Pergamon

Archives of Clinical Neuropsychology
18 (2003) 379–395

Archives of CLINICAL NEUROPSYCHOLOGY

Detection of malingering in assessment of adult ADHD

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Accepted 4 March 2002

Abstract

Comparisons of two assessment measures for ADHD: the ADHD Behavior Checklist and the Integrated Visual and Auditory Continuous Performance Test (IVA CPT) were examined using undergraduates ($n = 44$) randomly assigned to a control or a simulated malingerer condition and undergraduates with a valid diagnosis of ADHD ($n = 16$). It was predicted that malingerers would successfully fake ADHD on the rating scale but not on the CPT for which they would overcompensate, scoring lower than all other groups. Analyses indicated that the ADHD Behavior Rating Scale was successfully faked for childhood and current symptoms. IVA CPT could not be faked on 81% of its scales. The CPT's impairment index results revealed: sensitivity 94%, specificity 91%, PPP 88%, NPP 95%. Results provide support for the inclusion of a CPT in assessment of adult ADHD.

Keywords: Malingering; Adult ADHD; Continuous Performance Test; Assessment; ADHD rating scale

1. Introduction

The Diagnostic and Statistical Manual of Mental Disorders IV, DSM-IV (American Psychiatric Association, 1994) recognizes that Attention Deficit Hyperactivity Disorder (ADHD), can continue into adulthood. In recent years, general awareness that ADHD may persist into adulthood has increased. This may be due to many best-selling books (Hallowell & Ratey, 1993; Nadeau, 1994), and increased media coverage. Public awareness has led to a dramatic influx of adults seeking evaluation and treatment for this condition (Roy-Byrne et al., 1997). The purpose of this study is to examine diagnostic tools used in the assessment of adult

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0887-6177/02/$ – see front matter © 2002 National Academy of Neuropsychology.
PII: S0887-6177(02)00150-6

ADHD and to determine whether differences can be found to alert clinicians to the possibility of malingering.

1.1. Adult ADHD

ADHD is typified by three primary characteristics—inattentiveness, hyperactivity, and impulsiveness, according to the DSM-IV. For a diagnosis to be valid, symptoms must be pervasive with significant impairment to individual functioning across settings and symptoms must be evident early in life, before age 7 (Toone & Van Der Linden, 1997). However, past research recommends slight modifications in symptomotology for adults. In young adults, the salient characteristics of the disorder are inattention, impulsivity, personal disorganization (Toone & Van Der Linden, 1997) poor task persistence, poor time-management, and lack of goal-directed behavior (Murphy & Barkley, 1996a).

A comprehensive assessment of ADHD in adults should employ multiple strategies, including a structured clinical interview, medical examination, self-report rating scales, rating scales from other reporters, structured tasks of attention, and structured tasks of impulsivity (Roy-Byrne et al., 1997). A clinical interview with informant history should always guide the assessment protocol. However, most adults do not invite a parent or sibling along to the evaluation who can document the client's prior history. Moreover, most adults lack developmental documentation, such as report cards, teacher evaluations or past psychological testing results (Roy-Byrne et al., 1997). Poor recollection on the part of many adults further weakens the reliability of their report (Wender, 1997). A medical examination is often warranted to rule out conditions (e.g., Reye's syndrome, CNS infection, cerebral–vascular disease, hypothyroidism) in which lack of attention may be just one symptom (Barkley, 1990).

Some structured tasks of attention and/or impulsivity typically used in assessment of ADHD include the Matching Familiar Figures Test (MFFT), Wisconsin Card Sort, Stroop Word-Color Association Test, and Continuous Performance Tests (CPTs). However, the MFFT, and Wisconsin Card Sort fail to reliably discriminate those with ADHD from controls and are therefore not recommended for use in assessing this disorder (Barkley, 1990). Stroop Word-Color Association can reliably predict impulsive responding (Barkley, 1990). CPTs provide scores for both inattention and impulsivity (Ricco, Cohen, Hynd, & Keith, 1996).

1.2. Rating scales

Typically, rating scales have been a key component to most assessment procedures. Many self-report scales are derived from DSM criteria, which require the presence of six out of nine possible symptoms (Johnson, 1996). These types of scales show the greatest criterion-related validity for both adults and children (Doyle, Ostranser, Skare, Crosby, & August, 1997). When scales are used in childhood assessment, a parent and teacher present distinct observations from separate contexts (Roy-Byrne et al., 1997). Although data suggest that adults are reliable self-reporters (Biederman et al., 1993), an adult seeking diagnosis is often the only one to report on the scales. Moreover, most rating scales may be improperly worded for adults with diagnostic thresholds that are too stringent and/or restrictive in this population (Murphy &

Barkley, 1996b). Diagnosis is made more arduous because of the scales' lack of ability to determine which level of impairment is clinically significant (Murphy & Barkley, 1996a).

1.3. Continuous Performance Tests

CPTs involve selective attention, or vigilance, for an infrequently occurring stimulus. Performance is scored in terms of total correct responses, broken down into omission errors which are missed responses and show inattention, and commission errors which are incorrect responses, highlighting impulsivity (Ricco et al., 1996). CPTs can monitor variability in a test-taker's responding during different segments of the test or between different stimuli.

Losier, McGrath, and Klien (1996) performed a meta-analysis of 26 CPT studies to find that ADHD samples on average perform more poorly on CPTs with twice as many missed targets and twice as many false hits than non-ADHD samples. Most of these studies were conducted with child populations. One study (Epstein, Conners, Sitarenios, & Erhardt, 1998) did find significantly lower scores among ADHD adults when compared to adult controls. Another study (Epstein, Johnson, Varia, Conners, 2001) found that the only neuropsychological measure of those examined (Posner Visual Orienting Test, Stop-Signal task, and CPT) to differentiate between ADHD adults, controls, and adults with anxiety disorder was the CPT.

Though the bulk of the literature supports CPT's inclusion in the assessment of ADHD for determining specific core deficits, CPTs are not without critics. The ecological validity of the CPT has been questioned (Barkley, 1991; DuPaul, Anastopoulos, Shelton, Guevremont, & Metevia, 1992), as well as the inability of CPTs to differentiate between those with ADHD and other patient populations (Barkley, DuPaul, & McMurry, 1990).

1.4. Malingering

Malingering may be a potential factor for the difficulty in accurate diagnosis of adult ADHD. It is defined as a conscious fabrication or exaggeration of physical or psychological symptoms in pursuit of a recognizable goal, (American Psychiatric Association, 1994) and can include misrepresentations of physical symptoms, distortions of self-reports, and outright dishonesty (Sattler, 1988). Binder (1992) estimates that a quarter of individuals who could benefit economically from a particular diagnosis may be responding in a biased fashion on neuropsychological tests. Cognitive functioning is vulnerable to malingering because it is easier to convincingly fake a behavioral deficit by withholding normal behaviors, such as attention, than to fake a positive symptom, which requires the production of new behaviors, such as a constant twitching (Rogers, 1997).

In 1996, 3.8 million claims were made to social security or disability, of which 24 and 29%, respectively, of recipients qualified on the basis of mental illness other than retardation (Griffen, Normington, May, & Glassmire, 1996). During the Reagan administration, it was determined that approximately 548,000 individuals that were not disabled were still receiving benefits (Griffen et al., 1996). At least one case of confessed malingering in conjunction with seeking social security benefits because of a potential diagnosis of ADHD has been documented (Cassar, Hales, Longhurst, & Weiss, 1996). Social Security and Disability offices send out frequent memorandums of warning signs for potential malingerers to agency-approved

clinicians (Sandford, 2001). Often a client will act in such a way during the interview that will cause the clinician to be suspicious, casting all potential diagnoses in doubt. For example, some clients specifically mention potential benefits from diagnosis, some clients appear unusually nervous, some profess indiscriminant symptom endorsement, or improbable symptomotology (Rogers, 1997) and there can be an incongruency between expected neurological performance and presenting symptoms (Hall & Pritchard, 1996). But doubt alone is not sufficient to warrant denial of services. The purpose of the present study is to determine whether attempts to malinger can be detected in diagnostic tests for assessment of adult ADHD.

Malingerers search for cues within the environment as a guide for how they should respond (Rogers, 1997) therefore, items on a DSM criteria scale may provide cues to desired responses. With just a little preparation a malingerer can easily become familiar with the characteristics of the targeted disorder (Rogers, 1997). Library research may ensure correct responding. Prior knowledge of these symptoms with the intent to malinger can be a particular problem when rating scales are used without adjunctive assessment tools. Rogers (1997) suggested that clinicians assess potential mediators, such as an examinee's prior knowledge of the information on evaluative tests, before test administration. No studies have been found that attempt to identify malingering in the use of rating scales.

Inclusion of a CPT may be a particularly useful tool when malingering is suspected in that CPTs provide no cues that could foster deception. Between-item variance (Ray et al., 1997) and reaction-time variance (Matier-Sharma, Perachio, Newcorn, Sharma, Halperin, 1995), which are unknown to the test-taker, make malingering hard to successfully fake on the CPT because response times are measured in milliseconds. Malingering strategies include random responding to items and intentional wrong responses, both of which result in depressed scores, as well as delayed responding which leads to scoring penalties in timed tests, and is assessed as inattentiveness (Beetar & Williams, 1995). When CPT scores lack internal consistency in presented deficits, it is a clue to malingering (Sattler, 1988).

1.5. Hypotheses

Both sensitivity, which is the percent of correctly identified malingers and specificity, which is the percent of correctly identified non-malingerers are necessary to ascertain the merit of a diagnostic technique (Kramer, 1992). Three groups were used in this study, an ADHD group, simulated malingerers, and controls. It was hypothesized that the CPT would show greater specificity and sensitivity to malingering than a self-report scale, and that malingerer's scores would be more deviant than those with ADHD or controls. Additionally, Negative Predictor Power (NPP) and Positive Predictor Power (PPP) were calculated. PPP is the ratio of true cases to all test positives. Conversely, NPP is the ratio of true negative cases to all test negatives (Matier-Sharma et al., 1995). Predictor power reveals the likelihood of an individual belonging to a set group, given a set finding on a test. These statistics determine the probability that a target diagnosis is present on the basis of a test score.

Cutoff scores were calculated for group assignment, from which sensitivity, specificity, PPP and NPP were calculated. For any rating scale based on DSM-IV criteria, a score of 6 on either inattention or hyperactivity symptomotology must be present for valid diagnosis. However, DSM-IV only lists nine criteria for each domain. Therefore, cut-off scores to determine

malingerers were identified as greater than 6 (i.e., 7, 8, or 9) on either the inattentive sub-scale or the hyperactivity subscale of the ADHD Behavior Checklist. The Integrated Visual and Auditory CPT (IVA CPT) has a mean of 100 and a standard deviation of 15. Scores of less than 80 on either the Full Scale Response Control or the Full Scale Attention Quotient support a diagnosis of ADHD (Turner & Sandford, 1995). In adults, hyperactivity is a less salient characteristic of the disorder. Cut off scores were tabulated by taking the mid-point between the lower bound confidence interval for the ADHD scores and the upper bound confidence interval for the malingerer scores. Therefore, scores below 75 on the Full Scale Response Control were determined to signal malingering. Scores below 40 on the Full Scale Attention Quotient were determined to signal malingering. IVA cut-off scores were calculated as Full Scale Response Control Score plus Full Scale Attention Quotient Score. With detection of possible differences, correction scores can be developed for these instruments, thereby increasing their overall validity.

2. Method

2.1. Participants

Sixteen undergraduate students were recruited who had been previously diagnosed with ADHD by a trained psychiatrist in accordance with DSM criteria. Typically, a clinical interview and a self-report questionnaire were used for assessment. Some participants had been assessed using a CPT, however, none had been assessed with the IVA CPT. Therefore, the CPT used in this study represented a novel stimulus for each participant. Four participants were diagnosed with predominantly inattentive type and 12 were diagnosed with combined type. The ADHD volunteers were recruited through the University Office for Students with Disabilities.

Forty-four non-impaired volunteers were recruited from psychology classes and received class credit for their participation. These participants were randomly assigned to either the control or simulated malingerer condition. Data from one participant in the simulated malingerer group was not used because she admitted that she was too competitive to purposefully perform poorly on the CPT. Data from one participant in the control group was not used because a lengthy siren sounded throughout much of the CPT test. This left a control group of 19 and a malingerer group of 23. Demographics are listed in Figure 1.

2.2. Instruments

2.2.1. ADHD Behavior Checklist

The ADHD Behavior Checklist (Murphy & Barkley, 1996a) was formulated using the 18 items from the DSM-IV symptom list for ADHD. This checklist is administered twice with instructions to answer over the past six months (ADHD Behavior Checklist—Current) and then answer again reflecting upon childhood behavior between 5 and 12 years of age (ADHD Behavior Checklist—Retrospective). Items are stated to reflect first person reporting. Nine of the items refer to inattention and they are alternated with the nine items that refer to hyperactive–impulsive behavior. This is a Likert scale from 0 to 3 (Rarely or Never, Sometimes,

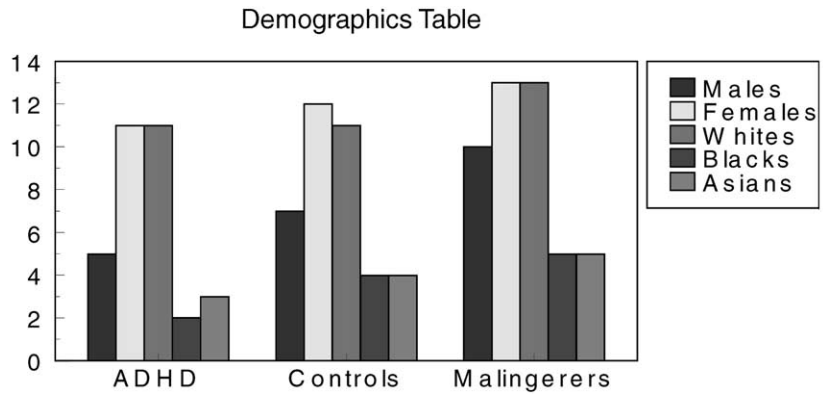

Fig. 1. Demographic table.

Often, or Very Often, respectively). A symptom is considered to be present if an answer of "Often" or "Very Often" is given.

Each scale (Current and Retrospective) produces six scores. The first three scores are summations of item scores for inattention, hyperactive–impulsive items, and the Total ADHD item list. For example, if a respondent checked "Very Often" (a Likert score of 3) for all items, the summation score for the 18 items or Total ADHD would be 54 and considered severely impaired. These scores reveal the severity of symptoms. A Total ADHD summation score above 28 would be within the threshold for clinical significance for a respondent between the ages of 17 and 29 years (Murphy & Barkley, 1996b).

The next three scores are symptom counts totaling the numbers of positively endorsed items for inattention, hyperactive–impulsive, and Total ADHD. Each item endorsed as either "Often" or "Very Often" is considered an endorsement of that symptom, and therefore is attached one point toward DSM-IV criteria. Symptom counts are used to determine if diagnostic criteria are met. Currently, six out of nine symptoms must be endorsed on either inattention or hyperactivity–impulsivity lists according to DSM-IV criteria.

Murphy and Barkley (1996b) found that cut-off scores of 6 were too stringent for adults. They recommended a cutoff score of 4 for hyperactivity and 5 for inattention for adults, 17–29 years old. Murphy and Barkley (1996a) collected normative data to determine the validity of this scale on 720 adults, ages 17–84 years. Within the general population, a significant declining result on all three summation scores for age was found, which supports the longitudinal studies that estimate a 30–50% continuation of symptoms into adulthood (Hill & Schoener, 1996; Roy-Byrne et al., 1997). Normative data collection with this scale showed a prevalence of statistically significant results within the general population of 1.3% for predominantly inattentive type ADHD, 2.5% for hyperactive–impulsive type, and .9% for ADHD—combined. This, again, is similar to results from longitudinal studies and meta-analysis.

Low but significant predictive validity ranging from −.12 to −.24 was found for the ADHD Behavior Checklist when compared to educational, occupational, and SES levels of high scorers verses low scorers among 720 adults (Murphy & Barkley, 1996a). Moreover, in a study of 172 ADHD adults and 30 controls, there was a .74 correlation on retrospective symptoms and

a .75 correlation on current symptoms in responding of self-reporters and parental reporters. Spousal association with ADHD adult self-reports on the ADHD Behavior Checklist was .64 for current symptoms (Murphy & Barkley, 1996c).

2.2.2. Integrated Visual And Auditory (IVA) CPT

The IVA CPT was developed by Sandford and Turner (1995). CPTs are computerized tests that consist of an ongoing series of stimuli, which the test-taker must monitor for the presence of predetermined targets. Stimuli may be presented auditorally or visually. The IVA is unique in that it presents both. IVA's targets consist of the numbers "1" (one) and "2" (two). After a brief practice period, the test lasts for 13 min.

Within the IVA there are two global scales, Full Scale Response Control and Full Scale Attention Quotient. Full Scale Response Control is a measure of impulsivity and commission errors. Prudence, Consistency and Stamina scores combine to determine to Full Scale Response Control global scale score. The Full Scale Attention Quotient measures attending and omission errors. Vigilance, Focus, and Speed scores combine to ascertain the Full Scale Attention Quotient. All scores are reported separately for the test-taker's auditory and visual modalities and then again, as a combined score.

Other scores are also calculated, such as comprehension. Low comprehension scores result from idiopathic errors of commission and omission, combined. These occur when there is no reason for a test taker to click a two, such as in the middle of a series of 2's or not click a one in a series of ones. Depressed scores can be an alarm for an invalid test. Statistically significant results are obtained with scores at or below 80, which is 1.5 standard deviations from the mean.

A study of IVA's validity showed a sensitivity of 92%, specificity 90% and concurrent validity with other instruments of 90% when compared to the TOVA CPT, the Gordon CPT, and the Connors Abbreviated Symptom Questionnaire. PPP was measured at 89% and NPP at 93% (Sandford, Fine, & Goldman, 1995). A follow-up study with children revealed a hit rate for correct classification of ADHD at 71% and a false positive rate at 36% (Edwards, 1998). A test–retest reliability study over a 4-week period using participants aged 5–70 years old revealed correlations for the Full Scale Response Control, Auditory and Visual Response Control ranging from .37 to .41, and correlations for the Full Scale Attention Quotient, Auditory and Visual Attention Quotient ranging from .66 to .75 (Seckler, Burns, Montgomery, & Sandford, 1995). Normative data was collected on 781 volunteers without impairment, ages 5–90 years (Turner & Sandford, 1995).

An IBM Think Pad laptop computer equipped with an auxiliary "mouse" and earphones was used for test administration.

2.3. Design and procedure

Letters were sent from the University's Office for Students with Disabilities directly to students who had been identified as having ADHD. The purpose of the letter was to make them aware of this study and the opportunity to volunteer. Interested students with ADHD contacted the researcher for details. Fifty percent of ADHD participants were currently prescribed stimulant medication. No ADHD participants were taking timed-release stimulants or

any other types of psychotropic medications. All ADHD participants refrained from taking stimulant medications for at least 12 h before testing.

Non-impaired volunteers were randomly assigned to either a control group condition or a simulated malingerer condition. All participants were tested individually for approximately 1 h. The control group was asked to fill out the ADHD Behavior Checklist—Current and Retrospective, with complete accuracy. They were then given the 20-min CPT. A research assistant was present for the administration of all measures. During administration of the IVA CPT, the research assistant sat quietly behind each test-taker, recording testing behaviors in accordance to administration manual guidelines. They were told that the test involves clicking a "mouse" whenever the number "1" (one) was seen or heard and not clicking when the number "2" (two) was seen or heard. These participants were asked to do their best on all tests. The ADHD group was given the same instructions except they were asked to answer the questionnaires as they would be without the aid of any medication.

Those in the simulated malingerer condition were given similar instructions as the control group, but they were asked to take the tests while playing the role of an adult with ADHD. They were told the symptoms of ADHD but given no suggestions of how to fake poor performance on the tests. Participants were encouraged to make their symptoms seem realistic by not faking too obviously. They were read the following scenario to encourage successful role-play:

> Imagine yourself having trouble in school. Things aren't working out as you planned but your counselor's only advice is to buckle down. You want to get some help. You hear about adult ADHD on a television show. When talking to a friend about it, your friend tells you that you could get special accommodations from the university, like untimed tests and rescheduling of exams if two are given on the same day. Your friend adds that the stimulant medications that are generally prescribed have minimal side effects and that you can take the medicine only when you need it, just for school. You decide to read a book on ADHD. You find out that some ADHD adults even collect social security benefits. You conclude that you have enough of the symptoms. You convince yourself that you have ADHD. You go to the doctor and you really want to get help. In order to get these benefits, you need to convincingly act like a person who has ADHD.

Since understanding and compliance with instructions was imperative, participants were asked to paraphrase these instructions prior to test administration. Upon completion of test administration, simulated malingerers were asked what strategies for faking that they had used and responses were recorded. Each participant was debriefed and encouraged to express any reactions to the experience.

3. Results

3.1. IVA CPT

To check the validity of the IVA CPT as a diagnostic tool, a one-way analysis of variance (ANOVA) was performed to determine if it could accurately distinguish between ADHD participants and controls as well as malingerers. As predicted, there was a significant difference in Full Scale Attention Quotient Scores, $F(2, 55) = 58.95$, $P < .001$. A Tukey post-hoc

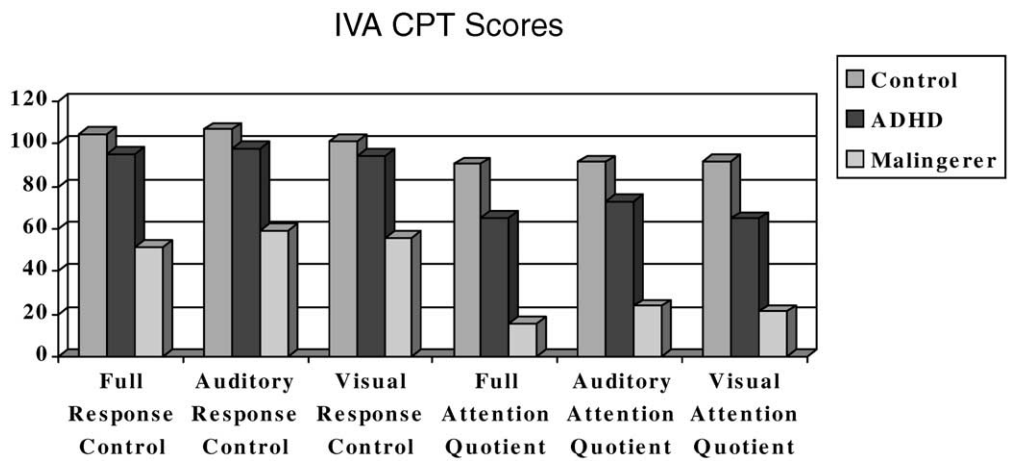

Fig. 2. IVA CPT scores.

test was then performed which determined that controls ($M = 90.4$, S.D. $= 16.1$) scored significantly better than the ADHD group ($M = 65.3$, S.D. $= 30.1$), $P = .005$ and the malingerer group ($M = 15.81$, S.D. $= 21.31$), $P < .001$. Moreover, the ADHD group scored significantly better than malingerers, $P < .001$ as seen in Figure 2.

Similarly, one-way ANOVA results revealed significant scoring differences between groups in auditory attention, $F(2, 55) = 62.47$, $P < .001$. Tukey post-hoc again revealed that controls ($M = 91.3$, S.D. $= 15.2$) scored higher than the ADHD group ($M = 72.9$, S.D. $= 29.1$), $P = .027$ and the malingerers ($M = 23.63$, S.D. $= 16.25$), $P < .001$, and those diagnosed with ADHD scored better than malingerers, $P < .001$ (Fig. 2).

Finally, one-way ANOVA revealed significant differences in results for visual attention, $F(2, 55) = 36.73$, $P < .001$. Tukey post-hoc showed that controls ($M = 91.5$, S.D. $= 16.2$) scored better than those with ADHD ($M = 64.8$, S.D. $= 33.5$), $P = .014$, and simulated malingerers ($M = 21.10$, S.D. $= 28.82$), $P < .001$. The ADHD group performed significantly better than malingerers, as well, $P < .001$. Table 1 shows that subscale scores on Visual Focus, Visual Vigilance, Auditory Vigilance, Visual Comprehension, and Auditory Comprehension were all significantly lower for the ADHD group when compared to controls. There were no significant differences between the ADHD group and controls in the Full Scale Response Control Scores, or any of the sub-scales that combine into that global score except for Auditory Consistency, $t(33) = 5.32$, $P < .05$. Figure 2 shows these results.

As hypothesized, 81% of IVA's sub-scales showed significant differences between the ADHD group and malingerers. Sub-scale scores revealed that malingerers scored deviantly as compared to the ADHD and control groups in 10 areas: Auditory Consistency, $F(2, 55) = 25.20$, $P < .01$; Visual Consistency, $F(2, 55) = 19.01$, $P < .001$; Auditory Focus, $F(2, 55) = 21.28$, $P < .001$; Visual Focus, $F(2, 55) = 24.09$, $P < .001$; Auditory Prudence, $F(2, 55) = 61.56$, $P < .001$; Visual Prudence, $F(2, 55) = 29.03$, $P < .001$. Malingerers could not successfully fake Auditory Consistency ($M = 73.8$, S.D. $= 16.8$), Visual Consistency ($M = 65.7$, S.D. $= 25.9$), Auditory Focus ($M = 81.5$, S.D. $= 16.7$), Visual Focus ($M = 53.8$,

Table 1
Comparison scores for IVA CPT

	Control		ADHD		Malingerer			
	M	S.D.	*M*	S.D.	*M*	S.D.	*F*	*P* (two-tail)
Full Attention Quotient	90.4	16.1	65.3	30.1	15.8	21.3	58.95	0
Auditory Attention Quotient	91.3	15.2	72.9	29.1	23.6	16.2	62.47	0
Visual Attention Quotient	91.5	16.2	64.8	33.5	21.2	28.8	36.73	0
Full Response Control	104.4	11.4	95.2	23.1	51.4	33.8	26.12	0
Auditory Response Control	106.7	10.8	97.6	18.8	58.8	24.4	36.39	0
Visual Response Control	101.0	12.2	94.5	23.6	55.7	36.6	17.31	0
Auditory Consistency	107.0	10.9	95.4	17.7	73.8	16.8	25.20	0
Visual Consistency	101.6	12.4	93.7	16.7	65.7	25.9	19.01	0
Auditory Stamina	102.6	13.5	106.1	19.0	109.2	45.2	.12	.886
Visual Stamina	104.1	11.8	105.0	17.1	108.0	39.6	.23	.793
Auditory Focus	108.2	10.2	99.7	11.8	81.5	16.7	21.28	0
Visual Focus	97.8	14.2	83.5	18.0	53.8	27.7	24.09	0
Auditory Prudence	103.1	10.2	95.3	15.1	32.0	32.5	61.56	0
Visual Prudence	98.0	14.2	90.6	22.0	38.9	37.1	29.03	0
Auditory Vigilance	97.7	19.3	73.9	38.1	4.9	16.3	78.37	0
Visual Vigilance	96.4	24.9	73.4	38.1	19.2	32.1	31.01	0
Auditory Comprehension	101.2	15.9	79.9	34.6	15.6	25.2	62.96	0
Visual Comprehension	95.8	23.4	63.3	43.9	10.8	19.5	45.18	0

S.D. = 27.7), Auditory Prudence ($M = 32.0$, S.D. = 32.5), or Visual Prudence ($M = 39.0$, S.D. = 37.1) compared to those diagnosed with ADHD or controls. All post-hoc differences were significant at the .001 level. Comparison ADHD scores are listed on Table 1.

The four most compelling discrepancies that differentiated between Malingerers and those with ADHD and/or controls were on the vigilance and comprehension sub-scales. One-way ANOVA highlighted vast discrepancies on Auditory Vigilance, $F(2, 55) = 78.37$, $P < .001$; Visual Vigilance, $F(2, 55) = 31.01$, $P < .001$; Auditory Comprehension, $F(2, 55) = 62.96$, $P < .001$; and Visual Comprehension, $F(2, 55) = 45.18$, $P < .001$. Tukey post-hoc analyses revealed that malingerers overcompensated deficits on Auditory Vigilance ($M = 4.9$, S.D. = 16.3), Visual Vigilance ($M = 19.2$, S.D. = 32.2), Auditory Comprehension ($M = 15.6$, S.D. = 25.2), and Visual Comprehension ($M = 10.8$, S.D. = 19.5). All differences are significant at the .001 level.

Post-hoc analysis was done to determine which strategies the malingerers said that they used to fake ADHD. All participants reported using more than one strategy. Sixty-one percent reported a strategy of general inattention, while 43% ignored visual stimuli and only 17% ignored auditory stimuli. Fifty-seven percent produced commission errors, while 35% reported deliberate omission errors and 9% used general random responding. Thirty percent double clicked the mouse to show hyperactivity, while 13% produced general fidgeting behavior. Nine percent were slow to respond and 9% were deliberately slower in responding at the end of the test than at the beginning.

Impairment indexes to identify malingerers were formulated based on attention quotients plus response control scores. Cut-off scores were derived by taking the mid-point between the

lower bound confidence interval for the mean ADHD score and the upper bound confidence interval for the mean malingerers score. Using Full Scale Response Control < 75 + Full Scale Attention Quotient < 37 for a combined score < 112 base rates were very good; sensitivity was .81, specificity .91, NPP .88, and PPP .87.

However, by using only Auditory Response Control < 74 + Auditory Attention Quotient < 44 for a combined score < 118, correct identification was even higher; sensitivity .94, specificity .91, PPP .88, and NPP .95. Using visual only did not change the results for the ADHD group at all but it did add five more false positives to the malingerer group while only correctly identifying one that had been previously mislabeled. Table 2 shows these results.

3.2. ADHD Behavior Checklist—Retrospective

Results suggest that malingerers were able to successfully fake their reports of childhood symptoms of ADHD, as hypothesized. While one-way ANOVAs showed overall significant

Table 2
Impairment Indexes for IVA CPT

	ADHD	Mallinger	Total
(A) Full Scale Response Control > 75 + Full Scale Attention Quotient > 37			
Test+	13	2	15
Test−	3	21	24
Total	16	23	
Sensitivity	81%		
Specificity	91%		
PPP	88%		
NPP	87%		
(B) Auditory Response Control > 74 + Auditory Attention Quotient > 44			
Test+	15	2	17
Test−	1	21	22
Total	16	23	
Sensitivity	94%		
Specificity	91%		
PPP	88%		
NPP	95%		
(C) Visual Response Control > 76 + Visual Attention Control > 40			
Test+	13	6	19
Test−	3	17	20
Total	16	23	
Sensitivity	81%		
Specificity	74%		
PPP	68%		
NPP	85%		

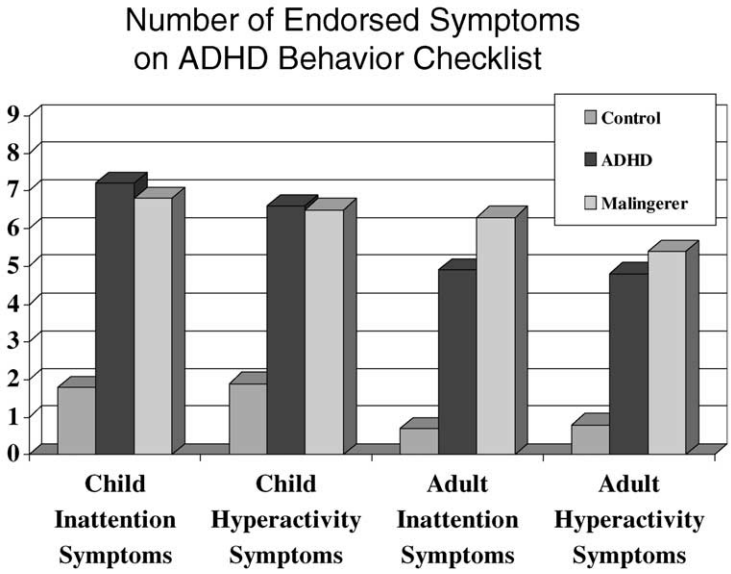

Fig. 3. Number of endorsed symptoms on ADHD Behavior Checklist.

differences for each sub-scale, Tukey post-hoc results revealed the only differences came from the control group scoring significantly lower on all measures relative to both the ADHD group and the malingering group as seen in childhood (Retrospective) scores in Figure 3. The ADHD and malingerer groups were not statistically different on any of the ADHD Behavior Checklist—Retrospective scales, inattention total (P = ns), hyperactivity total (P = ns), inattention symptom counts (P = ns), or hyperactivity symptom counts (P = ns). Table 3 presents the means and standard deviations for these scales.

Table 3
ADHD Behavior Checklist (Retrospective and Current) means and standard deviations

	Inattention total score		Hyperactivity total score		Inattention symptom counts		Hyperactivity symptom counts	
	M	S.D.	*M*	S.D.	*M*	S.D.	*M*	S.D.
Retrospective								
Control	6.9	5.2	6.7	5.1	1.8	2.5	1.9	2.1
ADHD	19.8	4.4	18	5.3	7.2	1.7	6.6	2.2
Malingerer	18.7	5.6	18.8	6.1	6.8	2.5	6.5	2.4
Current								
Control	4.9	3.6	5.3	3.4	.7	1.2	.8	1.1
ADHD	14.7	4.7	14.4	5.3	4.9	2.4	4.8	2.2
Malingerer	17.9	5.5	15.5	5.6	6.4	2.6	5.4	2.5

3.3. ADHD Behavior Checklist—Current

As hypothesized, the ADHD Behavior Checklist—Current scale could be faked. When participants were asked to rate their current symptoms, as an adult, after significant differences in one-way ANOVAs were analyzed using Tukey post-hoc tests, results showed that only the control group scored significantly lower than both the ADHD group and malingerers (Fig. 3). The malingerers were not statistically different than the ADHD groups on all four scales, inattention total (P = ns), hyperactivity total (P = ns), inattention symptom counts (P = ns) and hyperactivity symptom counts (P = ns). Table 3 shows the mean and standard deviations for this scale.

Even though the ADHD Behavior Checklist was successfully faked, an impairment index to identify malingerers was attempted by using scores from the adult scales. Murphy and Barkley (1996a) state that a score of 6 out of 9 for inattention and/or hyperactivity in symptom counts is 2.5–3 standard deviations above the mean and greater than the 99th percentile for behaviors

Table 4
Impairment indexes for ADHD Behavior Checklist—Current

	ADHD	Malingerer	Total
(A) Inattention symptoms > 6			
Test+	12	9	21
Test−	4	14	18
Total	16	23	
Sensitivity	75%		
Specificity	61%		
PPP	57%		
NPP	78%		
(B) Hyperactivity symptoms > 6			
Test+	11	14	25
Test−	5	9	14
Total	16	23	
Sensitivity	69%		
Specificity	39%		
PPP	44%		
NPP	64%		
(C) Inattention symptoms > 6 or hyperactivity symptoms > 6			
Test+	11	13	24
Test−	5	10	15
Total	16	23	
Sensitivity	69%		
Specificity	43%		
PPP	46%		
NPP	67%		

in the normal adult population. It is for this reason that scores greater than 6 (in other words 7, 8, and 9) were used to identify malingerers. Correct identification rates were very low, lower than chance alone for specificity and PPP using the criteria of inattention and hyperactivity combined. A sensitivity rate of .69, a specificity of .43, PPP of .46, and NPP of .67 were found as seen in Table 4.

4. Discussion and conclusions

The IVA CPT adequately distinguished adults with ADHD from non-ADHD, control adults. The lack of differences on the Full Scale Reaction Control global score make sense considering the reported changes in symptomotology as those with ADHD enter adulthood (Murphy & Barkley, 1996a, 1996b, 1996c; Toone & Van Der Linden, 1997) such as personal disorganization, lack of self-control, poor task persistence, insufficient time management and lack of goal-directed behavior while hyperactivity and fidgeting (which directly effect Reaction Control) diminish.

The results of this study suggest that through the use of impairment indexes, a CPT can discriminate simulated malingerers from those with a valid diagnosis of ADHD while a self-report scale alone cannot discriminate with the high accuracy level necessary for clinical use.

From the results, it is clear that the DSM criterion of the presence of 6 out of nine symptoms is too strict for the average adult with ADHD. On the ADHD Behavior Checklist—Current scale, mean scores for the ADHD group did not fall in the clinical range according to DSM criteria, whereas the mean scores for malingerers did. This finding may lend support to Murphy and Barkley's (1996a) assertion that DSM adult criteria are too stringent. These researchers recommend a cut-off score of 4 for hyperactivity and 5 for inattention for identification of ADHD (Murphy & Barkley, 1996a).

Malingerers, however, who typically overcompensate skill deficits, did easily meet the DSM-IV criteria without providing any cause for doubt to a diagnostician. Scales have been found imperfect before because of inability to determine clinical significance (Murphy & Barkley, 1996a). If a severe case of ADHD can result in a score of 8 or 9, then there is no score that can be definitive of malingering. Impairment indexes could not be tabulated that would predict correct identification any better than chance for the ADHD Behavior Checklist.

In some instances, wording on the ADHD Behavior Checklist may be misleading. To assess overt hyperactive behavior, this scale uses the wording, "[I] feel 'on the go' or 'driven by a motor'," which seems applicable to many people in today's society. In fact, analysis of variance showed that this item did not distinguish between any of the three groups, $F(2, 55) = 1.91$, $P =$ ns. On the other hand, similar ADHD self-report scales phrase the same DSM characteristic as, " I feel fidgety, restless or 'hyper'." The ADHD Behavior Checklist, however, produced significantly lower scores, well below the clinical range, for the control group, proving to be a reliable and valid measure.

Unlike the self-report scales' inability to provide clinical significance, the IVA CPT has a mean of 100, with a score of 80 at 1.5 standard deviations, as a clinical score. Scores in the 50's and below are typical of malingerers. These scores are well below three standard deviations from the mean. CPTs give scale scores that discriminate malingerers. Further, the subtlety

of scale scores such as variance in reaction time shown in focus and consistency scores are hidden items of which malingerers would not be aware.

The strength of the auditory predictors to differentiate malingerers from those with ADHD are especially interesting given the fact that far more (43%) simulated malingering participants reported ignoring visual stimuli than those ignoring auditory stimuli (17%). This reported technique supports the finding in Table 1 of typically lower visual mean scores for malingerers. Both the ADHD group and malingerers produced lower visual mean scores for response control, attention, consistency, focus, and comprehension. However, less variability in scoring was present for malingerers in auditory scores for response control, attention, consistency, focus, and reaction time. Additionally, the ADHD group had less variability in auditory scores for response control, attention, focus, prudence, vigilance, reaction time and comprehension. It appears that the variability of scoring weighted more heavily in correct identification through impairment indexes than did average mean scores.

The present study has limitations. First, the malingerers were undergraduate psychology students. Replications of this study are needed with other populations, other versions of CPT tests (TOVA, Connors, Gordon) and other ADHD diagnostic tools for cross-validation of these results. An ideal sample would be difficult to formulate, since malingerers seeking financial compensation and/or drugs are not going to admit they are malingering.

Second, a strict ADHD—combined group would provide stronger results. This study used a group that was 40% ADHD—predominantly inattentive type. Further, the ADHD participants used for this study were diagnosed, in part, by scores on different self-report scales. Some had been exposed to other versions of CPTs. Future studies in which ADHD participants were not diagnosed using these measures may provide stronger results.

Another consideration would be the sophistication of methods used by participants who are instructed to malinger but not taught how. The methods used by the simulated malingerers in the present study may not be as efficacious as those employed by real malingerers. Future research may want to inform subjects of various techniques to see if differences in CPT scores can still be detected.

In summary, as hypothesized, results do indicate that the CPT shows greater sensitivity to malingering than self-report scales. Such cases of malingering drain the Social Security and Disability System of the necessary funds to help worthy candidates. Fraudulent claims may be alleviated with the inclusion of computerized performance testing during assessment of adult ADHD.

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