Applied Neuropsychology: Adult

ISSN: 2327-9095 (Print) 2327-9109 (Online) Journal homepage: www.tandfonline.com/journals/hapn21

Determining cutoff scores on the Conners' adult ADHD rating scales that can definitively rule out the presence of ADHD in a clinical sample

Dylan Kwan, Nathaniel Davin, Allyson G. Harrison & Sienna Gillie

To cite this article: Dylan Kwan, Nathaniel Davin, Allyson G. Harrison & Sienna Gillie (2026) Determining cutoff scores on the Conners' adult ADHD rating scales that can definitively rule out the presence of ADHD in a clinical sample, Applied Neuropsychology: Adult, 33:1, 144-154, DOI: 10.1080/23279095.2024.2336204

To link to this article: https://doi.org/10.1080/23279095.2024.2336204

Published online: 03 Apr 2024.

APPLIED NEUROPSYCHOLOGY: ADULT
2026, VOL. 33, NO. 1, 144–154
https://doi.org/10.1080/23279095.2024.2336204

Determining cutoff scores on the Conners' adult ADHD rating scales that can definitively rule out the presence of ADHD in a clinical sample

Dylan Kwan, Nathaniel Davin, Allyson G. Harrison and Sienna Gillie

Regional Assessment & Resource Centre, Queens University, Kingston, ON, Canada

ABSTRACT

In recent years, the prevalence of Attention Deficit/Hyperactivity Disorder (ADHD) and the number of individuals seeking ADHD assessments has risen significantly, leading to an increased demand for accurate diagnostic tools. This study aimed to identify cutoff scores on the Conners' Adult ADHD Rating Scales (CAARS-S:L) that can definitively rule out the presence of ADHD. Among 102 clinically diagnosed adult ADHD participants and 448 non-ADHD participants who completed the CAARS-S:L, a receiver operating characteristic curve analysis established a perfectly discriminant cutoff T-score of <44 on the ADHD Symptoms Total subscale when looking at any ADHD diagnosis and <54 on the Inattentive Symptoms subscale when looking at individuals diagnosed with the inattentive subtype of ADHD. Alternative cutoffs of <54 (ADHD Symptoms Total subscale) and <63 (Inattentive Symptoms subscale) were also identified, both with a sensitivity of 0.95 or higher. Furthermore, the analysis found the ADHD Index to be a poor predictor of a negative ADHD diagnosis, suggesting against the use of this scale for cutoff determination. Despite this limitation, these findings indicate that with specific cutoffs, the CAARS-S:L may have the potential to conclusively rule out ADHD, effectively streamlining the diagnostic process and reducing unnecessary comprehensive assessments in clear negative cases.

KEYWORDS
Clinical; assessment/diagnosis; Neuropsychology; diagnosis; tests

Introduction

Neurodevelopmental disorders are a group of complex conditions that present early in childhood development. These disorders are typically defined by abnormal brain development, which commonly leads to impairments in personal, social, vocational, or academic functioning (American Psychiatric Association, 2013). One of the most common neurodevelopmental disorders in childhood is Attention-Deficit/Hyperactivity Disorder (ADHD), a chronic and debilitating disorder that causes symptoms of inattention, hyperactivity, and/or impulsivity (Salari et al., 2023). There are three main types of ADHD, each with varying degrees of severity: predominantly inattentive presentation, predominantly hyperactive/impulsive presentation, and combined presentation (American Psychiatric Association, 2013).

ADHD is present in nearly 7.2% of children worldwide (Thomas et al., 2015). This prevalence has been increasing over time; for instance, Xu et al. (2018) documented that the number of ADHD diagnoses in children/adolescents in the United States increased from 6.1% in 1997 to 10.2% in 2016. A study in North Carolina by Rowland et al. (2015) revealed an even higher ADHD prevalence of 15.5% among school-age children, more than double the worldwide childhood prevalence (Thomas et al., 2015). Similarly, Butt et al. (2023) found that the prevalence of ADHD in those aged 1–24 years in Ontario, Canada, increased from 5.29% in 2014 to 7.48% in 2021, and that the incidence in females surpassed males in 2021. The prevalence of ADHD in adults, while less established compared to children (Matte et al., 2012), has also shown a significant increase. A systematic review and meta-analysis by Song et al. (2021) estimated the global prevalence of adult ADHD to be 2.58%, affecting nearly 139.84 million adults. Regionally, the number of new adult ADHD cases in all Canadian provinces rose from 1999 to 2012, with Quebec experiencing a staggering 350% increase during this period (Vasiliadis et al., 2017). Comparatively, Zhu et al. (2018) noted a significant rise in ADHD incidence rates among American adults over the past decades. There has also been a drastic increase in the number of individuals with ADHD attending a post-secondary institution (Nugent & Smart, 2014). A study of 15,961 college students in nine countries by Mak et al. (2021) and the World Health Organization reported an ADHD prevalence of up to 15.9% in college freshmen, substantially higher than previous community (2.58%; Song et al., 2021) and college-based estimates (2–8%; DuPaul et al., 2001).

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013), defines the complete list of diagnostic criteria for ADHD. To begin with, a clinical diagnosis of ADHD is based on a pattern of inattention and/or hyperactive-impulsive symptoms that have persisted over time. It is also required

CONTACT Nathaniel Davin nathaniel.davin@gmail.com Regional Assessment & Resource Centre, Queen's University, Mackintosh-Corry Hall, B100, 68 University Avenue, Kingston, ON K7L 3N6, Canada.

that these symptoms are present before the age of 12, have been noticeable for the past six months, are present across environments, cause impairment, and cannot be attributed to another condition (American Psychiatric Association, 2013).

Due to the nature of the disorder, experts generally recommend that a multi-method, multi-informant assessment approach be used in a clinical diagnosis of ADHD (Handler & DuPaul, 2005; Sibley, 2021). For example, a qualitative review by Marshall et al. (2021) reported that clinical interviews and ADHD behavior rating scales alone had poor specificity in diagnosing ADHD. Standard methods, like clinical interview questions, behavior rating scales, symptom validity tests, and cognitive tests, can enhance assessment practices when used in conjunction (Marshall et al., 2021). However, the standard multi-method, multi-informant assessment process used in a clinical diagnosis of ADHD can be both expensive and time-consuming. Throughout Ontario, Canada, standard psychoeducational assessments can range from $1,500 to $5,000, and testing periods typically last six to eight hours over multiple appointments (Bayridge Counselling, 2022; Ferguson, 2022; Queen's University, 2023). In the United States, such assessments now cost anywhere from $5,000 to $10,000, depending on the location (Belkin et al., 2019). While these psychoeducational assessments diagnose disorders like ADHD, learning disabilities, and/or Autism Spectrum Disorder (ASD), undergoing such an evaluation does not guarantee a diagnosis will be given. Thus, it is paramount to have methods to quickly rule out the presence of such a condition so that patients do not commit extensive resources to such assessments when the disorder is absent.

There are multiple tests that currently screen for ADHD; however, research suggests that the current ADHD screening tools are lacking in sensitivity and specificity (Harrison & Edwards, 2023). The sensitivity of a test refers to the proportion of all true cases that will be correctly diagnosed based on the chosen cutoff, while specificity is the proportion of non-cases that will be correctly identified. In a psychiatric setting, sensitivity must be at least 0.7–0.8 to be considered acceptable, with specificity rates as close to 0.8 or higher used to select the optimal cutoff (Mulraney et al., 2022). Harrison and Edwards (2023) conducted a systematic review and meta-analysis of ADHD screening measures and found that no single measure conducted by a single reporter is sufficient for large-scale screening, as none could meet the minimum thresholds. An optimal cutoff on a screening tool to completely rule out an ADHD diagnosis would be the highest threshold that yields a sensitivity of 1.0, as everyone who scores below that would not have a diagnosis of ADHD.

Despite warnings against over-reliance on symptom checklists alone for diagnosis, research suggests that many clinicians continue to use these checklists as their primary tool when diagnosing ADHD (Joy et al., 2010; McCann & Roy-Byrne, 2004; Nelson et al., 2014). Primary care physicians (PCPs) often find themselves at the frontline of this issue, with nearly 48% of PCPs feeling uncomfortable diagnosing adult ADHD and 65% preferring to defer ADHD diagnoses to specialists, compared to 2% for depression and 3% for generalized anxiety disorder (Adler et al., 2009). However, in recent years, traditional ADHD specialists like psychiatrists, clinical psychologists, and mental health therapists have faced overwhelming demand due to the COVID-19 pandemic, resulting in monthslong waitlists for new patients (Cerasa et al., 2022; Sibley, 2023). While adult ADHD is much more difficult to diagnose than childhood ADHD due to the need to establish both current and historical presence of the syndrome (Kolar et al., 2008), up to 75% of PCPs rated the quality and accuracy of existing adult ADHD diagnostic tools to be either poor or fair (Adler et al., 2009). As such, development of a simple and reliable adult ADHD screening tool to rule out the presence of ADHD would be of significant benefit to both PCPs and specialty care providers. For PCPs, such a tool could increase confidence and accuracy in diagnosing adult ADHD, leading to more precise and appropriate referrals. For specialists, incorporating such a screening tool at the start of a multimodal assessments could streamline the diagnostic process, optimizing the allocation of specialist resources and potentially easing wait times as well.

When it comes to ADHD screening tools, much of the current research is focused solely on their ability to accurately predict an ADHD diagnosis. One commonly used ADHD screening tool is the Adult ADHD Self-Report Scale (ASRS), developed by the World Health Organization in 2005 to assess ADHD in adults more effectively (Kessler et al., 2005). Harrison and Edwards (2023) systematic review highlighted limitations of the ASRS in distinguishing ADHD from other mental health disorders, even revealing that a high score on the ASRS had, at best, a 22% chance of accurately identifying those with ADHD. This echoes the findings of Chamberlain et al. (2021), who estimated that the ASRS has only about an 11.5% chance of accurately diagnosing ADHD in a large sample of non-treatment-seeking young adults in two countries.

The Conners' Adult ADHD Rating Scales–Self-Report: Long Version (CAARS-S:L; Conners et al., 1998a) is another commonly used measure that is helpful when screening adults for possible ADHD. When evaluating the ability of the CAARS-S:L to accurately predict an ADHD diagnosis, the CAARS manual (Conners et al., 1998b) suggests that T-values of 65 on any of its subscales (Inattentive Symptoms, Hyperactive Symptoms, ADHD Symptoms Total, ADHD Index) *might* indicate an area of clinically significant problems, and that T-scores greater than 70–75 should be used as a cutoff for inferring clinically significant problems. The ADHD Index, formed by 12 CAARS-S:L items, measures the "overall level of ADHD symptoms" (Conners et al., 1998a, p. 23), and the ADHD symptoms total scale includes items that correspond directly with the DSM-outlined symptoms of inattention and hyperactivity/impulsivity. However, a high score on the CAARS-S:L has also been shown to have weak positive predictive value; at a 10% base rate, a high score on the CAARS-S:L had only had a 34% chance of accurate classification when differentiating young adults with ADHD from assessment-seeking but non-ADHD individuals (Harrison & Edwards, 2023). In contrast, almost all studies analyzed by Harrison and Edwards (2023) found that most ADHD screening measures have excellent negative predictive value (that is, a low score usually correctly identifies those who do not have

ADHD). Despite this, there were no indications of specific cutoff scores within these ADHD screening tools in general, or on the CAARS-S:L subscales in particular, that can be used to accurately rule out an ADHD diagnosis.

Thus, this study aims to examine the clinical samples of individuals seeking assessment at a university center to identify scores on the CAARS-S:L that can be used as a cutoff to rule out the presence of ADHD. As the global prevalence of ADHD continues to rise and the number of postsecondary students seeking assessments increases, it is essential to develop appropriate ways to rule out the presence of ADHD in a clinical evaluation. There is a current dearth of research when reporting scores on ADHD screening tools that can rule out an ADHD diagnosis, and current psychoeducational assessments typically come with a high cost and time commitment. Therefore, there is a need to identify scores on existing ADHD screening tools that can accurately rule out the disorder in patients and minimize unnecessary subsequent evaluation when the condition is absent.

Methods

Materials

The CAARS-S:L (Conners et al., 1998a) is a 66-item checklist of symptoms and behaviors found in those diagnosed with ADHD. The CAARS-S:L rates items on a 4-point scale (0 = not at all/never, 1 = just a little/once in a while, 2 = pretty much/often, 3 = very much/very frequently). The DSM-5 emphasizes the persistence of inattentive and/or hyperactive-impulsive symptoms in the diagnosis of ADHD, behaviors that are indexed by the CAARS-S:L's four principle factors: inattention/memory problems, hyperactivity/restlessness, impulsivity/emotional lability, and problems with self-concept. Those who score high on inattention/memory problems can experience difficulties such as trouble concentrating, difficulty planning or completing tasks, forgetfulness, absent-mindedness, and being disorganized. High scores of hyperactivity/restlessness may materialize as problems with working on the same task for longer periods, feelings of restlessness, and fidgeting. The difficulties associated with impulsivity/emotional lability involve engaging in impulsive acts or decisions, having a low frustration tolerance, experiencing frequent mood changes, and feeling easily angered and irritated by other people. Although problems with self-concept are not specifically addressed by the DSM-5, problems with self-concept provide insights into an individual's self-esteem, self-perception, and social relationships, aspects that are often impacted by the chronic nature of ADHD's symptoms (Cueli et al., 2020). These four factors are weighed evenly on the ADHD index scale, which is said to measure the "overall level of ADHD symptoms" (Conners et al., 1998a, p. 23). As well, the CAARS-S:L has three additional scales that correspond with the DSM IV symptoms—Inattentive Symptoms, Hyperactive-Impulsive Symptoms, and Total ADHD Symptoms. However, the CAARS test manual notes that the CAARS-S:L was designed to act solely as an interpretive aid and should not be used as the basis for an ADHD diagnosis or intervention (Conners et al., 1998a).

In the present study, we examined three subscales of the CAARS-S:L: the ADHD index, which measures the overall level of ADHD symptoms; the ADHD total symptoms scale, created from the sum of the DSM-IV Inattentive Symptoms scale and the DSM-IV Hyperactive-Impulsive symptoms scale to assess DSM-IV ADHD criteria (those with scores in the clinically significant range on this scale are said to "meet the criteria for ADHD, as described in the DSM-IV"; Conners et al., 1998a, p. 24); and the inattentive symptoms scale, which focuses exclusively on inattentive symptoms. The hyperactive-impulsive symptoms scale was not analyzed due to the small number of adults diagnosed specifically with the hyperactive/impulsive subtype of ADHD in the current sample. While the CAARS manual suggests that scores above 70 on the ADHD index likely indicate an ADHD diagnosis, no mention is made of the lowest score required to rule out potential ADHD. In general, the CAARS is considered to have strong psychometric qualities, including good internal consistency, test-retest reliability, and strong content validity (Adler et al., 2008; Gallagher & Blader, 2001; Taylor et al., 2011). However, recent studies have revealed a poor diagnostic accuracy when using the CAARS to distinguish between individuals diagnosed with ADHD and those in non-ADHD clinical samples (Harrison et al., 2019; Harrison & Edwards, 2023).

Symptom validity tests (SVTs)

Participants were all administered between one to three symptom validity measures. Out of an abundance of caution, those who demonstrated a strong tendency to overreport symptoms on the CAARS-derived SVT were removed from the current sample, as were those whose scores on two PAI SVTs were above published cutoffs.

SVTs derived from the CAARS

Two newly described methods of evaluating self-report credibility on the CAARS have been published. The CAARS Infrequency Index (CII; Suhr et al., 2011) was retrospectively calculated from participant data. The CII is composed of 12 items rarely endorsed by typically developing adults as well as those diagnosed with ADHD. Suhr et al. (2011) identified a cut score of >21 as producing few false positive identifications for those with ADHD. The index was found to have modest sensitivity (approximately 30%) and high specificity (approximately 95%). Cook et al. (2016) found that the CII had 52% sensitivity to feigning and 97% specificity for ADHD based on extreme elevations of the three CAARS clinical scales derived from DSM-IV ADHD criteria. Because item-level responses were not recorded for all clients, data from only $n = 431$ clients could be used to calculate the CII in the present investigation.

The E-CAARS includes 18 additional symptom validity items embedded within the regular items, and has been described in detail by Harrison and Armstrong (2016). While allowing for all of the regular CAARS indices to be calculated, the embedded items included in this experimental version also allow clinicians to identify over-endorsement of ADHD-related symptoms. The sum of these symptom validity items produces a Dissimulation score (DISS), while a formula that combines the DISS with extreme scores from existing CAARS indices produces the Exaggeration Index (EI). According to Harrison and Armstrong (2016), this Exaggeration Index (EI) is said to have acceptable classification accuracy when discriminating between those feigning ADHD and other clinical groups (including those with ADHD) who were reporting symptoms accurately, with sensitivity to feigning ranging from .24 to .69 and specificity ranging from .74 to .97, depending on cut score used and estimated population prevalence. Harrison et al. (2022) found the EI and the DISS had the best sensitivity and specificity to exaggeration of ADHD symptoms relative to any other method examined SVT.

SVTs on the personality assessment inventory (PAI)

The PAI (Morey, 1991) is a widely used, 344-item self-report inventory that measures a number of personality traits; it also includes a number of symptom validity measures sensitive to overreporting or exaggeration of symptoms. Musso et al. (2016) found that test-takers who were exaggerating symptoms of ADHD returned elevated scores on the Negative Impression Management (NIM; Morey, 1991), the Roger's Discriminant Function (RDF; Rogers et al., 1996) and the Malingering Index (MAL; Morey, 1993, Morey, 1996). Musso et al. (2016) reported that the NIM, RDF and MAL showed promise in identifying college students feigning ADHD when using the following cutoffs (NIM >=77, Mal >= 3, RDF >=1). Using these cut scores, Harrison et al. (2022) confirmed that the NIM and MAL discriminated well between students undergoing assessment for possible ADHD who met criteria for malingered neurocognitive disorder and those who were reporting genuinely, with specificity of over 90%.

Performance validity measures

A variety of PVTs were employed in the archival assessments, depending on clinician preference. All assessments included at least two PVTs, as this is said to produce excellent specificity when both tests are failed (Odland et al., 2015). Measures employed in the assessments included at least two of the following:

The Word Memory Test (WMT; Green, 2003) evaluates test-taking compliance. Subjects are given a list of 20 word pairs on a computer screen and must identify all words pairs immediately (Immediate Recall; IR) and after a delay of 30 minutes (Delayed Recall: DR). The consistency (CNS) of responses between IR and DR is also measured. Following the delayed recognition task, individuals are also asked to identify words from the original list in a multiple choice format (MC); in a paired associates format (PA); and in a free recall format (FR). According to the test manual, scores less than 82.5 percent on any of the first three subtests indicate noncredible performance.

The Medical Symptom Validity Test (MSVT; Green, 2004) is a similar, shorter version of the WMT. Like the WMT, the MSVT measures Immediate Recognition (IR) and Delayed Recognition (DR) of a word list, as well as the consistency (CNS) of answers between the two subtests. According to the test manual, scores less than 85 on any of the first three subtests indicate noncredible performance.

The Test of Memory Malingering (TOMM; Tombaugh, 1996) is a frequently used visual recognition PVT consisting of two learning trials, an immediate retention trial, and a delayed retention trial. Learning trials contain 50 line-drawn pictures, which are paired with a second distractor line drawing during the retention trials. A cutoff of ≤45 for both Trial 2 and the retention trial was taken as evidence of noncredible performance.

The Victoria Symptom Validity Test (VSVT; Slick et al., 1997) requires individuals to learn and recognize a series of "easy" and "hard" number sequences presented at different time intervals on a computer screen. Following the recommendations of Frazier et al. (2008), subjects were deemed to be performing noncredibly if their score on the "hard" items fell below 19.

The WAIS-IV Reliable Digit Span (RDS: Greiffenstein et al., 1994) is a well-validated PVT (Schroeder et al., 2012) calculated from the Digit span subtest of the WAIS-IV (Wechsler, 2008). It evaluates how consistently an examinee performs on tasks of comparable difficulty during each of the forwards and backwards trials of this auditory working memory test (see On et al., 2020 for instructions on how to calculate). Previous studies have shown that those with developmental disabilities such as LD and ADHD are not likely to be falsely accused of non-credible performance if a cut score of <=7 is used (Harrison et al., 2010).

The Test of Variables of Attention (TOVA; Greenberg et al., 2007) is a computer-based Continuous Performance Test (CPT). The current version includes a Symptom Exaggeration Index (SEI) developed as a result of research by Leark et al. (2008). A SEI score of 3 or more on the TOVA is said to provide firm evidence of noncredible performance.

Participants and procedure

Participants in this retrospective study were community college or four-year University students in Ontario, Canada who were referred to a government-funded assessment center for either an updated assessment of a previously diagnosed disorder or to investigate the cause for currently reported academic difficulties. Students were assessed by a registered clinical psychologist or a supervised graduate student, with the specific assessor varying depending on the date of assessment. Informed consent was obtained by the participants to have their deidentified data used in research, and all research procedures were approved by the University's General Research Ethics Board.

All evaluations included a multi-method, multi-informant procedure: a) a review of all available historical records (medical, mental health, academic history including elementary school report cards, and any prior psychoeducational or neuropsychological evaluations); b) semi-structured clinical interview based on the DSM-IV-TR (American Pyschiatric Association, 2000) or DSM-5 (2013) diagnostic criteria for ADHD; c) retrospective evaluation by parents or caregivers of ADHD symptoms displayed by the client prior to age 12; d) both self-and observer ratings of current ADHD symptoms; e) performance and symptom validity tests shown to have good sensitivity to exaggeration of ADHD symptoms; f) assessment of general psychological difficulties using the Personality Assessment Inventory (Morey, 1991) to help rule out other potential causes for reported symptoms; and g) a comprehensive neuropsychological battery of tests. The overall diagnostic procedure mirrored closely the steps recommended by Sibley (2021). In particular, diagnosis was not contingent upon self-reported ADHD symptoms alone but relied on all available information, including evidence of historical and current impairment.

Data for the present study were retrieved from a large archival database, selecting individuals who completed the CAARS-S:L screening test between 2007 and 2023 during assessment for possible ADHD. Information regarding ethnicity was not collected at the time of assessment, however, an evaluation of all the referrals made to the assessment center revealed the following distribution of ethnic background: 72% White, 12% Asian, 6% Black, 3% Middle Eastern, and 7% Other/Not Specified. Therefore, we estimate a similar ethnic distribution in the current sample. Consistent with the advice in the CAARS manual (Conners et al., 1998b) we removed all subjects who answered the CAARS-S:L in an extremely inconsistent manner (Inconsistency score >=8). Furthermore, to ensure purity of the sample, individuals who had failed both a CAARS-specific SVT and at least one PVT at the time of the assessment were removed. Next, after removing participants due to inconsistency and validity issues, we further removed those whose diagnosis was "in remission" or if they were taking stimulant medication at the time of the assessment (as medication effects might have artificially lowered their self-reported symptoms). These sample parameters were chosen to reflect the current demographic of untreated adults pursuing either an initial diagnosis or reassessment for ADHD, while also excluding those who self-report inconsistently or exaggerate their deficits. Ultimately, we were left with a sample size of 102 for the ADHD group and a sample size of 448 for the non-ADHD group, with ages ranging from 17 to 56. In the ADHD-diagnosed group, 68 adults were specified as having the inattentive subtype, 31 had the combined subtype, 1 had the hyperactive/impulsive subtype, and 2 were left unclassified. A chi-squared independence analysis was performed on gender to see if there were significant differences between genders across the groups. This analysis was used as it is a non-parametric test and gender is a categorical variable. After running a chi-squared analysis on gender, no significant difference was found between the groups. However, there was a greater proportion of males in the ADHD group, while the reverse trend was found for the non-ADHD group. Additional data regarding participant demographics may be found in Table 1.

Table 1. Characteristics of participants.

Characteristic	ADHD Dx ($n=102$) *n*	ADHD Dx %	No ADHD Dx ($n=448$) *n*	No ADHD Dx %
Sex				
Female	49	48.0	246	54.9
Male	53	52.0	202	45.1
Mean Age	21.5 (17–40)		22.2 (17–56)	
Comorbid Disorder				
LD	27	26.5	204	45.5
ASD	3	2.9	16	3.6
Anxiety	5	4.9	45	9.4
Depression	1	1.0	15	3.3
PTSD	0	0	2	0.4
OCD	0	0	5	1.1
PD	0	0	4	.9

Note. Mean age is reported in years, age range is in brackets. LD: learning disability; ASD: autism spectrum disorder; PTSD: post-traumatic stress disorder; OCD: obsessive-compulsive disorder; PD: personality disorder.

Results

CAARS-S:L ADHD index T-scores

The ROC curve analysis was run to determine the lowest T-score on the ADHD Index associated with an ADHD diagnosis. When comparing the ADHD DX group ($n=102$) to the non-ADHD group ($n=448$), the Area Under the Curve (AUC) was 0.691 [95% CI: 0.637, 0.745], indicating a poor level of accuracy in this subscale's ability to discriminate between students with and without an ADHD diagnosis. The AUC measures the entire two-dimensional area underneath the ROC curve, providing a single number that summarizes the classification accuracy of diagnostic tests (Nahm, 2022). The ideal ROC curve has an AUC of 1.0; this occurs when the ROC curve is at the upper left of the graph, where both the sensitivity and specificity equal 1.0.

In conducting the ROC curve analysis on our study group, the minimum T-score identified among participants diagnosed with ADHD was 32 (sensitivity = 1.0). This finding suggests an optimal cutoff score of <32 for ruling out an ADHD diagnosis, as all participants who scored lower than 32 on the ADHD Index had a confirmed negative diagnosis of ADHD. However, given that the lowest score on this index is 31, this cutoff score is limited as it identified only five (1.1% of the entire study group without ADHD) participants with a confirmed negative diagnosis of ADHD (see Table 2). An alternative cutoff score was also identified at T<48, characterized by a lower sensitivity of 0.922. While this cutoff score correctly identified a higher proportion of

Table 2. Cutoff scores for the ADHD index, ADHD symptoms total scale, and inattentive symptoms scale of the cAARS-S:L.

CAARS-S:L Scale	Cutoff Score	Sensitivity (%)	ADHD Dx N (%)	No ADHD DX N (%)
ADHD Index	< 32	100	0 (0%)	5 (1.1%)
	< 48	92.2	8 (7.8%)	143 (31.9%)
ADHD Symptoms	< 44	100	0 (0%)	46 (10.3%)
Total Scale	< 54	95.1	5 (4.9%)	160 (35.7%)
Inattentive	< 54	100	0 (0%)	112 (25.0%)
Symptoms Scale	< 63	95.6	3 (4.4%)	236 (52.7%)

Note. N indicates the number of participants in each group who scored below the cutoff.

the no ADHD Dx group (143 individuals; 31.9% of the no ADHD Dx group), up to 7.8% of individuals diagnosed with ADHD may be considered false negatives as they scored below this threshold (see Table 2).

CAARS-S:L ADHD symptoms total scale T-scores

The ROC curve analysis aimed to determine the lowest T-score on the CAARS-S:L ADHD Symptoms Total Scale associated with an ADHD diagnosis. When comparing the ADHD DX group ($n=102$) to the non-ADHD group ($n=448$), the AUC was 0.767 [95% CI: 0.721, 0.813], indicating an acceptable level of accuracy in the test's ability to discriminate between students with and without an ADHD diagnosis.

In conducting the ROC curve analysis on this sample, the minimum T-score identified among participants diagnosed with ADHD was 44. This finding established an optimal cutoff score of <44 for ruling out an ADHD diagnosis, characterized by a sensitivity of 1.0. At this threshold, all participants diagnosed with ADHD had a T-score value greater than or equal to 44. Consequently, a score below this cutoff reliably excludes ADHD in our sample population, as all participants who scored lower than 44 on the ADHD Symptoms Total Scale had a confirmed negative diagnosis of ADHD. This cutoff score accurately identified 46 participants (10.3%) without ADHD (see Table 2). It is important to note that not all participants without ADHD had a T-score value less than 44; therefore, a T-score above 44 on the ADHD Symptoms Total Scale does not confirm the presence of ADHD.

An alternative cutoff score was also identified, characterized by a sensitivity of 0.951. Our analysis revealed that 5% of participants diagnosed with ADHD received T-scores lower than 54 and 95% of positive cases had T-scores higher than 54. This indicates that a T-score of <54 may also serve as an effective cutoff score for ruling out ADHD (sensitivity = 0.95), correctly identifying 160 patients (35.7%) without ADHD who had scored below this threshold. However, at this score, 5% of individuals diagnosed with ADHD may be considered false negatives as they scored below this threshold (see Table 2).

CAARS-S:L inattentive symptoms T-scores

Of the 102 clinically diagnosed adult ADHD participants, the study sample consisted of $n=68$ adults specifically diagnosed with inattentive ADHD. The ROC curve analysis aimed to determine the lowest T-score on the Inattentive Symptoms subscale of the CAARS-S:L associated with an ADHD inattentive diagnosis. When comparing the inattentive ADHD group ($n=68$) to the non-ADHD group ($n=448$), the AUC was 0.784 [95% CI: .736, .833], indicating an acceptable level of accuracy in the test's ability to discriminate between students with and without an ADHD type inattentive diagnosis.

In conducting the ROC curve analysis on this sample, the minimum T-score identified among participants diagnosed with inattentive ADHD was 54. This finding established an optimal cutoff score of <54 for ruling out an inattentive ADHD diagnosis, characterized by a sensitivity of 1.0. At this threshold, all participants diagnosed with ADHD inattentive type had a T-score value greater than or equal to 54, and all participants who scored lower than 54 on the inattentive symptoms subscale of the CAARS-S:L had a confirmed negative diagnoses of inattentive ADHD. This cutoff score accurately identified 112 participants (25%) without inattentive ADHD (see Table 2). Once again, it is important to note that a T-score above 54 on the inattentive subscale of the CAARS-S:L does not necessarily confirm the presence of ADHD.

An alternative cutoff score, characterized by a sensitivity of 0.956, was also identified. Our analysis revealed that 4.4% of participants diagnosed with inattentive ADHD received T-scores lower than 63 and 95.6% of positive cases had T-scores higher than 63. This indicates that a T-score of <63 on the inattentive subscale of the CAARS-S:L may also serve as an effective cutoff score for ruling out the inattentive presentation of ADHD, correctly identifying 236 participants (52.7%) without inattentive ADHD who had scored below this threshold. However, at this score, 4.4% of individuals diagnosed with inattentive ADHD may be considered false negatives as they scored below this threshold (see Table 2).

Discussion

The purpose of this study was to determine a score on the CAARS-S:L below which no individual diagnosed with ADHD would score, and evaluate whether this score could act as a functional means of ruling out a clinical ADHD diagnosis. All participants had validly completed the CAARS-S:L, and had either a positive or negative diagnosis of ADHD. Individuals were excluded if they were taking stimulant medication at the time of diagnosis as that may alter the severity of their self-reported symptom scores. Furthermore, participants were excluded if they received a previous ADHD diagnosis but no longer met the DSM-5 criteria for a diagnosis. Last, all participants who had failed performance and/or symptom validity tests during their testing period were not included in this study population, as their results may reflect inaccurate self-reported symptom scores. Thus, this study population was specifically chosen to represent the current demographic of untreated, qualifying adults seeking a first-time diagnosis or an updated ADHD assessment.

Our results indicate the lowest entry with any type of diagnosed ADHD had a CAARS-S:L ADHD Symptoms Total Scale T-Score of 44. These findings suggest a cutoff score of <44 on the ADHD Symptoms Total Scale to rule out an ADHD diagnosis with absolute certainty (100% sensitivity). The second cutoff score for the CAARS-S:L ADHD Symptoms Total Scale was established at a higher T-score of <54, offering a lower sensitivity of 95% and consequently, a 5% false negative rate. Contrarily, when analyzing the inattentive symptoms section of the CAARS-S:L, we found the lowest entry with diagnosed inattentive ADHD had a score of 54, suggesting a reliable cutoff score of <54 when ruling out a diagnosis of inattentive ADHD. The second cutoff score, characterized by a lower sensitivity of 95.6%, was established at a T-score of <63 with a 4.4% false negative rate. From our sample population, we found employing a cutoff score of <44 on the ADHD Symptoms Total Scale would save 10% of non-ADHD individuals from undergoing extensive diagnosis assessments. Increasing this threshold to <54 could benefit 36% of non-ADHD individuals. Similarly, using a cutoff score of <54 on the inattentive subscale of the CAARS-S:L would streamline ADHD diagnoses for 25% of individuals without inattentive ADHD, and up to 52.7% with a cutoff score of <63. Utilizing these cutoff scores to rule out an ADHD diagnosis could serve as a preliminary screening tool for general practitioners, aiding in more appropriate referrals. Similarly, integrating these cutoffs at the beginning of multimodal assessments could streamline the diagnostic process, saving time and resources for both specialists and patients by reducing the need for comprehensive evaluations.

When analyzing the ADHD Index, the lowest entry with any type of diagnosed ADHD had a T-score of 32 (100% sensitivity). While this suggests an optimal cutoff score of <32 on the ADHD Index for reliably ruling out an ADHD diagnosis, this cutoff score is merely 1 point higher than the minimum possible T-score on the ADHD Index (T-score = 31) and only accurately screens 1.1% of the entire population without ADHD. An alternative cutoff of <48 on the ADHD Index was also identified, expanding the screening capability to 31.9% of the population without an ADHD diagnosis. However, this threshold has a 7.8% false negative rate, potentially undermining the reliability of this cutoff. In general, adjusting a threshold to have a higher specificity, meaning a higher proportion of true negatives is correctly identified by the cutoff, typically reduces the sensitivity of the test (meaning fewer true positives are detected). By contrast, requiring higher sensitivity will typically result in lower specificity. In the context of determining cutoff scores necessary to rule out an ADHD diagnosis on the CAARS-S:L, prioritizing high sensitivity is preferred to minimize the number of false negatives, ensuring individuals who genuinely have ADHD are not misdiagnosed as not having it. However, a high sensitivity accompanied by a very low specificity, where a small number of true negatives are correctly identified, might render the threshold clinically useless as it would fail to accurately exclude those without the condition. Thus, given the poor screening ability of the ADHD Index at the 100% sensitivity cutoff (<32), and the fact that the alternative cutoff of T < 48 still misses 7.8% of those diagnosed with ADHD, we conclude that both thresholds lack clinical significance.

The abnormally low T-scores associated with a small number of ADHD-diagnosed students in our sample could stem from a tendency for adults with ADHD to minimize and under-report symptoms and impairments (Manor et al., 2012; Rietz et al., 2016; Sibley, 2021). Individuals with genuine ADHD often struggle with self-reflection, self-awareness, and self-evaluation, problems attributed to frontal lobe impairments (Leisman & Melillo, 2022; Mörstedt et al., 2015). This may diminish their ability to accurately observe and assess their symptoms. Self-reporting difficulties may also arise from a combination of self-protection mechanisms and a blame-avoidant mental set, where individuals downplay or omit symptoms to shield themselves from perceived judgment or criticism (Hoza et al., 2012; Sibley, 2021; Sibley et al., 2019). Moreover, given the developmental trajectory of ADHD, in which hyperactivity/impulsivity symptoms reduce and mainly inattentive symptoms persist as individuals enter adulthood (Biederman et al., 2000; Larsson et al., 2011), adults completing self-report measures for ADHD may compare their current symptoms to their past experiences, rather than against a general population standard. This internal comparison could further influence the accuracy of their self-assessments. Considering the reduced reliability of self-reported ADHD symptoms, our results support the need for a multi-method multi-informant assessment when confirming an ADHD diagnosis.

The cutoff scores for the ADHD index being significantly lower than the total symptoms and inattentive symptoms subscale may be attributed to the ADHD index's total score giving equal weighting to the first four subsections of the CAARS: inattention/memory problems, hyperactivity/restlessness, impulsivity/emotional lability, and problems with self-concept. This means if you were to take the CAARS-S:L and score high on only the inattention/memory problems section, you could meet diagnostic criteria for ADHD-primarily inattentive type but produce a low overall ADHD index score due to low hyperactivity, impulsivity, and self-concept scores. Thus, a low ADHD index score may not necessarily indicate the lack of ADHD, but a lack of symptoms in other areas. As noted above, this discrepancy could also be indicative of individual cases of underreporting, where some individuals with ADHD may be oblivious to their own problems and so underreport symptoms. Contrarily, the total symptoms subscale was likely a better predictor of ADHD as it evaluates only DSM-classified inattentive and hyperactive symptoms. However, this scale still under identifies a lot of the non-ADHD students in our sample. Furthermore, the inattentive symptoms subscale of the CAARS-S:L was specifically measured because the inattentive presentation of ADHD is the most prevalent in adults, with studies suggesting that inattentive symptoms were endorsed in up to 90% of adults with ADHD (Targum & Adler, 2014; Wilens et al., 2009). As the inattentive symptoms subscale of the CAARS-S:L focuses specifically on inattentive symptoms related to ADHD, it may serve as a better screening tool for adults concerned explicitly with inattention symptoms. This is particularly relevant because, when screening or evaluating adults for ADHD, the main concern often lies with the inattentive subtype/symptoms.

For both the ADHD Symptoms Total Scale and the inattentive subscale, the 95% sensitivity cutoff, which has a higher T-score threshold compared to the 100% sensitivity cutoff, may be more effective in ruling out ADHD in additional cases that might otherwise go unrecognized. However, this cutoff carries the risk of potentially misclassifying a small number of individuals who, despite having low T-scores values, may still be diagnosed with ADHD. Usage of the 100% sensitivity cutoff score may be employed in scenarios where a missed ADHD diagnosis would have significant consequences. For example, in educational settings, undiagnosed ADHD can lead to severe academic underperformance and future occupational difficulties during adulthood due to a lack of accommodations (Español-Martín et al., 2023). Considering that at least 25% of college students with disabilities are diagnosed with ADHD (Green & Rabiner, 2012), psychology clinics and assessment centers in postsecondary institutions may prefer the 100% sensitivity cutoff during the initial screening process to avoid premature termination of the evaluation. However, in many settings, overdiagnosis of ADHD may be a major concern. For instance, a systematic scoping review by Kazda et al. (2021), which investigated 334 published studies in children and adolescents, concluded that ADHD overdiagnosis is a frequent occurrence. The review also found that in individuals with milder symptoms, the harms associated with an ADHD diagnosis may outweigh the benefits. As such, the 95% sensitivity cutoff may be preferred in situations where the primary concern is to minimize the risk of over diagnosing ADHD, such as in general population screenings or when evaluating individuals where ADHD is one of several potential diagnoses being considered (Anbarasan et al., 2020).

With the exponential rise in the global prevalence of ADHD in postsecondary students, the study aimed to contribute to developing appropriate ways to rule out the presence of ADHD in a clinical evaluation. In recent years, there has been a notable increase in the number of adults seeking an ADHD evaluation. This, in turn, may lead to significant delays and assessment backlogs for healthcare providers, many of whom may be unfamiliar with how best to diagnose adult ADHD while ruling out other potential ADHD-mimics (e.g., Adler et al., 2009). While the majority of current research on ADHD screening tools focuses on their ability to predict an ADHD diagnosis, recent research underscores the fact that high scores on ADHD screening measures have a high false positive rate (Harrison & Edwards, 2023). Thus, a high score alone is insufficient to confirm this diagnosis. However, to our knowledge, no study to date has identified the lowest scores that can be obtained on such screening measures to help rule out the presence of ADHD. Given the high cost and time commitment associated with a full-length ADHD assessment and the current concern with ADHD overdiagnosis, the cutoff scores in this present study provide valuable insights on methods to rule out an ADHD diagnosis, thereby addressing the existing gap in research on these screening tools. It also provides valuable insights into the nature of the CAARS ADHD Index, questioning the validity of this subscale given its poor clinical utility in both predicting an ADHD diagnosis (Harrison & Edwards, 2023) and ruling it out.

Our study did have limitations. To begin with, while the self-report version of the CAARS:S-L has advantages in its time and cost efficiency, experts in psychology suggest that self-report data should not be used alone as it tends to be prone to response bias (Rosenman et al., 2011). Given that our population consists exclusively of postsecondary students, there may be an incentive for students to feign or exaggerate ADHD symptoms in hopes of obtaining academic accommodations or stimulant medication (Benson et al., 2015; Harrison et al., 2007; Johnson & Suhr, 2021). By excluding all students who had failed both a CAARS-specific SVT and at least one PVT, we significantly reduced the likelihood of these factors impacting the outcomes of the present study. Given, however, that our focus was on the minimal score necessary for an ADHD diagnosis, it is unlikely that such feigners would underreport their symptoms on the CAARS-S:L, thus minimizing the impact of potentially overlooked feigners. Furthermore, other ADHD screening tools, like the ASRS screener and the CAARS observer forms, were not investigated in the current study. Future research should investigate differences between self and collateral symptom reporting to better understand the reasons for low self-reports in those diagnosed with ADHD. Additionally, the hyperactivity symptoms subscale of the CAARS was also not investigated in the current study due to the small population diagnosed with the mainly hyperactive form of ADHD; appropriate cut-scores for this subscale should be investigated. Last, given the retrospective nature of this study, the participants were diagnosed by different psychologists over various periods, potentially resulting in inconsistencies in assessment methods, procedures, and ultimately, in the diagnoses themselves. This variability extends to the diagnostic criteria used, as both the DSM-IV and DSM-5 were employed due to the timespan covered by this study (2007 to 2023). However, all participants in this study completed the CAARS-S:L, which was the only screening tool analyzed, and all diagnoses were based on current DSM standards at the time, conducted by certified psychologists adhering to the gold standard of a multi-method, multi-informant assessment approach.

In summary, in a sample of postsecondary students who had completed the CAARS-S:L, no individual diagnosed with ADHD scored below a value of 44 on the ADHD Symptoms Total Scale. Additionally, no individual diagnosed with inattentive ADHD scored below 54 on the inattentive symptoms subscale. To our knowledge, this is the first study demonstrating a cutoff score of <44 on the ADHD Symptoms Total Scale that can reliably rule out the presence of ADHD, and a cutoff score of <54 on the ADHD inattentive subscale that can reliably rule out the presence of the ADHD inattentive subtype. Utilization of these cutoff scores could streamline investigations in those without the disorder, saving the extensive costs, time, and resources typically spent on complete diagnostic assessments. Alternative cutoff scores of <54 (ADHD Symptoms Total Scale) and <63 (inattentive symptoms subscale) were also identified; however, their clinically applicability may be limited as both were shown to misclassify ADHD diagnoses in up to approximately 5% of the study population. Similarly, the ADHD index was found to be a poor predictor of a negative ADHD diagnosis, and thus, no clinically significant cutoffs are suggested. Ultimately, further validation of the cutoff scores with a prospective study should be pursued.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The author(s) reported there is no funding associated with the work featured in this article.

ORCID

Dylan Kwan http://orcid.org/0009-0008-8051-1156
Nathaniel Davin http://orcid.org/0000-0002-2687-4617
Allyson G. Harrison http://orcid.org/0000-0002-0426-2011

References

Adler, L. A., Faraone, S. V., Spencer, T. J., Michelson, D., Reimherr, F. W., Glatt, S. J., Marchant, B. K., & Biederman, J. (2008). The reliability and validity of self- and investigator ratings of ADHD in adults. *Journal of Attention Disorders*, *11*(6), 711–719. https://doi.org/10.1177/1087054707308503

Adler, L., Shaw, D., Sitt, D., Maya, E., & Morrill, M. I. (2009). Issues in the Diagnosis and Treatment of Adult ADHD by Primary Care Physicians. *Primary Psychiatry*, *16*(5), 57–63.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders*. (4th ed., Text Revision). American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. (5th ed). American Psychiatric Association.

Anbarasan, D., Kitchin, M., & Adler, L. A. (2020). Screening for Adult ADHD. *Current Psychiatry Reports*, *22*(12), 72. https://doi.org/10.1007/s11920-020-01194-9

Bayridge Counselling. (2022). *Psycho-Educational Assessment*. https://www.bayridgecounsellingcentres.ca/online-counselling/psycho-educational-assessment/

Belkin, D., Levitz, J., & Korn, M. (2019). Many more students, especially the affluent, get extra time to take the SAT. *Wall Street Journal*, May 21. https://www.wsj.com/articles/many-more-students-especially-the-affluent-get-extra-time-to-take-the-sat-11558450347

Benson, K., Flory, K., Humphreys, K. L., & Lee, S. S. (2015). Misuse of stimulant medication among college students: a comprehensive review and meta-analysis. *Clinical Child and Family Psychology Review*, *18*(1), 50–76. https://doi.org/10.1007/s10567-014-0177-z

Biederman, J., Mick, E., & Faraone, S. V. (2000). Age-dependent decline of symptoms of attention deficit hyperactivity disorder: impact of remission definition and symptom type. *The American Journal of Psychiatry*, *157*(5), 816–818. https://doi.org/10.1176/appi.ajp.157.5.816

Butt, D. A., Jaakkimainen, L., & Tu, K. (2023). Prevalence and Incidence Trends of Attention Deficit/Hyperactivity Disorder in Children and Youth Aged 1-24 Years in Ontario, Canada: A Validation Study of Health Administrative Data Algorithms. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie*, Advance online publication. https://doi.org/10.1177/07067437231213553

Cerasa, A., Craig, F., Foti, F., Palermo, L., & Costabile, A. (2022). The impact of COVID-19 on psychologists' practice: An Italian experience. *Journal of Affective Disorders Reports*, *7*, 100309. https://doi.org/10.1016/j.jadr.2022.100309

Chamberlain, S. R., Cortese, S., & Grant, J. E. (2021). Screening for adult ADHD using brief rating tools: What can we conclude from a positive screen? Some caveats. *Comprehensive Psychiatry*, *106*, 152224. https://doi.org/10.1016/j.comppsych.2021.152224

Conners, C. K., Erhardt, D., & Sparrow, E. (1998a). *Conners' Adult ADHD Rating Scales (CAARS): ADHD across the life span*. Multi-Health Systems.

Conners, C. K., Erhardt, D., & Sparrow, E. (1998b). *Conners' Adult ADHD Rating Scales (CAARS)—Technical manual*. Multi-Health Systems.

Cook, C. M., Bolinger, E., & Suhr, J. (2016). Further Validation of the Conner's Adult Attention Deficit/Hyperactivity Rating Scale Infrequency Index (CII) for Detection of Non-Credible Report of Attention Deficit/Hyperactivity Disorder Symptoms. *Archives of Clinical Neuropsychology : The Official Journal of the National Academy of Neuropsychologists*, *31*(4), 358–364. https://doi.org/10.1093/arclin/acw01527193367

Cueli, M., Rodríguez, C., Cañamero, L. M., Núñez, J. C., & González-Castro, P. (2020). Self-concept and inattention or hyperactivity-impulsivity symptomatology: The role of anxiety. *Brain Sciences*, *10*(4), 250–263. https://doi.org/10.3390/brainsci10040250

DuPaul, G. J., Schaughency, E. A., Weyandt, L. L., Tripp, G., Kiesner, J., Ota, K., & Stanish, H. (2001). Self-report of ADHD symptoms in university students: cross-gender and cross-national prevalence. *Journal of Learning Disabilities*, *34*(4), 370–379. 10.1177/002221940103400412155O3581

Español-Martín, G., Pagerols, M., Prat, R., Rivas, C., Ramos-Quiroga, J. A., Casas, M., & Bosch, R. (2023). The impact of attention-deficit/hyperactivity disorder and specific learning disorders on academic performance in Spanish children from a low-middle- and a high-income population. *Frontiers in Psychiatry*, *14*, 1136994. https://doi.org/10.3389/fpsyt.2023.1136994

Ferguson, E. (2022). Parents looking to fundraise for educational assessments to address backlog. *Calgary Herald*, June 26. https://calgaryherald.com/news/local-news/parents-looking-to-fundraise-for-educational-assessments-to-address-backlog

Frazier, T.,W., Frazier, A. R., Busch, R.,M., Kerwood, M. A., & Demaree, H. A. (2008). Detection of simulated ADHD and reading disorder using symptom validity measures. *Archives of Clinical Neuropsychology: The Official Journal of the National Academy of Neuropsychologists*, *23*(5), 501–509. https://doi.org/10.1016/j.acn.2008.04.001

Gallagher, R., & Blader, J. (2001). The diagnosis and neuropsychological assessment of adult attention deficit/hyperactivity disorder. Scientific study and practical guidelines. *Annals of the New York Academy of Sciences*, *931*(1), 148–171. https://doi.org/10.1111/j.1749-6632.2001.tb05778.x

Green, A. L., & Rabiner, D. L. (2012). What do we really know about ADHD in college students? *Neurotherapeutics: The Journal of the American Society for Experimental NeuroTherapeutics*, *9*(3), 559–568. https://doi.org/10.1007/s13311-012-0127-8

Green, P. (2003). *Word memory test for windows: User's manual and program*. Green's Publishing.

Green, P. (2004). *Green's Medical Symptom Validity Test (MSVT) for Microsoft Windows*. User's manual. Green's Publishing.

Greenberg, L. M., Kindschi, C. L., Dupuy, T. R., & Hughes, S. J. (2007). *T.O.V.A. clinical manual: Test of Variables of Attention continuous performance test*. The TOVA Company.

Greiffenstein, M. F., Baker, W. J., & Gola, T. (1994). Validation of malingered amnesia measures with a large clinical sample. *Psychological Assessment*, *6*(3), 218–224. https://doi.org/10.1037/1040-3590.6.3.218

Handler, M. W., & DuPaul, G. J. (2005). Assessment of ADHD: Differences across psychology specialty areas. *Journal of Attention Disorders*, *9*(2), 402–412. https://doi.org/10.1177/1087054705278762

Harrison, A. G., Harrison, K. A., & Armstrong, I. T. (2022). Discriminating malingered Attention Deficit Hyperactivity Disorder from genuine symptom reporting using novel Personality Assessment Inventory validity measures. *Applied Neuropsychology. Adult*, *29*(1), 10–22. https://doi.org/10.1080/23279095.2019.1702043

Harrison, A. G., Rosenblum, Y., & Currie, S. (2010). Examining unusual digit span performance in a population of postsecondary students assessed for academic difficulties. *Assessment*, *17*(3), 283–293. https://doi.org/10.1177/1073191109348590

Harrison, A. G., & Armstrong, I. T. (2016). Development of a symptom validity index to assist in identifying ADHD symptom exaggeration or feigning. *The Clinical Neuropsychologist*, *30*(2), 265–283. https://doi.org/10.1080/13854046.2016.1154188

Harrison, A. G., & Edwards, M. J. (2023). The ability of self-report methods to accurately diagnose attention deficit hyperactivity disorder: A systematic review. *Journal of Attention Disorders*, *27*(12), 1343–1359. https://doi.org/10.1177/10870547231177470

Harrison, A. G., Edwards, M. J., & Parker, K. C. (2007). Identifying students faking ADHD: Preliminary findings and strategies for detection. *Archives of Clinical Neuropsychology: The Official Journal of the National Academy of Neuropsychologists*, *22*(5), 577–588. https://doi.org/10.1016/j.acn.2007.03.008

Harrison, A. G., Nay, S., & Armstrong, I. T. (2019). Diagnostic Accuracy of the Conners' adult ADHD rating scale in a postsecondary population. *Journal of Attention Disorders*, *23*(14), 1829–1837. https://doi.org/10.1177/1087054715625299

Hoza, B., Vaughn, A., Waschbusch, D. A., Murray-Close, D., & McCabe, G. (2012). Can children with ADHD be motivated to reduce bias in self-reports of competence? *Journal of Consulting and Clinical Psychology*, *80*(2), 245–254. https://doi.org/10.1037/a0027299

Johnson, E. E. H., & Suhr, J. (2021). Self-reported functional impairment in college students: relationship to noncredible reporting, ADHD, psychological disorders, and other psychological factors. *Journal of Clinical and Experimental Neuropsychology*, *43*(4), 399–411. https://doi.org/10.1080/13803395.2021.1935490

Joy, J. A., Julius, R. J., Akter, R., & Baron, D. A. (2010). Assessment of ADHD documentation from candidates requesting Americans With Disabilities Act (ADA) accommodations for the National Board of Osteopathic Medical Examiners COMLEX exam. *Journal of Attention Disorders*, *14*(2), 104–108. https://doi.org/10.1177/1087054710365056

Kazda, L., Bell, K., Thomas, R., McGeechan, K., Sims, R., & Barratt, A. (2021). Overdiagnosis of attention-deficit/hyperactivity disorder in children and adolescents. *JAMA Network Open*, *4*(4), e215335. https://doi.org/10.1001/jamanetworkopen.2021.5335

Kessler, R. C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M. J., Jin, R., Secnik, K., Spencer, T., Ustun, T. B., & Walters, E. E. (2005). The world health organization adult ADHD Self-Report Scale (ASRS): a short screening scale for use in the general population. *Psychological Medicine*, *35*(2), 245–256. https://doi.org/10.1017/S0033291704002892

Kolar, D., Keller, A., Golfinopoulos, M., Cumyn, L., Syer, C., & Hechtman, L. (2008). Treatment of adults with attention-deficit/hyperactivity disorder. *Neuropsychiatric Disease and Treatment*, *4*(1), 107–121. https://doi.org/10.2147/ndt.s1747

Larsson, H., Dilshad, R., Lichtenstein, P., & Barker, E. D. (2011). Developmental trajectories of DSM-IV symptoms of attention-deficit/hyperactivity disorder: genetic effects, family risk and associated psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, *52*(9), 954–963. https://doi.org/10.1111/j.1469-7610.2011.02379.x

Leark, R., Greenberg, L., Kindschi, C., Dupuy, T., & Hughes, S. (2008). *T.O.V.A. professional manual*. The TOVA Company.

Leisman, G., & Melillo, R. (2022). Front and center: Maturational dysregulation of frontal lobe functional neuroanatomic connections in attention deficit hyperactivity disorder. *Frontiers in Neuroanatomy*, *16*, 936025. https://doi.org/10.3389/fnana.2022.936025

Mak, A. D., Lee, S., Sampson, N. A., Albor, Y., Alonso, J., Auerbach, R. P., Baumeister, H., Benjet, C., Bruffaerts, R., Cuijpers, P., Ebert, D. D., Gutierrez-Garcia, R. A., Hasking, P., Lapsley, C., Lochner, C., & Kessler, R. C. (2021). ADHD comorbidity structure and impairment: Results of the WHO world mental health surveys international college student project (WMH-ICS). *Journal of Attention Disorders*, *26*(8), 1078–1096. https://doi.org/10.1177/10870547211057275

Manor, I., Vurembrandt, N., Rozen, S., Gevah, D., Weizman, A., & Zalsman, G. (2012). Low self-awareness of ADHD in adults using a self-report screening questionnaire. *European Psychiatry: The Journal of the Association of European Psychiatrists*, *27*(5), 314–320. https://doi.org/10.1016/j.eurpsy.2010.08.013

Marshall, P., Hoelzle, J., & Nikolas, M. (2021). Diagnosing Attention-Deficit/Hyperactivity Disorder (ADHD) in young adults: A qualitative review of the utility of assessment measures and recommendations for improving the diagnostic process. *The Clinical Neuropsychologist*, *35*(1), 165–198. https://doi.org/10.1080/13854046.2019.1696409

Matte, B., Rohde, L. A., & Grevet, E. H. (2012). ADHD in adults: A concept in evolution. *ADHD Attention Deficit and Hyperactivity Disorders*, *4*(2), 53–62. https://doi.org/10.1007/s12402-012-0077-3

McCann, B. S., & Roy-Byrne, P. (2004). Screening and diagnostic utility of self-report attention deficit hyperactivity disorder scales in adults. *Comprehensive Psychiatry*, *45*(3), 175–183. https://doi.org/10.1016/j.comppsych.2004.02.006

Morey, Leslie C., Defensiveness and Malingering Indices for the PAI, Paper presented at the meetings of the American Psychological Association, Toronto, Ontario, Canada, 1993, August

Morey, Leslie C., An interpretive guide to the Personality Assessment Inventory, Psychological Assessment Resources, Odessa, Fl, 1996

Morey, L. C. (1991). *The Personality Assessment Inventory: Professional manual*. Psychological Assessment Resources.

Mörstedt, B., Corbisiero, S., Bitto, H., & Stieglitz, R. D. (2015). Attention-Deficit/Hyperactivity Disorder (ADHD) in Adulthood: Concordance and Differences between Self- and Informant Perspectives on Symptoms and Functional Impairment. *PloS One*, *10*(11), e0141342. https://doi.org/10.1371/journal.pone.0141342

Mulraney, M., Arrondo, G., Musullulu, H., Iturmendi-Sabater, I., Cortese, S., Westwood, S. J., Donno, F., Banaschewski, T., Simonoff, E., Zuddas, A., Döpfner, M., Hinshaw, S. P., & Coghill, D. (2022). Systematic review and meta-analysis: Screening tools for attention-deficit/hyperactivity disorder in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, *61*(8), 982–996. https://doi.org/10.1016/j.jaac.2021.11.031

Musso, M. W., Hill, B. D., Barker, A. A., Pella, R. D., & Gouvier, W. D. (2016). Utility of the Personality Assessment Inventory for detecting malingered ADHD in college students. *Journal of Attention Disorders*, *20*(9), 763–774. https://doi.org/10.1177/1087054714548031

Nahm, F. S. (2022). Receiver operating characteristic curve: overview and practical use for clinicians. *Korean Journal of Anesthesiology*, *75*(1), 25–36. https://doi.org/10.4097/kja.21209

Nelson, J. M., Whipple, B., Lindstrom, W., & Foels, P. A. (2014). How Is ADHD assessed and documented? examination of psychological reports submitted to determine eligibility for postsecondary disability. *Journal of Attention Disorders*, *23*(14), 1780–1791. https://doi.org/10.1177/1087054714561860

Nugent, K., & Smart, W. (2014). Attention-deficit/hyperactivity disorder in postsecondary students. *Neuropsychiatric Disease and Treatment*, *10*, 1781–1791. https://doi.org/10.2147/NDT.S64136

Odland, A. P., Lammy, A. B., Martin, P. K., Grote, C. L., & Mittenberg, W. (2015). Advanced Administration and Interpretation of Multiple Validity Tests. *Psychological Injury and Law*, *8*(1), 46–63. 10.1007/s12207-015-9216-4

On, A. K., Hwang, K. S., Jang, S. H., Lee, H. J., Soh, M. J., Yang, C. M., & Lee, S. Y. (2020). Detection of malingering using Wechsler Adult Intelligence Scale-IV for psychiatric patients. *Psychiatry Investigation*, *17*(6), 526–532. https://doi.org/10.30773/pi.2019.0330

Queen's University. (2023). *RARC assessments*. Retrieved July 17, 2023: https://www.queensu.ca/rarc/assessments/rarc

Rietz, E., Cheung, C., McLoughlin, G., Brandeis, D., Banaschewski, T., Asherson, P., & Kuntsi, J. (2016). Self-report of ADHD shows limited agreement with objective markers of persistence and remittance. *Journal of Psychiatric Research*, *82*, 91–99. https://doi.org/10.1016/j.jpsychires.2016.07.020

Rogers, R., Sewell, K. W., Morey, L. C., & Ustad, K. L. (1996). Detection of feigned mental disorders on the Personality Assessment Inventory: A discriminant analysis. *Journal of Personality Assessment*, *67*(3), 629–640. https://doi.org/10.1207/s15327752jpa6703_15

Rosenman, R., Tennekoon, V., & Hill, L. G. (2011). Measuring bias in self-reported data. *International Journal of Behavioural & Healthcare Research*, *2*(4), 320–332. https://doi.org/10.1504/IJBHR.2011.043414

Rowland, A. S., Skipper, B. J., Umbach, D. M., Rabiner, D. L., Campbell, R. A., Naftel, A. J., & Sandler, D. P. (2015). The prevalence of ADHD in a population-based sample. *Journal of Attention Disorders*, *19*(9), 741–754. https://doi.org/10.1177/1087054713513799

Salari, N., Ghasemi, H., Abdoli, N., Rahmani, A., Shiri, M. H., Hashemian, A. H., Akbari, H., & Mohammadi, M. (2023). The global prevalence of ADHD in children and adolescents: a systematic review and meta-analysis. *Italian Journal of Pediatrics*, *49*(1), 48. https://doi.org/10.1186/s13052-023-01456-1

Schroeder, R. W., Twumasi-Ankrah, P., Baade, L. E., & Marshall, P. S. (2012). Reliable Digit Span: a systematic review and cross-validation study. *Assessment*, *19*(1), 21–30. 10.1177/107319111142876422156721

Sibley, M. H., Campez, M., & Raiker, J. S. (2019). Reexamining ADHD-Related Self-Reporting Problems Using Polynomial Regression. *Assessment*, *26*(2), 305–314. https://doi.org/10.1177/1073191117693349

Sibley, M. H. (2021). Empirically-informed guidelines for first-time adult ADHD diagnosis. *Journal of Clinical and Experimental Neuropsychology*, *43*(4), 340–351. https://doi.org/10.1080/13803395.2021.1923665

Sibley, M. (2023). More adults than ever have been seeking ADHD medications – an ADHD expert explains what could be driving the trend. *The Conversation*, August 5. https://theconversation.com/more-adults-than-ever-have-been-seeking-adhd-medications-an-adhd-expert-explains-what-could-be-driving-the-trend-206052

Slick, D. J., Hopp, G., Strauss, E., & Thompson, G. B. (1997). *Manual for the Victoria Symptom Validity Test*. Psychological Assessment Resources.

Song, P., Zha, M., Yang, Q., Zhang, Y., Li, X., & Rudan, I. (2021). The prevalence of adult attention-deficit hyperactivity disorder: A global systematic review and meta-analysis. *Journal of Global Health*, *11*, 04009. https://doi.org/10.7189/jogh.11.04009

Suhr, J. A., Buelow, M., & Riddle, T. (2011). Development of an infrequency index for the CAARS. *Journal of Psychoeducational Assessment*, *29*(2), 160–170. https://doi.org/10.1177/0734282910380190

Targum, S. D., & Adler, L. A. (2014). Our current understanding of adult ADHD. *Innovations in Clinical Neuroscience*, *11*(11-12), 30–35.

Taylor, A., Deb, S., & Unwin, G. (2011). Scales for the identification of adults with attention deficit hyperactivity disorder (ADHD): a systematic review. *Research in Developmental Disabilities*, *32*(3), 924–938. https://doi.org/10.1016/j.ridd.2010.12.036

Tombaugh, T. N. (1996). *TOMM: Test of memory malingering*. Multi-Health Systems.

Thomas, R., Sanders, S., Doust, J., Beller, E., & Glasziou, P. (2015). Prevalence of attention-deficit/hyperactivity disorder: a systematic review and meta-analysis. *Pediatrics*, *135*(4), e994–e1001. https://doi.org/10.1542/peds.2014-3482

Vasiliadis, H.-M., Diallo, F. B., Rochette, L., Smith, M., Langille, D., Lin, E., Kisely, S., Fombonne, E., Thompson, A. H., Renaud, J., & Lesage, A. (2017). Temporal trends in the prevalence and incidence of diagnosed ADHD in children and young adults between 1999 and 2012 in Canada: A data linkage study. *Canadian Journal of Psychiatry. Revue Canadienne de Psychiatrie*, *62*(12), 818–826. https://doi.org/10.1177/0706743717714468

Wechsler, David, Wechsler Adult Intelligence Scale: WAIS-IV; Technical and Interpretive Manual. United Kingdom, Pearson, United Kingdom, 2008

Wilens, T. E., Biederman, J., Faraone, S. V., Martelon, M., Westerberg, D., & Spencer, T. J. (2009). Presenting ADHD symptoms, subtypes, and comorbid disorders in clinically referred adults with ADHD. *The Journal of Clinical Psychiatry*, *70*(11), 1557–1562. https://doi.org/10.4088/JCP.08m04785pur

Xu, G., Strathearn, L., Liu, B., Yang, B., & Bao, W. (2018). Twenty-year trends in diagnosed Attention-Deficit/Hyperactivity Disorder among US children and adolescents, 1997-2016. *JAMA Network Open*, *1*(4), e181471–e181471. https://doi.org/10.1001/jamanetworkopen.2018.1471

Zhu, Y., Liu, W., Li, Y., Wang, X., & Winterstein, A. G. (2018). Prevalence of ADHD in publicly insured adults. *Journal of Attention Disorders*, *22*(2), 182–190. https://doi.org/10.1177/1087054717698815