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Research Article

Internalizing and somatic symptoms influence the discrepancy between subjective and objective cognitive difficulties in adults with ADHD who have valid and invalid test scores

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Abstract

Objectives: This study investigated the relationship between various intrapersonal factors and the discrepancy between subjective and objective cognitive difficulties in adults with attention-deficit hyperactivity disorder (ADHD). The first aim was to examine these associations in patients with valid cognitive symptom reporting. The next aim was to investigate the same associations in patients with invalid scores on tests of cognitive symptom overreporting. **Method:** The sample comprised 154 adults who underwent a neuropsychological evaluation for ADHD. Patients were divided into groups based on whether they had valid cognitive symptom reporting and valid test performance ($n = 117$) or invalid cognitive symptom overreporting but valid test performance ($n = 37$). Scores from multiple symptom and performance validity tests were used to group patients. Using patients' scores from a cognitive concerns self-report measure and composite index of objective performance tests, we created a subjective-objective discrepancy index to quantify the extent of cognitive concerns that exceeded difficulties on objective testing. Various measures were used to assess intrapersonal factors thought to influence the subjective-objective cognitive discrepancy, including demographics, estimated premorbid intellectual ability, internalizing symptoms, somatic symptoms, and perceived social support. **Results:** Patients reported greater cognitive difficulties on subjective measures than observed on objective testing. The discrepancy between subjective and objective scores was most strongly associated with internalizing and somatic symptoms. These associations were observed in both validity groups. **Conclusions:** Subjective cognitive concerns may be more indicative of the extent of internalizing and somatic symptoms than actual cognitive impairment in adults with ADHD, regardless if they have valid scores on cognitive symptom overreporting tests.

Keywords: ADHD; subjective cognitive impairment; cognitive complaints; symptom validity testing; overreporting; neuropsychology

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Introduction

ADHD and the subjective-objective cognitive discrepancy

Attention-deficit hyperactivity disorder (ADHD) is associated with attention, working memory, and executive functioning difficulties (Mahone & Denckla, 2017; Schoechlin & Engel, 2005). These difficulties can persist into adulthood and be assessed using both self-report and objective performance measures (APA, 2013). However, adults with ADHD often endorse a greater number of cognitive symptoms on self-report measures than are observed with objective testing (Baggio et al., 2020; Fuermaier et al., 2015; Magnante et al., 2024). Although this discrepancy has been demonstrated across many clinical populations (Finley et al., 2023a; Groenman et al., 2022), it is a commonly described phenomenon in ADHD that has resulted in longstanding debate regarding evaluation protocols and theoretical underpinnings of ADHD (Barkley, 2019). In cases in which patients endorse cognitive concerns but perform within normal limits on objective testing, several factors may be contributing.

Correlates of the subjective-objective cognitive discrepancy

Prior research suggests that objective measures may be less sensitive to cognitive difficulties that occur in daily activities for adults with ADHD than subjective measures (Barkley & Murphy, 2011; Pinto et al., 2023). Studies have also found that patients with co-occurring internalizing symptoms of depression and anxiety are more likely to overestimate their cognitive difficulties (Groenman et al., 2022). Pain and fatigue symptoms, which are commonly reported in adults with ADHD, may further contribute to this subjective-objective cognitive discrepancy (Finley et al., 2023a; Hughes et al., 2019; Instanes et al., 2018). Internalizing and somatic symptoms may lead patients to appraise and cope with cognitive

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symptoms or normal cognitive lapses more negatively and maladaptively (Hill et al., 2016).

Much of the existing literature has explored the relationship between perceived cognitive difficulties and present emotional states; but there is evidence that longstanding, trait-like factors may also exacerbate the subjective-objective discrepancy in adults with ADHD. It has been found that perceived cognitive difficulties are associated with personality traits – namely, neuroticism – even when controlling for depression (Sutin et al., 2020); but this has never been studied in ADHD populations. Recent studies have also found that patients who report limited social and emotional support in adulthood and childhood are more likely to overreport cognitive symptoms (Costa-Cordella et al., 2021; Gonzalez et al., 2024). However, the association between perceived poor social support, personality traits, and cognitive concerns remains understudied in ADHD populations.

Demographics, including age, sex, educational level, and race, are proxies for social health determinants and have also been associated with the discrepancy between subjective-objective cognitive symptoms (Jang et al., 2022; Tomita et al., 2014), though findings are mixed (Benito-Lein et al., 2010; Mendes et al., 2008). It is possible certain demographics may be associated with the subjective-objective discrepancy in ADHD, but this has never been studied. Furthermore, most extant research has exclusively investigated the association between demographic factors and cognitive concerns in older adults.

Symptom validity and the subjective-objective discrepancy

The relationship between cognitive concerns and certain intrapersonal factors (e.g., depression, fatigue, pain, perceived social support, and demographics) are rendered uninterpretable when patients endorse an improbable amount or type of cognitive symptoms on symptom validity tests (SVTs; Larrabee, 2012). Certain SVTs are designed to exclusively index overreporting of cognitive symptoms, and scoring above the cutoff on these SVTs may indicate that the reported concerns are "invalid" and uninterpretable (Sweet et al., 2021). Historically, it has been presumed that individuals with invalid symptom reporting also have invalid objective cognitive performance. However, researchers have since discovered that adults with ADHD who have invalid cognitive symptom reporting often demonstrate valid cognitive test performance (Ovsiew et al., 2023; White et al., 2022). For instance, Ovsiew et al. (2023) found that 22% of patients referred for ADHD evaluations had both invalid scores on cognitive symptom overreporting SVTs and valid test performance, while only 6% of referrals had both invalid SVTs and invalid performance validity tests (PVTs). The discrepancy between SVTs and PVTs in this context is not well understood. Some researchers have suggested this discrepancy emerges when patients inaccurately believe they have ADHD and thus are inclined to overreport symptoms exclusively on self-report measures (Boone, 2009; Sagar et al., 2017). Suhr and Wei (2017) proposed that the high rate of overreporting in ADHD may be influenced by attentional and/or motivational biases or distorted perceptions of everyday cognitive lapses. Others have opined that individuals may purposefully feign symptoms on select measures (Fuermaier et al., 2015; Jasinski et al., 2011; Ramachandran et al., 2023) and that such individuals may be more likely to exaggerate on self-report measures because they ostensibly and overtly assess ADHD symptoms.

Summary and implications of the literature

There are many potential factors that influence individuals with ADHD to exhibit invalid scores on overreporting SVTs but valid scores on PVTs. In some cases, it is possible that such reasons are fully explained by one's strategy or level of sophistication when feigning symptoms. However, the frequently observed subjective-objective discrepancy in ADHD populations raises the concern that factors contributing to the heightened cognitive concerns in patients with valid ratings also influence overreporting in patients with invalid ratings; this is particularly relevant if such individuals also exhibit valid cognitive performance. Identifying factors contributing to the objective-subjective discrepancy in both patients with valid and invalid ratings has several clinical implications. First, it can improve our overall understanding of why adults with ADHD commonly endorse greater cognitive impairment than is observed on objective testing. Second, it may help discern why, apart from intentional symptom exaggeration, certain individuals have invalid scores on cognitive symptom overreporting SVTs but have valid scores on PVTs. Third, it may elucidate treatment targets for patients who do and do not score in the invalid range on cognitive symptom overreporting SVTs. The latter implication is particularly important as patients with invalid SVTs may often be dismissed and not given any treatment recommendations, even if they could benefit from treatment.

Current study

This study sought to address these gaps by investigating the relationship between relevant intrapersonal factors (i.e., demographics, estimated premorbid intellectual ability, internalizing symptoms, somatic symptoms, and perceived social support) and the discrepancy between subjective and objective cognitive symptoms in a sample of adults with ADHD. We first examined such associations in patients with valid cognitive concerns and valid test performance. We then investigated the same associations in patients with invalid scores on tests of cognitive symptom overreporting but valid test performance. Based on our literature review, we hypothesized that a greater subjective-objective cognitive discrepancy is primarily associated with greater internalizing and somatic symptoms, irrespective of symptom validity scores.

Method

Participants and procedures

Prior to the initiation of study procedures, ethical approval was obtained from the University of Illinois at Chicago Institutional Review Board. All study procedures were conducted research in accordance with Helsinki Declaration and its subsequent revisions (World Medical Association, 2013). Data were collected between 2019 and 2024, and patients provided written informed consent for their data to be collected and retained in this clinic database.

This cross-sectional study included data from a sample of 802 adults consecutively referred for neuropsychological evaluation at an academic medical center for diagnostic clarification of suspected or established ADHD and treatment planning. Prior to undergoing this evaluation, patients were screened by their treating provider to rule out any obvious medical causes of attention symptoms. Patients underwent a multimodal ADHD diagnostic evaluation, which included record review (including academic records, medical history, and prior [neuro]psychological evaluations when available, to confirm presence of lifelong symptoms); a

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semi-structured clinical interview developed within clinic assessing criteria for ADHD and other mental health disorders according to the *Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition* (APA, 2013); and administration of self-report questionnaires assessing ADHD and relevant psychological symptoms with validity indicators. To further inform diagnosis and treatment planning, patients were administered a fixed neurocognitive test battery with validity indicators. Diagnoses and treatment recommendations were determined by a board-certified clinical neuropsychologist.

Patients with missing data ($n = 158$) were first excluded, followed by those without ADHD diagnosis ($n = 164$), those with any comorbid mental health diagnosis ($n = 297$), those with invalid performance as defined by scoring below the cutoff on ≥2 PVTs ($n = 15$) according to standard practice guidelines (Sweet et al., 2021), and finally, those with invalid inconsistency scores on the Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; T-scores ≥80 on the True and Variable Response Inconsistency Scales) to ensure their reporting of symptoms was deliberate and not confounded by inconsistent or careless responding ($n = 3$). Patients with comorbid diagnoses were excluded because prior research indicates that symptom reporting in such individuals differs from those with ADHD alone (Wilens et al., 2009), and the presence of other disorders could have convoluted our understanding of which intrapersonal factors are linked to ADHD alone. Patients with invalid performance were excluded to ensure the discrepancy between subjective and objective scores was not distorted by exaggerated impairments on testing.

After applying these exclusion criteria, participants were then divided into two groups: the Valid Cognitive Concerns Group and Invalid Cognitive Concerns Group. The Valid Cognitive Concerns Group comprised 117 patients with ADHD who had valid cognitive symptom reporting, defined as valid scores on the SVT indexing cognitive concerns, invalid scores on no more than one SVT indexing noncognitive concerns, and valid test performance. The Invalid Cognitive Concerns Group comprised 37 patients with ADHD who had invalid scores on the cognitive overreporting SVT but valid scores on all other SVTs and valid test performance. Thus, individuals ($n = 11$) with valid scores on any of the noncognitive SVTs were excluded from the Invalid Cognitive Concerns Group. See Table 1 for sample characteristics. For supplemental analyses (see below for details), we included participants without a diagnosis of ADHD who had valid cognitive concerns ($n = 102$) and invalid cognitive concerns ($n = 50$), applying the same exclusion criteria for those with ADHD. Furthermore, because some research suggests that scoring below the cutoff on a single PVT can be indicative of invalid test performance (Denning, 2023; Tierney et al., 2023), analyses were re-run excluding participants with a single invalid PVT score (see below for details).

Measures

Symptom validity tests: cognitive concerns

The Response Bias Scale (RBS) from the Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF; Ben-Porath & Tellegen, 2008) was used to index overreporting of cognitive concerns related to memory and attention (Gervais et al., 2010). A T-score ≥80 was the cutoff used for this measure based on cross-validation research with an adult ADHD sample (Morris et al., 2023).

Symptom validity tests: noncognitive concerns

Multiple SVTs were used to index other aspects of symptom validity. The MMPI-2-RF Infrequent Responses (cutoff ≥83 T-score; Morris et al., 2023), Infrequent Psychopathology Responses (cutoff ≥85 T-score; Morris et al., 2023), and Infrequent Somatic Responses (cutoff ≥91 T-score; Harp et al., 2011; Robinson & Rogers, 2018) were used to assess overreporting of noncognitive symptoms. The MMPI-2-RF Uncommon Virtues and Adjustment Validity (cutoffs ≥81 T-score; Ben-Porath & Tellegen, 2008) was used to assess symptom underreporting. Cutoffs used for these measures were based on their manuals and cross-validation research with ADHD samples (Finley, et al., 2024a).

Performance validity tests

Multiple standalone and embedded PVTs were used to assess performance validity, including the Rey 15-item Test Recall and Recognition (cutoff ≤23 raw score; Ashendorf et al., 2021), Dot Counting Test E-Score (cutoff ≥14 raw score; Abramson et al., 2021), Reliable Digit Span (cutoff ≤7 raw score; Bing-Canar et al., 2022; Finley et al., 2024b; Schroeder et al., 2012), and Rey Auditory Verbal Learning Test-Effort Score (cutoff ≤13 raw score; Finley et al., 2023b; Tse et al., 2023). Cutoffs used for these measures were based on cross-validation research with ADHD samples as well as other clinical samples (e.g., Abeare et al., 2019; McCaul et al., 2018; Pliskin et al., 2021; Poynter et al., 2019).

Intrapersonal factors

Self-report measures were used to assess various relevant intrapersonal factors including internalizing and somatic symptoms and perceived social support. The MMPI-2-RF Emotional/Internalizing Dysfunction scale was used to measure various types of internalizing symptoms. More specifically, symptoms of depression and anxiety were measured via the Beck Depression Inventory-Second Edition (Beck et al., 1996) and Beck Anxiety Inventory (Beck & Steer, 1993), respectively. Traits related to internalizing symptoms, including helplessness/hopelessness and dysfunctional negative emotions, were evaluated using the MMPI-2-RF Helplessness and RC7 scales, respectively. Perceived somatic symptoms were evaluated using the MMPI-2-RF RC1 scale. More specifically, the MMPI-2-RF Malaise scale was used to assess symptoms of fatigue and malaise. Pain-related concerns were assessed by averaging the scores from the MMPI-2-RF Gastrointestinal Complaints, Head Pain Complaints, and Neurological Complaints scales. Perceived social support was measured using scales related to family dynamics and social interactions. Family conflict was measured using the MMPI-2-RF Family Problems scale. The tendency to disaffiliate from social interactions was assessed using the MMPI-2-RF Disaffiliativeness scale, and social avoidance was measured using the MMPI-2-RF Social Avoidance scale. All MMPI-2-RF scale values were expressed as T-scores. Estimated premorbid intellectual ability was assessed via the Test of Premorbid Functioning (Pearson, 2009). Demographic factors included age, sex, race, and years of education.

Subjective-objective discrepancy scores

A subjective-objective discrepancy index was created to quantify the extent that cognitive concerns exceeded difficulties on objective cognitive testing. To create this subjective-objective discrepancy index, the MMPI-2-RF Cognitive Complaints subscale was used to assess perceived cognitive concerns regarding memory, intellect,

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Table 1. Sample characteristics and descriptive statistics

Demographics and Clinical Characteristics	Valid Cognitive Concerns Group ($n = 117$)	Invalid Cognitive Concerns Group ($n = 37$)
Age	$M = 29.18$, $SD = 6.78$	$M = 26.51$, $SD = 6.43$
Years of Education	$M = 16.30$, $SD = 2.15$	$M = 15.86$, $SD = 1.97$
Female Sex	61 (52%)	17 (46%)
Racial Identity		
Non-Hispanic White	62 (53%)	16 (43%)
Non-Hispanic Black	25 (21%)	6 (16%)
Hispanic	12 (10%)	5 (14%)
Asian	10 (9%)	8 (22%)
Multiracial	8 (7%)	2 (5%)
Estimated Premorbid Intellectual Ability (TOPF Standard Scores)	$M = 108.95$, $SD = 11.03$	$M = 108.78$, $SD = 10.63$
Objective Cognitive Performance (Z-Scores)	$M = 0.01$, $SD = 0.55$	$M = -0.18$, $SD = 0.47$
Subjective Cognitive Concerns (MMPI-2-RF COG T-Scores)	$M = 68.08$, $SD = 8.48$	$M = 74.35$, $SD = 7.73$
Cognitive Symptom Overreporting (MMPI-2-RF RBS T-Scores)	$M = 61.26$, $SD = 9.51$	$M = 68.51$, $SD = 13.64$
Internalizing Symptoms		
Various Internalizing Symptoms (MMPI-2-RF EID T-Scores)	$M = 54.33$, $SD = 7.88$	$M = 55.62$, $SD = 8.72$
Depression (BDI-II Raw Scores)	$M = 9.03$, $SD = 5.74$	$M = 10.36$, $SD = 6.65$
Anxiety (BAI Raw Scores)	$M = 5.44$, $SD = 4.18$	$M = 7.78$, $SD = 5.96$
Helplessness / Hopelessness (MMPI-2-RF HLP T-Scores)	$M = 47.98$, $SD = 8.78$	$M = 50.35$, $SD = 12.29$
Dysfunctional Negative Emotions (MMPI-2-RF RC7 T-Scores)	$M = 51.44$, $SD = 7.95$	$M = 55.49$, $SD = 8.42$
Somatic Symptoms		
Various Somatic Symptoms (MMPI-2-RF RC1 T-Scores)	$M = 55.25$, $SD = 7.58$	$M = 60.05$, $SD = 8.36$
Fatigue / Malaise (MMPI-2-RF MLS T-Scores)	$M = 55.56$, $SD = 9.13$	$M = 56.35$, $SD = 10.38$
Pain (Mean MMPI-2-RF GIC, HPC, NUC T-Scores)	$M = 53.10$, $SD = 6.00$	$M = 57.17$, $SD = 7.77$
Perceived Social Support		
Family Conflicts (MMPI-2-RF FML T-Scores)	$M = 50.80$, $SD = 9.91$	$M = 53.57$, $SD = 10.38$
Disaffilativenesss (MMPI-2-RF DFS T-Scores)	$M = 52.37$, $SD = 11.69$	$M = 54.92$, $SD = 15.60$
Social Avoidance (MMPI-2-RF SAV T-Scores)	$M = 50.12$, $SD = 11.01$	$M = 48.19$, $SD = 12.20$

Note: M = mean; SD = standard deviation; TOPF = Test of Premorbid Functioning; MMPI-2-RF = Minnesota Multiphasic Personality Inventory-2-Restructured Form; COG = Cognitive Complaints scale; RBS = Response Bias Scale; EID = Emotional / Internalizing Dysfunction scale; BDI-II = Beck Depression Inventory-Second Edition; BAI = Beck Anxiety Inventory; HLP = Helplessness scale; RC7 = Dysfunctional Negative Emotions scale; RC1 = Somatic / Cognitive Complaints scale; MLS = Malaise scale; GIC = Gastrointestinal Complaints scale; HPC = Head Pain Complaints scale; NUC = Neurological Complaints scale; FML = Family Problems scale; DFS = Disaffiliativeness scale; SAV = Social Avoidance scale.

and concentration, and an index score[1] from a battery of performance tests was used to assess related objective cognitive abilities. The discrepancy between these scores was quantified using the positive standardized residuals from a linear regression of the objective cognitive index scores on the subjective scores.

Statistical analyses

All statistical assumptions were met, including normal distribution of the subjective-objective discrepancy scores in both study groups. *Post hoc* power analyses indicated that findings had >80% observed power. For the preliminary analyses, a Pearson product-moment bivariate correlation was performed to determine the strength of the relationship between the subjective and objective cognitive measure. Correlations were also examined between subjective cognitive concerns and specific types of objective cognitive performance (see Supplemental Table 1). Independent samples t tests were also conducted to identify potential group differences in the intrapersonal factors of interest. For the primary analyses, Pearson bivariate correlations were used to examine associations between subjective-objective discrepancy index scores and intrapersonal factors within the Valid Cognitive Concerns Group and Invalid Cognitive Concerns Group.

For the supplemental analysis, a sequential (hierarchical) multiple linear regression was conducted to identify which intrapersonal factors explained the most variance in the subjective-objective discrepancy scores, per study group. The inclusion of every intrapersonal variable in the model, however, was not possible given the sample size. Thus, the model only included the internalizing (MMPI-2-RF EID) and somatic symptoms scales (MMPI-2-RF RC1) since they capture multiple intrapersonal subscales and were hypothesized to have the most influence on the subjective-objective discrepancy scores. Furthermore, for this analysis, the focus was on modifiable factors that are most relevant to practitioners. Thus, demographic factors and premorbid ability were not included. Using the subjective-objective discrepancy index as the dependent variable, a hierarchical regression was run in two ways. Initially, the internalizing symptoms variable was included in the first step and somatic symptoms in the second step. Then, the analyses were re-run, including somatic symptoms in the first step and internalizing symptoms in the second step. The false discovery rate procedure was applied with a threshold of .05 to control for Type 1 error (Benjamini & Hochberg, 1995). All primary analyses were re-run in a subset of 129 participants excluding those ($n = 25$) with just one invalid PVT score. To better understand how specific the findings were to individuals with ADHD, all primary analyses were also re-run in a subset of participants without ADHD who had valid cognitive concerns ($n = 102$) and invalid cognitive concerns ($n = 50$).

[1]The objective cognitive index was designed to assess difficulties on cognitive testing that are commonly observed in ADHD (Schoechlin & Engel, 2005) as well as difficulties assessed via the MMPI-2-RF Cognitive Complaints scale. Specifically, the objective cognitive index was derived from the Wechsler Adult Intelligence Scale-Fourth Edition Working Memory Index and Processing Speed Index, Conners Continuous Performance Test-Third Edition Omissions, Commissions, and Hit Reaction Time, Golden Stroop Test Word Reading, Color Naming, and Color-Word trials, Trail Making Test Part A and B, Controlled Auditory Word Association Test Letter Fluency (FAS), and Rey Auditory Verbal Learning Test Learning Trials 1–5. All age-corrected scaled scores and demographically corrected T-scores (i.e., age, sex, race, and education) from these measures were transformed into z-scores to create a uniform metric. Although some scores were age-corrected and others demographically corrected, preliminary analyses showed no significant ($p > .05$) association between cognitive test scores and demographics (i.e., age, sex, race, and education).

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Table 2. Correlations between intrapersonal factors and the subjective-objective discrepancy scores among patients with invalid and valid scores on tests of cognitive symptom overreporting

	Valid Cognitive Concerns Group ($n = 117$)	Invalid Cognitive Concerns Group ($n = 37$)
Intrapersonal Factors	Subjective-Objective Cognitive Discrepancy Scores	
Estimated Premorbid Intellectual Ability (TOPF Standard Scores)	−.09	−.10
Demographics		
Age	.03	−.06
Sex	−.07	−.14
Education	−.03	.04
Race	.09	.01
Internalizing Symptoms (MMPI-2-RF EID T-Scores)	.21*	.46**
Depression (BDI-II Raw Scores)	.24*	.38*
Anxiety (BAI Raw Scores)	.05	.01
Helplessness / Hopelessness (MMPI-2-RF HLP T-Scores)	.04	.44**
Dysfunctional Negative Emotions (MMPI-2-RF RC7 T-Scores)	.22*	.50**
Somatic Symptoms (MMPI-2-RF RC1 T-Scores)	.23*	.58***
Fatigue / Malaise (MMPI-2-RF MLS T-Scores)	.16	.29
Pain (Mean MMPI-2-RF GIC, HPC, NUC T-Scores)	.23*	.60***
Perceived Social Support		
Family Conflicts (MMPI-2-RF FML T-Scores)	.14	.03
Disaffiliativeness (MMPI-2-RF DFS T-Scores)	.07	.33*
Social Avoidance (MMPI-2-RF SAV T-Scores)	.01	.26

Note: MMPI-2-RF = Minnesota Multiphasic Personality Inventory-2-Restructured Form; EID = Emotional / Internalizing Dysfunction; BDI-II = Beck Depression Inventory-Second Edition; BAI = Beck Anxiety Inventory; HLP = Helplessness; RC7 = Dysfunctional Negative Emotions; RC1 = Somatic / Cognitive Complaints; MLS = Malaise; GIC = Gastrointestinal Complaints; HPC = Head Pain Complaints; NUC = Neurological Complaints; FML = Family Problems; DFS = Disaffiliativeness; SAV = Social Avoidance; TOPF = Test of Premorbid Functioning.
*$p < .05$. **$p < .01$. ***$p < .001$. All p-values reflect false discovery rate-corrected p-values.

Results

Preliminary analyses

Performance on the objective cognitive composite was not significantly correlated with self-reported cognitive concerns ($r = .14$, $p = .121$), accounting for less than 2% of the variance in ratings of perceived cognitive difficulties. There were also no significant associations observed between self-reported cognitive concerns and specific types of objective cognitive performance (see Supplemental Table 1). As expected, ratings of perceived cognitive difficulties were significantly higher in the Invalid Cognitive Concerns Group, with large effect sizes ($t[152] = -3.01$, $p < .001$, $d = .76$); but there were no significant group differences with regard to objective test performance. Likewise, scores on the RBS validity scale ($t[152] = -3.01$, $p = .004$) were significantly higher in the Invalid Cognitive Concerns Group, with large effect sizes ($d = 0.68$). Furthermore, few intrapersonal factors were significantly different across groups. The Valid Cognitive Concerns Group was 2.67 years older, on average, which yielded a significant difference that was small to medium ($t[152] = 2.17$, $p = .034$, $d = 0.40$) in its effect. The Invalid Cognitive Concerns Group reported significantly greater symptoms of anxiety ($t[152] = 2.18$, $p = .034$, $d = 0.45$) and dysfunctional negative emotions ($t[152] = 2.58$, $p = .012$, $d = 0.50$), on average, yielding small to medium effect sizes. This group also reported, on average, significantly greater somatic symptoms with a medium effect size($t[152] = 3.11$, $p = .003$, $d = 0.62$). No other significant differences were observed between groups. See Table 1 for descriptive statistics.

Intrapersonal factors associated with the subjective-objective discrepancy

As shown in Table 2, a greater subjective-objective discrepancy was significantly associated with more internalizing symptoms ($r = .21$, $p = .034$) in the Valid Cognitive Concerns Group. Specifically, subjective-objective scores were modestly associated with symptoms of depression ($r = .24$, $p = .030$), but not anxiety. Similar patterns were observed in the Invalid Cognitive Concerns Group, with moderate associations found between the subjective-objective discrepancy scores and various internalizing symptoms ($r = .46$, $p = .007$), including depression ($r = .38$, $p = .012$). For the Invalid Cognitive Concerns Group, traits of helplessness and hopelessness ($p = .009$, $r = .44$) and dysfunctional negative emotions ($r = .50$, $p = .004$) were strongly associated with the subjective-objective discrepancy scores. In contrast, these traits were not significantly associated with the discrepancy scores in the Valid Cognitive Concerns Group, except for a modest ($r = .22$) association with dysfunctional negative emotions and the discrepancy scores.

Both groups exhibited positive associations between greater subjective-objective discrepancy scores and somatic symptoms, with the Invalid Cognitive Concerns Group demonstrating a relatively stronger correlation ($r = .58$, $p < .001$). Specifically, pain-related concerns were mildly associated with the discrepancy scores in the Valid Cognitive Concerns Group ($r = .23$, $p = .031$) and strongly correlated with the scores in the Invalid Cognitive Concerns Group ($r = .60$, $p < .001$). Relatively stronger, though modest, associations ($r = .29$, $p = .051$) between fatigue and the subjective-objective discrepancy scores were observed in the Invalid Cognitive Concerns Group.

Perceived social disaffiliation was the only factor related to social support that was correlated with the subjective-objective discrepancy scores ($r = .33$, $p = .028$), albeit only in the Invalid Cognitive Concerns Group. None of the historical, nonmodifiable factors, including demographic factors or estimated premorbid intellectual ability, were significantly correlated with the discrepancy scores in either group.

Intrapersonal factors most associated with the subjective-objective discrepancy

Tables 3 and 4 present results of the hierarchical multiple linear regression models examining the associations between the subjective-objective discrepancy scores and select intrapersonal variables. No interaction effects were observed between the

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Table 3. Hierarchical linear regression analysis of intrapersonal factors and the subjective-objective discrepancy scores in the valid cognitive concerns group

Outcome	Step	Predictors	R^2	ΔR^2	*B*	*SE*(*B*)	95% CI(*B*)	β	95% CI(β)	*t*
Subjective-Objective Cognitive Discrepancy Scores	1	Internalizing Symptoms	.044*	–						
					.03	.01	.00, .05	.21	.19, .23	2.31
	2	Somatic Symptoms	.099*	.055*						
					.03	.01	.00, .05	.19	.17, .21	2.05
	1	Somatic Symptoms	.054*	–						
					.03	.01	.00, .05	.23	.21, .26	2.56
	2	Internalizing Symptoms	.099*	.045*						
					.02	.01	.00, .04	.30	.27, .33	2.17

Note. $n = 117$; *B* = unstandardized beta coefficient; β = standardized beta coefficient; CI = confidence interval; *SE* = standard error; Internalizing and Somatic Symptoms were measured via the Minnesota Multiphasic Personality Inventory-2-Restructured Form Response Emotional/Internalizing Dysfunction and RC1 scales, respectively.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 4. Hierarchical linear regression analysis of intrapersonal factors and the subjective-objective discrepancy scores in the invalid cognitive concerns group

Outcome	Step	Predictors	R^2	ΔR^2	*B*	*SE*(*B*)	95% CI(*B*)	β	95% CI(β)	*t*
Subjective-Objective Cognitive Discrepancy Scores	1	Internalizing Symptoms	.209**	–						
					.05	.02	.02, .09	.46	.42, .49	3.04
	2	Somatic Symptoms	.419**	.210**						
					.06	.02	.03, .09	.48	.45, .52	3.51
	1	Somatic Symptoms	.339**	–						
					.07	.02	.04, .10	.58	.55, .62	4.23
	2	Internalizing Symptoms	.419**	.080**						
					.03	.02	.00, .07	.30	.27, .33	2.17

Note. $n = 37$; *B* = unstandardized beta coefficient; β = standardized beta coefficient; CI = confidence interval; *SE* = standard error; Internalizing and Somatic Symptoms were measured via the Minnesota Multiphasic Personality Inventory-2-Restructured Form Response Emotional/Internalizing Dysfunction and RC1 scales, respectively.
*$p < .05$. **$p < .01$. ***$p < .001$.

variables within the models described below, indicating that the statistically significant variables were independently associated with the subjective-objective discrepancy scores.

For the Valid Cognitive Concerns Group, the overall model accounting for both internalizing and somatic symptoms explained a modest, though significant proportion (~10%) of the variance in the subjective-objective discrepancy scores. Regardless of the entry of order, the model significantly improved when accounting for somatic and internalizing symptoms, suggesting that each variable explains a significant and unique portion of the variance in the discrepancy scores. Although both variables were significant correlates, somatic symptoms explained a relatively larger portion of the variance (6%) compared to internalizing symptoms (4%).

Similarly, the overall model accounting for both internalizing and somatic symptoms in the Invalid Cognitive Concerns Group explained a substantial and significant proportion (~42%) of the variance in the subjective-objective discrepancy scores. As with the Valid Cognitive Concerns Group, both variables significantly improved the model, irrespective of the order of entry. The somatic symptoms variable was again most associated with the discrepancy scores, independently explaining 21% of the variance in scores. Findings were similar when re-running the analyses in a subset of the sample excluding participants who had just one invalid PVT score. Furthermore, a similar pattern of findings was observed when re-running the analyses in a subset of participants without ADHD; but the magnitude of the associations between intrapersonal factors and discrepancy scores was weaker than observed in the ADHD sample (see Supplemental Tables 2, 3, and 4).

Overall, these findings indicate that somatic and internalizing symptoms are independently associated with the subjective-objective discrepancy scores in both study groups. Somatic symptoms appeared to be relatively more associated with the discrepancy scores as compared to the internalizing symptoms; but much less of the overall variance in discrepancy scores was explained by the somatic symptoms in the Valid Cognitive Concerns Group as compared to the Invalid Cognitive Concerns Group.

Discussion

This study investigated the relationship between several intrapersonal factors and the commonly observed discrepancy between subjective and objective cognitive difficulties in adults with ADHD who had valid and invalid scores on a cognitive overreporting SVT. Our results are consistent with published findings demonstrating that adults with ADHD report greater cognitive difficulties on subjective measures than observed on objective measures (Baggio et al., 2020; Fuermaier et al., 2015; Groenman et al., 2022; Magnante et al., 2024). In line with prior research (Finley et al., 2023a; Hughes et al., 2019), our hypothesis that this subjective-objective discrepancy would be more strongly associated with internalizing and somatic symptoms than any other intrapersonal factor was supported by the current findings. Furthermore, this study is the first to demonstrate that internalizing and somatic symptoms are associated with a greater discrepancy between scores on subjective and objective measures of cognition among participants with valid and invalid cognitive symptom over-reporting scores.

Although these findings do not inform diagnostic procedures for ADHD since they are solely based on adults with confirmed ADHD, they do suggest that cognitive concerns are not reliable indicators of objective cognitive impairment among adults with ADHD. This implication is important because it further informs our understanding of why such individuals may endorse cognitive concerns on self-report measures and helps identify potential

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treatment targets to mitigate these concerns. Regardless of whether cognitive concerns are indicative of true cognitive impairment, they are important to address because they can be distressing and treatment-interfering. Before describing which modifiable, intrapersonal factors contribute to this subjective-objective discrepancy, it should be acknowledged that subjective and objective tests have inherently different paradigms and psychometric properties that limit their convergence. The paradigms and items within objective measures may be less sensitive to cognitive difficulties that occur in daily life activities for patients with ADHD (Pinto et al., 2023). Furthermore, most subjective measures, including the one used in this study, assess lapses in everyday cognition (e.g., "I often walk into a room and forget what I was going to do") that are not necessarily meant to be captured by performance measures administered in controlled testing environments. It is possible that self-reported cognitive concerns and objective cognitive difficulties as measured via performance testing reflect inherently different mental constructs (Toplak et al., 2013). Akin to the widely used "signs" and "symptoms" terms, difficulties on performance testing may indicate signs of actual cognitive impairment with underlying brain dysfunction. On the other hand, cognitive concerns elicited via self-report measures may represent nonspecific symptoms influenced by a broad range of factors that are unrelated to actual cognitive impairment. Research has shown that among many clinical populations, cognitive concerns can be influenced by internalizing psychopathology, somatic symptoms (Arola et al., 2023; Finley et al., 2023a, 2023b, 2023c), inaccurate, negative, or rigid beliefs and expectations regarding one's own cognitive abilities (e.g., Edmonds et al., 2018; Gunstad & Suhr, 2001; Lange et al., 2010; Polich et al., 2020), and in some cases, normal aging (Peng et al., 2023), among others. Indeed, the current study findings could suggest that self-reported and performance-based measures of cognition do not tap into the same underlying neural process or substrate in adults with ADHD. Instead, findings indicated that a significant proportion of the variance in the subjective-objective discrepancy scores was explained by intrapersonal factors that are core and ancillary to the diagnosis of ADHD.

Both somatic and internalizing symptoms were strongly and interdependently associated with the subjective-objective discrepancy scores in both validity groups, though somatic symptoms explained relatively more variance in the discrepancy scores. Specific traits related to internalizing symptoms, including hopelessness, dysfunctional negative emotions, and dissafiliativeness, were also significantly correlated with the subjective-objective cognitive discrepancy scores. It is important to recognize that these internalizing symptoms significantly influenced the subjective-objective discrepancy even though they were not clinically elevated, since individuals with co-occurring psychopathology were excluded from analyses. Taken together, these findings suggest that adults with ADHD who have subclinical internalizing and somatic symptoms may have a greater propensity to overestimate their degree of cognitive difficulties, via potentially discernable mechanisms. Such mechanisms may be related to negativity bias and misattribution of normal everyday cognitive lapses (Hill et al., 2016). Given that previous research has identified associations between internalizing and somatic symptoms and cognitive concerns across various clinical populations (Finley et al., 2023a), it is likely that these potential causal mechanisms are not unique to ADHD. Using a single index score to measure cognitive concerns and performance also limits the ability to determine if the observed associations are specific to ADHD cognitive symptoms. The similar yet weaker pattern of correlations between subjective-objective scores and intrapersonal factors in patients without ADHD, as compared to those with ADHD, further suggests that these findings may not be entirely unique to ADHD. Instead, the association between intrapersonal factors and cognitive overreporting may be exacerbated in an ADHD population.

To our knowledge, all studies that have examined the link between intrapersonal factors and cognitive concerns have excluded patients with invalid scores on overreporting SVTs due to concerns regarding the legitimacy of the reported symptoms. However, these results suggest that internalizing and somatic symptoms are related to cognitive concerns, even among patients who score in the invalid range on overreporting SVTs. This raises the question of whether some patients have invalid scores on SVTs assessing cognitive symptom overreporting because they inadvertently overestimate their cognitive difficulties due to negativity or misattribution biases associated with internalizing and somatic symptoms. Such biases can occur even in individuals with subclinical internalizing symptoms (Baumeister et al., 2001). Indeed, much extant research has indicated that patients with ADHD inadvertently score in the invalid range on SVTs but perform validly on cognitive testing due to attentional and/or motivational biases (Boone, 2009; Sagar et al., 2017; Suhr & Wei, 2017). Although our findings do not elucidate why patients who had both invalid and valid scores on the SVTs of overreporting had similar subjective-objective discrepancy correlates, they generally indicate that the more distressed patients are, the more likely they are to overestimate the extent of their cognitive difficulties. This could mean that some individuals with ADHD who have invalid SVTs would benefit from treatment targeting the intrapersonal factors – internalizing and somatic symptoms – associated with their cognitive concerns, even if they do not meet criteria for a comorbid psychiatric disorder. Although the literature on symptom and performance validity has evolved significantly over the past several decades (Finley, 2024; Larrabee, 2012) minimal research has focused on treatment outcomes in patients with invalid scores. This is an important topic to pursue in future research since a substantial portion of individuals with ADHD demonstrate symptom invalidity (Sullivan et al., 2007), but still may benefit from treatment.

Limitations and future directions

The current study is not without limitations. First, the scores for certain intrapersonal factors were obtained from measures without embedded SVTs (e.g., Beck Anxiety Inventory). As such, we cannot definitively confirm that responses on all these measures were valid. However, by excluding individuals with invalid SVTs assessing overreporting of psychopathology and somatic complaints, we increased the likelihood of only utilizing valid ratings of psychopathology and somatic symptoms. Nevertheless, future research should seek to replicate these findings using measures with embedded SVTs. Similarly, it would be helpful to see if these findings replicate using other overreporting measures specific to ADHD (e.g., Finley et al., 2023c). Second, the subjective-objective cognitive discrepancy score was derived using an index that aggregated scores from various types of cognitive tests. This limited our ability to determine whether the findings were specific to ADHD symptoms or indicative of cognitive symptoms more broadly. It also precluded our ability to examine how intrapersonal factors may relate to domain-specific discrepancies (e.g., attention, memory). Although we were able to ascertain specific objective

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cognitive performance indices, we could not identify the specific types of cognitive concerns. As such, it remains unclear which subjective and objective cognitive indices are more or less discrepant with each other and with certain intrapersonal factors. Future research should also examine the relationship between intrapersonal factors and subjective-objective discrepancies by cognitive domain. Third, although certain intrapersonal factors were associated with overreporting of cognitive symptoms, these findings do not necessarily indicate that addressing such factors will lead to reduced cognitive concerns or improved treatment outcomes. As indicated above, future research should examine interventions targeting these intrapersonal factors to determine their effectiveness in mitigating cognitive concerns and enhancing overall well-being in patients who have valid and invalid scores on certain SVTs. It could also be helpful to investigate the extent to which overreporting of cognitive concerns is associated with adherence to treatment and treatment outcomes. Lastly, some of the PVTs used to exclude participants with invalid cognitive performance had low sensitivity, which may have resulted in misclassifying some individuals with invalid performance as valid. We attempted to address this issue by using a variety of PVTs. However, future studies may benefit from employing more robust freestanding PVTs to identify those with valid performance.

Conclusions

Adults commonly present for ADHD evaluations with cognitive, mood, and somatic concerns, regardless of the degree of objectively measured cognitive impairment. The discrepancy between the subjectively and objectively measured cognitive difficulties has resulted in a longstanding debate regarding evaluation protocols and theoretical underpinnings for ADHD. Current study findings provide further evidence for a lack of convergence between subjective cognitive concerns and objectively measured cognitive performance in adults with ADHD. Instead, findings suggest that the discrepancy between subjective and objective cognitive difficulties is predominately influenced by somatic symptoms, and to a lesser extent internalizing symptoms, regardless of whether patients have valid scores on tests of cognitive symptom overreporting. As such, we hope researchers will continue to expand upon the role of subclinical internalizing and somatic symptoms as determinants of cognitive concerns in adults with ADHD who have variable SVT scores. We hope that such research will improve assessment practices and treatment recommendations for adults with ADHD who report both valid and invalid levels of cognitive concerns.

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References

Abeare, C., Sabelli, A., Taylor, B., Holcomb, M., Dumitrescu, C., Kirsch, N., & Erdodi, L. (2019). The importance of demographically adjusted cutoffs: Age and education bias in raw score cutoffs within the Trail Making Test. *Psychological Injury and Law*, *12*(2), 170–182. https://doi.org/10.1007/s12207-019-09353-x

Abramson, D. A., White, D. J., Rhoads, T., Carter, D. A., Hansen, N. D., Resch, Z. J., Jennette, K. J., Ovsiew, G. P., & Soble, J. R. (2023). Cross-validating the Dot Counting Test among an adult ADHD clinical sample and analyzing the effect of ADHD subtype and comorbid psychopathology. *Assessment*, *30*(2), 264–273. https://doi.org/10.1177/10731911211050895

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders*, 5th edn. American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Arola, A., Laakso, H. M., Heinonen, H., Pitkänen, J., Ahlström, M., Lempiäinen, J., Paajanen, T., Virkkala, J., Koikkalainen, J., Lötjönen, J., Korvenoja, A., Melkas, S., & Jokinen, H. (2023). Subjective vs informant-reported cognitive complaints have differential clinical significance in covert cerebral small vessel disease. *Cerebral Circulation - Cognition and Behavior*, *5*, 100182. https://doi.org/10.1016/j.cccb.2023.100182

Ashendorf, L., Clark, E. L., & Humphreys, C. T. (2021). The Rey 15-item memory test in US veterans. *Journal of Clinical and Experimental Neuropsychology*, *43*(3), 324–331. https://doi.org/10.1080/13803395.2021.1932761

Baggio, S., Hasler, R., Giacomini, V., El-Masri, H., Weibel, S., Perroud, N., & Deiber, M. P. (2020). Does the continuous performance test predict ADHD symptoms severity and ADHD presentation in adults? *Journal of Attention Disorders*, *24*(6), 840–848. https://doi.org/10.1177/1087054718822060

Barkley, R. A. (2019). Neuropsychological testing is not useful in the diagnosis of ADHD: Stop it (or prove it)!. *The ADHD Report*, *27*(2), 1–8. https://doi.org/10.1521/adhd.2019.27.2.1

Barkley, R. A., & Murphy, K. R. (2011). The nature of executive function (EF) deficits in daily life activities in adults with ADHD and their relationship to performance on EF tests. *Journal of Psychopathology and Behavioral Assessment*, *33*(2), 137–158. https://doi.org/10.1007/s10862-011-9217-x

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, *5*(4), 323–370. https://doi.org/10.1037//1089-2680.5.4.323

Beck, A. T., & Steer, R. A. (1993). *Beck anxiety inventory manual*. Psychological Corporation.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck depression inventory-II*. Psychological Corporation.

Ben-Porath, Y. S., & Tellegen, A. (2008). *Minnesota multiphasic inventory-2-restructured form (MMPI-2-RF): Manual for administration, scoring, and interpretation*. University of Minnesota Press. https://doi.org/10.1037/t15121-000

Benito-Lein, J., Mitchell, A. J., Vega, S., & Bermejo-Pareja, F. (2010). A population-based study of cognitive function in older people with subjective memory complaints. *Journal of Alzheimer's Disease*, *22*(1), 159–170. https://doi.org/10.3233/JAD-2010-100972

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), 289–300.

Bing-Canar, H., Phillips, M. S., Shields, A. N., Ogram Buckley, C. M., Chang, F., Khan, H., Skymba, H. V., Ovsiew, G. P., Resch, Z. J., Jennette, K. J., & Soble, J. R. (2022). Cross-validation of multiple WAIS-IV digit span embedded performance validity indices among a large sample of adult attention deficit/hyperactivity disorder clinical referrals. *Journal of Psychoeducational Assessment*, *40*(5), 678–688. https://doi.org/10.1177/07342829221081921

Boone, K. B. (2009). Fixed belief in cognitive dysfunction despite normal neuropsychological scores: Neurocognitive hypochondriasis? *The Clinical Neuropsychologist*, *23*(6), 1016–1036. https://doi.org/10.1080/13854040802441135

Costa-Cordella, S., Arevalo-Romero, C., Parada, F. J., & Rossi, A. (2021). Social support and cognition: A systematic review. *Frontiers in Psychology*, *12*, 637060. https://doi.org/10.3389/fpsyg.2021.637060

Denning, J. H. (2023). When failing one performance validity test matters. *Applied Neuropsychology: Adult*, 1–12. https://doi.org/10.1080/23279095.2023.2285503

Edmonds, E. C., Weigand, A. J., Thomas, K. R., Eppig, J., Delano-Wood, L., Galasko, D. R., Salmon, D. P., & Bondi, M. W. (2018). Increasing inaccuracy of self-reported subjective cognitive complaints over 24 months in empirically derived subtypes of mild cognitive impairment. *Journal of the International Neuropsychological Society*, *24*(8), 842–853. https://doi.org/10.1017/S1355617718000486

Finley, J. C. A. (2024). Performance validity testing: the need for digital technology and where to go from here. *Frontiers in Psychology*, *15*, 1452462. https://doi.org/10.3389/fpsyg.2024.1452462

Finley, J. C. A., Cerny, B. M., Brooks, J. M., Obolsky, M. A., Haneda, A., Ovsiew, G. P., & Ulrich, D. M., Resch, Z. J., & Soble, J. R. (2023c). Cross-validating the Clinical Assessment of Attention Deficit-Adult symptom validity scales for assessment of attention deficit/hyperactivity disorder in adults. *Journal of Clinical and Experimental Neuropsychology*, *46*(2), 111–123. https://doi.org/10.1080/13803395.2023.2283940

Finley, J. C. A., Cladek, A., Gonzalez, C., & Brook, M. (2023a). Perceived cognitive impairment is related to internalizing psychopathology but unrelated to objective cognitive performance among nongeriatric adults presenting for outpatient neuropsychological evaluation. *The Clinical Neuropsychologist*, *38*(3), 644–667. https://doi.org/10.1080/13854046.2023.2241190

Finley, J. C. A., Robinson, A. D. & Soble, J. R. (2024a) The utility of one versus multiple symptom validity test failures on the MMPI-2-RF in adult ADHD evaluations. *Psychological Injury and Law*. https://doi.org/10.1007/s12207-024-09517-4

Finley, J. C. A., Rodriguez, V. J., Cerny, B. M., Chang, F., Brooks, J. M., Ovsiew, G. P., Ulrich, D. M., Resch, Z. J., & Soble, J. R. (2024b). Comparing embedded performance validity indicators within the WAIS-IV Letter-Number sequencing subtest to Reliable Digit Span among adults referred for evaluation of attention-deficit/hyperactivity disorder. *The Clinical Neuropsychologist*, 1–20. https://doi.org/10.1080/13854046.2024.2315738

Finley, J. C. A., Brooks, J. M., Nili, A. N., Oh, A., VanLandingham, H. B., Ovsiew, G. P., Ulrich, D. M., Resch, Z. J., & Soble, J. R. (2023b). Multivariate examination of embedded indicators of performance validity for ADHD evaluations: A targeted approach. *Applied Neuropsychology: Adult*, 1–14. https://doi.org/10.1080/23279095.2023.2256440

Fuermaier, A. B. M., Tucha, L., Koerts, J., Aschenbrenner, S., Kaunzinger, I., Hauser, J., Weisbrod, M., Lange, K. W., & Tucha, O. (2015). Cognitive impairment in adult ADHD—Perspective matters!. *Neuropsychology*, *29*(1), 45–58. https://doi.org/10.1037/neu0000108

Gervais, R. O., Ben-Porath, Y. S., Wygant, D. B., & Sellbom, M. (2010). Incremental validity of the MMPI-2-RF over-reporting scales and RBS in assessing the veracity of memory complaints. *Archives of Clinical Neuropsychology*, *25*(4), 274–284. https://doi.org/10.1093/arclin/acq018

Gonzalez, C., Finley, J. C. A., Khalid, E., Basurto, K. S., VanLandingham, H. B., Frick, L. A., & Brooks, J. M., Ellison, R. L., Ulrich, D. M., Soble, J. R., & Resch, Z. J. (2024). Impact of adverse childhood experiences on symptom and performance validity tests among a multiracial sample presenting for ADHD evaluation. *Archives of Clinical Neuropsychology*, *39*(6), 692–701. https://doi.org/10.1093/arclin/acae006

Groenman, A. P., van der Werf, S., & Geurts, H. M. (2022). Subjective cognition in adults with common psychiatric classifications; a systematic review. *Psychiatry Research*, *308*, 114374. https://doi.org/10.1016/j.psychres.2021.114374

Gunstad, J., & Suhr, J. A. (2001). Expectation as etiology" versus "the good old days": Postconcussion syndrome symptom reporting in athletes, headache sufferers, and depressed individuals. *Journal of the International Neuropsychological Society*, *7*(3), 323–333. https://doi.org/10.1017/S1355617701733061

Harp, J. P., Jasinski, L. J., Shandera-Ochsner, A. L., Mason, L. H., & Berry, D. T. (2011). Detection of malingered ADHD using the MMPI-2-RF. *Psychological Injury and Law*, *4*(1), 32–43. https://doi.org/10.1007/s12207-011-9100-9

Hill, N. L., Mogle, J., Wion, R., Munoz, E., DePasquale, N., Yevchak, A. M., & Parisi, J. M. (2016). Subjective cognitive impairment and affective symptoms: A systematic review. *The Gerontologist*, *56*(6), e109–e127. https://doi.org/10.1093/geront/gnw091

Hughes, A. J., Bhattarai, J., Paul, S., & Beier, M. (2019). Depressive symptoms and fatigue as predictors of objective-subjective discrepancies in cognitive function in multiple sclerosis. *Multiple Sclerosis and Related Disorders*, *30*, 192–197. https://doi.org/10.1016/j.msard.2019.01.055

Instanes, J. T., Klungsøyr, K., Halmøy, A., Fasmer, O. B., & Haavik, J. (2018). Adult ADHD and comorbid somatic disease: A systematic literature review. *Journal of Attention Disorders*, *22*(3), 203–228. https://doi.org/10.1177/1087054716669589

Jang, Y., Haley, W. E., Choi, E. Y., & Franco, Y. (2022). Racial/Ethnic differences in correspondence between subjective cognitive ratings and cognitive impairment. *The American Journal of Geriatric Psychiatry*, *30*(5), 627–635. https://doi.org/10.1016/j.jagp.2021.10.015

Jasinski, L. J., Harp, J. P., Berry, D. T., Shandera-Ochsner, A. L., Mason, L. H., & Ranseen, J. D. (2011). Using symptom validity tests to detect malingered ADHD in college students. *The Clinical Neuropsychologist*, *25*(8), 1415–1428. https://doi.org/10.1080/13854046.2011.630024

Lange, R. T., Iverson, G. L., & Rose, A. (2010). Post-concussion symptom reporting and the "good-old-days" bias following mild traumatic brain injury. *Archives of Clinical Neuropsychology*, *25*(5), 442–450. https://doi.org/10.1093/arclin/acq031

Larrabee, G. (2012). Performance validity and symptom validity in neuropsychological assessment. *Journal of the International Neuropsychological Society*, *18*(4), 625–630. https://doi.org/10.1017/s1355617712000240

Magnante, A. T., Ord, A. S., Kuschel, S., & Shura, R. D. (2024). An evaluation of the relationship between objective and subjective measures of attention. *Psychology & Neuroscience*, *17*(2), 104–121. https://doi.org/10.1037/pne0000333

Mahone, E. M., & Denckla, M. B. (2017). Attention-deficit/hyperactivity disorder: A historical neuropsychological perspective. *Journal of the International Neuropsychological Society*, *23*(9-10), 916–929. https://doi.org/10.1017/S1355617717000807

McCaul, C., Boone, K. B., Ermshar, A., Cottingham, M., Victor, T. L., Ziegler, E., Zeller, M. A., & Wright, M. (2018). Cross-validation of the Dot Counting Test in a large sample of credible and non-credible patients referred for neuropsychological testing. *The Clinical Neuropsychologist*, *32*(6), 1054–1067. https://doi.org/10.1080/13854046.2018.1425481

Mendes, T., Gin., S., Ribeiro, F., Guerreiro, M., Sousa, G.de, Ritchie, K., & de Mendon.a, A. (2008). Memory complaints in healthy young and elderly adults: Reliability of memory reporting. *Aging & Mental Health*, *12*(2), 177–182. https://doi.org/10.1080/13607860701797281

Morris, C., Lee, T. T., Demakis, G. J., & Park, S. (2023). Detecting feigned ADHD in college students using the Minnesota multiphasic personality inventory-2-restructured form (MMPI-2-RF). *The Clinical Neuropsychologist*, *37*(6), 1154–1172. https://doi.org/10.1080/13854046.2022.2112294

Ovsiew, G. P., Cerny, B. M., Boer, A. B. D., Petry, L. G., Resch, Z. J., Durkin, N. M., & Soble, J. R. (2023). Performance and symptom validity assessment in attention deficit/hyperactivity disorder: Base rates of invalidity, concordance, and relative impact on cognitive performance. *The Clinical Neuropsychologist*, *37*(7), 1498–1515. https://doi.org/10.1080/13854046.2022.2162440

Pearson 2009). *Advanced clinical solutions for the WAIS-IV and WMS-IV – Technical manual*. Pearson.

Peng, S. W., Wang, C. Y., Lin, S. Y., Lee, Y. L., Lin, Y. C., Lin, Y. J., & Wang, P. N. (2023). Subjective cognitive complaints: Comparing the relation between self-reported versus informant-reported subjective cognitive complaints and cognitive performances in cognitively unimpaired, mild cognitive impairment and populations with dementia. *The Journal of Prevention of Alzheimer's Disease*, *10*(3), 562–570. https://doi.org/10.14283/jpad.2023.47

Pinto, J. O., Dores, A. R., Peixoto, B., & Barbosa, F. (2023). Ecological validity in neurocognitive assessment: Systematized review, content analysis, and proposal of an instrument. *Applied Neuropsychology: Adult*, 1–18. https://doi.org/10.1080/23279095.2023.2170800

Pliskin, J. I., DeDios Stern, S., Resch, Z. J., Saladino, K. F., Ovsiew, G. P., Carter, D. A., & Soble, J. R. (2021). Comparing the psychometric properties of eight embedded performance validity tests in the Rey Auditory Verbal Learning Test, Wechsler Memory Scale Logical Memory, and Brief Visuospatial Memory Test-Revised recognition trials for detecting invalid neuropsychological test performance. *Assessment*, *28*(8), 1871–1881. https://doi.org/10.1177/1073191120929093

Polich, G., Iaccarino, M. A., Kaptchuk, T. J., Morales-Quezada, L., & Zafonte, R. (2020). Nocebo effects in concussion: Is all that is told beneficial? *American Journal of Physical Medicine & Rehabilitation*, *99*(1), 71–80. https://doi.org/10.1097/PHM.0000000000001290

Poynter, K., Boone, K. B., Ermshar, A., Miora, D., Cottingham, M., Victor, T. L., Ziegler, E., Zeller, M. A., Wright, M. (2019). Wait, there's a baby in this bath water! Update on quantitative and qualitative cut-offs for Rey 15-Item Recall

and Recognition. *Archives of Clinical Neuropsychology*, *34*(8), 1367–1380. https://doi.org/10.1093/arclin/acy087

Ramachandran, S., Pavlacic, J. M., Young, J., & Bentley, J. P. (2023). ADHD symptom malingering and nonmedical drug use in adults. In *Clinical handbook of ADHD assessment and treatment across the lifespan* (pp. 277–293). Springer International Publishing.

Robinson, E. V., & Rogers, R. (2018). Detection of feigned ADHD across two domains: The MMPI-2-RF and CAARS for faked symptoms and TOVA for simulated attention deficits. *Journal of Psychopathology and Behavioral Assessment*, *40*(3), 376–385. https://doi.org/10.1007/s10862-017-9640-8

Sagar, S., Miller, C. J., & Erdodi, L. A. (2017). Detecting feigned attention-deficit/hyperactivity disorder (ADHD): Current methods and future directions. *Psychological Injury and Law*, *10*(2), 105–113. https://doi.org/10.1007/s12207-017-9286-6

Schoechlin, C., & Engel, R. R. (2005). Neuropsychological performance in adult attention-deficit hyperactivity disorder: Meta-analysis of empirical data. *Archives of Clinical Neuropsychology*, *20*(6), 727–744. https://doi.org/10.1016/j.acn.2005.04.005

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. https://doi.org/10.1177/1073191111428764

Suhr, J., & Wei, C. (2017). Attention deficit/hyperactivity disorder as an illness identity: Implications for neuropsychological practice. In *Neuropsychological evaluation of somatoform and other functional somatic conditions* (pp. 251–273). Routledge.

Sullivan, B. K., May, K., & Galbally, L. (2007). Symptom exaggeration by college adults in attention-deficit hyperactivity disorder and learning disorder assessments. *Applied Neuropsychology*, *14*(3), 189–207. https://doi.org/10.1080/09084280701509083

Sutin, A. R., Aschwanden, D., Stephan, Y., & Terracciano, A. (2020). Five Factor Model personality traits and subjective cognitive failures. *Personality and Individual Differences*, *155*, 109741. https://doi.org/10.1016/j.paid.2019.109741

Sweet, J. J., Heilbronner, R. L., Morgan, J. E., Larrabee, G. J., Rohling, M. L., Boone, K. B., Kirkwood, M. W., Schroeder, R. W., Suhr, J. A., Conference Participants (2021). American Academy of Clinical Neuropsychology (AACN) 2021 consensus statement on validity assessment: Update of the 2009 AACN consensus conference statement on neuropsychological assessment of effort, response bias, and malingering. *The Clinical Neuropsychologist*, *35*(6), 1053–1106. https://doi.org/10.1080/13854046.2021.1896036

Tierney, S. M., Taiwo, Z., Choudhury, T. K., Lippa, S. M., Troyanskaya, M., Pastorek, N. J., Miller, B., Romesser, J., Sim, A. (2023). Varying failure criteria on performance validity tests influences interpretation of cognitive outcomes. *Neuropsychology*, *37*(1), 93–103. https://doi.org/10.1037/neu0000857

Tomita, T., Sugawara, N., Kaneda, A., Okubo, N., Iwane, K., Takahashi, I., Kaneko, S., Yasui-Furukori, N. (2014). Sex-specific effects of subjective memory complaints with respect to cognitive impairment or depressive symptoms. *Psychiatry and Clinical Neurosciences*, *68*(3), 176–181. https://doi.org/10.1111/pcn.12102

Toplak, M. E., West, R. F., & Stanovich, K. E. (2013). Practitioner review: Do performance-based measures and ratings of executive function assess the same construct? *Journal of Child Psychology and Psychiatry*, *54*(2), 131–143. https://doi.org/10.1111/jcpp.12001

Tse, P. K. Y., Finley, J. C., Frick, L., Guilfoyle, J., Brooks, J., Khalid, E., Charara, R., Resch, Z. J., Ulrich, D. M., Ovsiew, G. P., Soble, J. R. (2023). Cross-validating the embedded performance validity indicators in the Rey Auditory Verbal Learning Test in mixed neuropsychiatric and attention-deficit/hyperactivity disorder clinical samples. *Psychology & Neuroscience*, *16*(2), 125–137. https://doi.org/10.1037/pne0000302

White, D. J., Ovsiew, G. P., Rhoads, T., Resch, Z. J., Lee, M., Oh, A. J., & Soble, J. R. (2022). The divergent roles of symptom and performance validity in the assessment of ADHD. *Journal of Attention Disorders*, *26*(1), 101–108. https://doi.org/10.1177/1087054720964575

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), 15333–1562. https://doi.org/10.4088/JCP.08m04785pur

World Medical Association. (2013). World medical association declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA*, *310*, 2191–2194.