caution and knowledge of these measures' shortcomings.

Second, clinicians utilizing screening measures like the CAARS-S:L should review and consider all scales. We found inconsistent accuracy across scales, so, ideally, clinicians should be well versed with the psychometric properties of measures they use, including the individual scales and composite indices. A cautious approach to adult ADHD screening would involve further assessment with any scale elevation. When using the CAARS-S:L, in particular, clinicians might consider weighing the DSM-IV Inattentive Symptoms and DSM-IV ADHD Total Symptoms Scales most heavily, as these seem to show the highest sensitivity. In pursuing further assessment, clinicians must also carefully consider other diagnoses that may better explain symptoms or co-occur with ADHD. Our findings imply that depression, anxiety, and bipolar possess overlapping symptoms with adult ADHD; thus, clinicians may benefit from routinely screening for these disorders when an individual presents with attention-related concerns.

Third, clinicians should be wary of the potential for symptom overreporting, particularly on self-report ADHD symptom inventories. As indicated in the literature, ADHD symptoms may be especially easy to overreport or exaggerate on a self-report symptom inventory (Harrison et al., 2007; Johnson & Suhr, 2021). In our study, we found a high false positive rate on many of the CAARS-S:L subscales, which may, in part, be driven by symptom overreporting. Clinicians should (1) administer specific symptom validity or performance validity instruments, and/or (2) choose instruments that contain built-in symptom or performance validity scales and carefully consider such scales in the assessment process. Furthermore, on self-report instruments administered to assess non-ADHD-related symptoms, it is also important to assess validity of responses as to mitigate noncredible reporting across all domains included in the assessment.

Fourth, clinicians engaged in adult ADHD assessment should remain updated on the literature. The inconsistent sensitivity of the CAARS:S-L may reflect how self-report measures are in the nascent stages of capturing symptom

profiles of ADHD in adults. Our findings also contribute to the emerging literature supporting sex differences in ADHD symptom profiles and whether self-report measures may show differential validity between males and females. To facilitate accurate diagnosis, clinicians must be knowledgeable of these subtle differences in how ADHD may present across the lifespan and for those of varying demographic groups.

Finally, clinicians should consider providing psychoeducation before initiating a comprehensive assessment battery. Given the overreliance on self-report measures in some settings, individuals may present for assessment with a pre-conceived notion whether or not they have ADHD (e.g., the individual screened positive online). Information (and misinformation) disseminated about ADHD has seen a recent surge in popularity on the social media platform *TikTok* (Yeung et al., 2022). Further, some recent evidence suggests individuals may self-diagnose and/or attempt to feign various psychiatric disorders based on information viewed on social media platforms (Haltigan et al., 2023). Talking with individuals about normative inattention/hyperactivity, ADHD in adulthood, and other possible diagnoses may facilitate buy-in to the assessment process and potential diagnosis. Clinicians should also be wary of individuals who present themselves as already diagnosed with ADHD and carefully assess the source of information and whether other possible explanatory diagnoses have been explored.

Limitations

The current study is not without limitations. We report solely on issues with the CAARS-S:L. This instrument is only one of the many self-report symptom inventories widely used by practitioners in adult ADHD assessment. While we discuss issues related to self-report symptom measures more broadly throughout our paper, our results are specific to the CAARS-S:L. Findings may not generalize to other self-report adult ADHD symptom inventories. Also, the CAARS-S:L is based on the DSM-IV criteria of ADHD and thus future studies replicating our findings with an instrument measuring DSM-5 ADHD criteria is warranted. The sample was predominantly Caucasian (approximately 75%) and relatively young (approximately 74% between 18 and 22 years old) and thus, our findings may not generalize to other demographic groups. While the participants included in our study were not limited to post-secondary students, many individuals seeking adult ADHD assessment at our clinics were college students. This may further limit generalizability of our findings to other populations beyond college students, but it is also important to note the college years are often when adults identify a need and/or are prompted to be tested for adult ADHD. Finally, we note the procedures used to validate an ADHD diagnosis in the current study did not specifically include a symptom validity or performance validity instrument, as is recommended as best practice (e.g., Lovett & Harrison, 2021). However, some of the specific tests used in our ADHD assessment battery did contain a built-in symptom or performance validity scales, and such scales were always considered in the assessment process. Of note, updated conceptualizations of validity have shown that performance validity tests and symptom validity tests measure distinct non-overlapping constructs (e.g., Ovsiew et al., 2023); therefore, future research should consider multiple sources of validity in the context of adult ADHD assessment.

Conclusion

The current study reflects real-world outpatient assessment clinics where many adults report significant ADHD-related symptoms, but not all these individuals meet diagnostic criteria for ADHD (e.g., Harrison et al., 2019). In this setting and others (e.g., primary care, psychiatry), self-report measures of ADHD (such as the CAARS-S:L) are commonly used and may improperly be the primary means of providing a diagnosis (Lovett & Harrison, 2021). Yet, self-reported ADHD symptoms and results from multimodal ADHD assessments do not always align (e.g., Bottini et al., 2019). The current study provides additional evidence that assessors should not rely solely on self-report symptom inventories when making a diagnosis in adults seeking ADHD assessment.

While findings indicated that CAARS-S:L scales can be used in combination to inform assessment decisions, the measure exhibited poor diagnostic accuracy in identifying adults with ADHD marked by weak sensitivity and specificity, and low PPV and NPV. Further, our data demonstrated notable sex differences in specificity and PPV between males and females, such that the measure demonstrates better diagnostic accuracy for males versus females. Ultimately, we strongly recommend utilizing a multimodal assessment approach following an initial ADHD screen that focuses on attentional processes, demographic variables, and rule-out disorders to ensure a more accurate diagnosis in adults.

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