The Relationship of Noncredible Performance to Continuous Performance Test Scores in Adults Referred for Attention-Deficit/Hyperactivity Disorder Evaluation

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Abstract

Diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) in adults is complicated by the fact that neither symptom report nor neuropsychological findings are specific to the diagnosis. Few studies have addressed the possibility that noncredible performance influences the effectiveness of neuropsychological test findings in ADHD assessment. The present study utilized archival data on Conner’s Continuous Performance Test (CPT) scores from young adults referred for concerns about ADHD at two different universities, who were divided into three groups: (1) those who failed a measure of noncredible performance (the Word Memory Test; WMT), (2) those who met diagnostic criteria for ADHD, and (3) controls with psychological symptoms who did not meet the diagnostic criteria for ADHD. More individuals who failed the WMT were also clinically impaired on the CPT than individuals diagnosed with ADHD and individuals with psychological symptoms, who could not be distinguished from each other. Results demonstrate the importance of assessing for noncredible performance before interpreting neuropsychological test scores in ADHD assessment. Results also emphasize the importance of considering other disorders that can impact CPT performance prior to interpreting CPT impairment as indicative of ADHD.

Keywords: Malingering; Attention deficit disorder with hyperactivity; Neuropsychological assessment; Continuous performance tests

Introduction

Adults frequently present for psychological or neuropsychological evaluation with concerns that they have Attention-Deficit/Hyperactivity Disorder (ADHD). A problem only recently recognized in ADHD assessment and not addressed in most existing adult ADHD research is the effect of noncredible performance on evaluation for ADHD. Neuropsychological research has not identified consistent findings in adults with ADHD, and neuropsychological impairments are not necessarily sensitive to nor specific to the disorder (Nigg, 2005). For example, variations in Continuous Performance Tests (CPTs) are among the most commonly used neuropsychological paradigms in ADHD (Cohen & Shapiro, 2007) and assess several variables of attentional control and behavioral response, including vigilance (sustained attention), perceptual discrimination, and response inhibition. However, reviews show inconsistent results on CPT measures, with limitations to both sensitivity and specificity noted for both child and adult ADHD assessment (Advokat, Martino, Hill, & Gouvier, 2007; Barkley, 2006; Cohen & Shapiro, 2007; Epstein, Conners, Sitarenious, & Erhardt, 1998; Riccio, Reynolds, & Lowe, 2001; Solanto, Etefia, & Marks, 2004).

Some of the inconsistency in neuropsychological findings in ADHD may be related to the fact that the role of noncredible responding has not been adequately addressed in studies to date. Individuals being evaluated for possible ADHD may be motivated to perform in a noncredible manner for secondary gain, including prescriptions for psychostimulant medications and receipt of academic/work accommodations (i.e., malingering; Alfano & Boone, 2007; Sullivan, May, & Galbally, 2007). It
is important to note that noncredible performance may also occur for reasons other than malingering, but such a causal attribution for noncredible performance is not necessary for determining that performance is noncredible or invalid. Noncredible representation of current or past symptoms of ADHD is made easier by the face validity of most ADHD symptom report measures and their lack of validity subscales (Quinn, 2003), as well as the fact that the symptoms associated with ADHD are well known (Conti, 2004; Murphy, 1994). Studies show that self-report ADHD measures are vulnerable to the effects of simulated malingering (Booksh, Pella, Singh, & Gouvier, 2010; Harrison, Edwards, & Parker, 2007; Jackimowicz & Geiselman, 2004; Quinn, 2003). In clinical samples, failure on measures of noncredible responding is associated with high endorsement of ADHD symptoms, rendering individuals who fail such measures difficult to distinguish clinically from individuals with ADHD (Suhr, Hammers, Dobbins-Buckland, Zimak, & Hughes, 2008; Sullivan et al., 2007). Noncredible performance also includes performing in an invalid manner on neuropsychological tests, which likely contributes to the poor diagnostic sensitivity of neuropsychological tests in ADHD, just as in other disorders (Green, Rohling, Lees-Haley, & Allen, 2001). Studies have shown that simulated malingers perform worse than individuals diagnosed with ADHD on CPT measures (Booksh et al., 2010; Leark, Dixon, Hoffman, & Huynh, 2001; Quinn, 2003), but not working memory measures (Booksh et al., 2010), with inconsistent effects of malingering on processing speed tasks (Booksh et al., 2010; Harrison et al., 2007). Individuals asked to simulate ADHD, however, are identifiable using measures designed to assess for noncredible performance (Frazier, Frazier, Busch, Kerwood & Demaree, 2008).

In a clinical sample of adults referred for either ADHD or learning disability assessment, failure on a common measure of noncredible performance (Word Memory Test, WMT; Green, 2005) was related to poorer performance on intelligence and memory measures (Sullivan et al., 2007). In another clinical sample, individuals who referred themselves for ADHD assessment but failed the WMT performed significantly worse on measures of memory, working memory, and inhibition, but not processing speed, when compared with individuals diagnosed with ADHD and those who referred themselves for ADHD evaluation but who had psychological symptoms/diagnoses (Suhr et al., 2008). Thus, research suggests that individuals behaving in a noncredible manner can easily perform poorly on other cognitive measures, in fact sometimes more poorly than individuals who actually have diagnoses.

The purpose of the present study was to examine the relation of noncredible responding as assessed by the WMT to performance on the Conner’s CPT in young adults self-referred for evaluation of possible ADHD. We hypothesized that individuals who failed the WMT would perform worse on CPT measures when compared with those diagnosed with ADHD and to psychological controls.

Materials and Methods

Participants

Participants (N = 101) were drawn from two samples. The first sample was 33 participants from the 85 individuals in Suhr and colleagues (2008) who met criteria for the current study groups (see below), were 40 years of age or under, and had completed the CPT. The second sample was a sample of 68 cases seen within a campus counseling services’ assessment clinic over the past 5 years who met criteria for the current study groups. Some but not all of those individuals were included in Sullivan and colleagues (2007). Note that neither previous study reported on CPT data. There were 50 men in the current sample, and six individuals who reported race/ethnicity status other than Caucasian (three African American, two Hispanic, one biracial). The average age was 22.3 (range 18–40 years) and the average years of completed education was 13.8, with a range 12–20 years. Participants were divided into three groups based on de-identified records review.

Individuals who failed at least two of the first four subtests of the WMT using norms available for the test and who did not show the General Memory Impairment Profile (with one exception) were assigned to the Noncredible group (n = 22). Of note, this represented a 22% failure rate on the WMT using this stringent definition in the total sample. [Although the WMT manual (Green, 2005) suggests failure of any of the first three subtests is indicative of noncredible performance, we set a more stringent standard for the present analyses to minimize concerns over false positives. An additional 11 people who failed only one WMT subtest were removed from the sample reported here, 2 of whom were originally diagnosed with ADHD and 1 of whom was originally diagnosed with a mood disorder at their respective clinics; inclusion of the 11 in the final sample would actually change the fail rate on the WMT to 33%.] Of the 22, 11 failed all four subtests, 6 failed three subtests, and 5 failed two subtests. It is important to note that we defined this group based on evidence for noncredible performance, rather than using any formal diagnostic criteria for malingering per se; although in many (but not all cases) there were clear external incentives for ADHD diagnosis, we were unable with certainty to attribute the noncredible performance to any particular “cause” in the present study.

To be included in the ADHD group (n = 27), individuals (1) showed evidence of previous impairment in childhood related to ADHD symptoms, based on at least two pieces of evidence (self-report, parent report, school records, prior medical/
psychological records), (2) evidenced clinically high ADHD symptoms at the present time through both self-report (including but not limited to the Conner’s Adult ADHD Rating Scale, Conners, Erhardt, & Sparrow, 1998) and either collateral report or behavioral observation during the evaluation, and (3) passed the WMT. Based on their report of childhood and adult symptoms, 78% (n = 21) met criteria for predominantly inattentive subtype. Of note, 37% (n = 10) were also diagnosed with and/or receiving treatment for another psychological disorder (usually a mood or anxiety disorder) at the time of the evaluation. Also of note, 46% (n = 13) were prescribed medication for ADHD at the time of the evaluation. Individuals who were taking stimulants were, with physician consent, not taking the stimulants while they completed their neuropsychological testing. In addition, individuals who were taking stimulants were instructed to complete self-report ADHD items and answer interview questions based on their typical behavior, rather than their behavior while on medication, as part of their full evaluation.

To be included in the Psychological Symptom group (n = 41), individuals (1) had no evidence of impairment in childhood related to ADHD complaints—note virtually all individuals in this group dated the onset of any current ADHD symptoms to high school or college, (2) evidenced current diagnosis of/treatment for a non-ADHD psychological condition independent of our clinical evaluation OR in some cases, had not yet been diagnosed but met diagnostic criteria for a psychological disorder, usually major depressive disorder, based on diagnostic interviewing and psychological testing at the time of their evaluation, and (3) passed the WMT.

**Measures**

Individuals presenting for ADHD evaluation in the clinics from which participants were drawn typically received a comprehensive neuropsychological evaluation, although not all individuals received the identical set of measures, nor did they receive measures in any particular order at either site. Measures of interest to the present study’s hypotheses are described in detail below.

Conners’ CPT-II (Conners & MHS Staff, 2000) is a computerized attention task in which an individual is asked to respond to all letters flashing on the computer screen except for a target letter; the task includes several blocks of trials with different interstimulus intervals. Dependent variables for the present study were T scores relative to a normative group for omission errors, commission errors, discriminability (ability to discriminate targets from nontargets), hit reaction time, variability of reaction time (hit reaction time standard error), perseverations, and reaction time changes over time (hit reaction time block change, hit reaction time interstimulus interval change).

The WMT (Green, 2005) assesses noncredible cognitive responding. There is strong evidence for the validity of the WMT as a measure of noncredible responding in a variety of clinical samples, including psychiatric patients, disability claimants, and adults with mild and severe brain injury, as well as other neurological conditions (Grote & Hook, 2007). The split-half reliability of the WMT falls between $r = .86$ and $r = .90$ (Green, 2005). Within a given test session, subtests on the WMT that assess for noncredible performance correlate highly (Green, 2005). The WMT shows generally good concordance with other measures of noncredible responding (Green, 2005; Groot & Hook, 2007; Suhr et al., 2008) and accurately classifies individuals simulating brain injury (Tan, Slick, Strauss, & Hultsch, 2002), as well as individuals simulating ADHD (Booksh et al., 2010). In the present study, the first four subtests of the WMT, which have been best validated as measures of noncredible responding (Green, 2005), were used to create study groups. The General Memory Impairment Profile was examined due to its potential value in examining false positives on the WMT (Green, Flaro & Courtney, 2009; Harrison & Edwards, 2010).

**Results**

The three groups were not different from one another in age, $F < 1$, education, $F < 1$, or gender, $\chi^2(2) < 1$.

The three groups performed differently on many aspects of the CPT, including omissions, $F(2,89) = 3.61, p = .03$, commissions, $F(2,89) = 5.48, p = .01$, reaction time, $F(2,89) = 5.92, p = .004$, reaction time variability, $F(2,89) = 11.70, p < .001$, discriminability, $F(2,89) = 3.81, p = .03$, and hit reaction time change over interstimulus intervals, $F(2,89) = 9.92, p < .001$. Groups were not different in perseverations, $F(2,89) = 2.57, p = .08$, or hit reaction time change over blocks, $F(2,89) = 1.02, p = .37$ (Table 1). The Bonferroni corrected post hoc tests showed that, in every case, overall group differences were due to significant differences between the Noncredible group and the other groups. Specifically, the Noncredible group performed much worse than the Psychological Symptom group on all variables except perseverations and hit reaction time change over blocks. However, the Noncredible group was difficult to distinguish from the ADHD group, performing worse than the ADHD group on only two subtests (reaction time variability and reaction time change over interstimulus intervals). Of note, the ADHD group was not different from the Psychological Symptom group on any CPT variables; effect sizes
In order to examine differences in clinical performance on the CPT among study groups, we defined impairment on any of the CPT variables as performance of greater than $T = 60$ on any subscale (a decision guided by the clinical manual for the test). The three groups differed significantly in how many subscales fell in the impaired range, $F(2, 98) = 8.44, p < .001$, with the Noncredible group performing in the impaired range on a significantly larger number of subscales than the ADHD group, $p = .02$, and the Psychological Symptom group, $p = .001$, but with no difference between the ADHD group and the Psychological Symptom group, $p = .73$ (Table 1). Table 2 shows the likelihood of group membership, based on the number of CPT subscales falling at $T = 60$ or greater. The CPT manual also suggests that performance greater than $T = 60$ on two or more subtests is potentially indicative of clinical problems. Therefore, we further coded each participant as “clinically impaired” overall on the CPT based on this criterion. The three groups varied significantly in the proportion of individuals who performed in the clinically impaired range on the CPT, $\chi^2(2) = 8.85, p = .01$, with 77% of the Noncredible group meeting this criterion, when compared with 44% of the ADHD group and 39% of the Psychological Symptom group.

### Discussion

As hypothesized, individuals who failed the WMT performed worse on average on several of the CPT subscales than individuals with psychological conditions, but contrary to expectations, they did not perform differently on average than individuals in the ADHD group. Thus, using mean scores, it would be difficult to distinguish performance on the CPT in individuals performing noncredibly from individuals with ADHD. Furthermore, using a clinical criterion, significantly more of the individuals who failed the WMT would have been identified as being clinically impaired on the CPT than both the ADHD and the Psychological Symptom groups. Overall, the pattern of findings is consistent with that seen in studies of individuals simulating ADHD on continuous performance tasks, who often perform globally worse than control groups (Booksh et al., 2010; Leark et al., 2001; Quinn, 2003). The present results provide additional evidence that the CPT is vulnerable to noncredible performance and that noncredible performance on the CPT can be difficult to distinguish from actual ADHD.
Of note, the ADHD group was not distinguishable from the Psychological Symptom group on CPT measures using either mean scores or clinical cutoffs. These results are in contrast to those of Advokat and colleagues (2007), who assessed a similar undergraduate clinical sample and found that individuals with ADHD made more CPT errors of omission, had longer response times, and showed greater variability in responding than individuals with psychological symptoms or disorders, but only in nonparametric analyses. However, individuals with ADHD did not perform differently than those with other learning or cognitive disorders on the CPT. Furthermore, the investigators did not control for noncredible responding in their design. In fact, one of the reasons for the inconsistent findings in the broader CPT literature may well be because there was no control for noncredible performance in those studies.

One reason for the similarity in performance between the ADHD and the Psychological Symptom groups in the present study may be the high rate of psychological comorbidity in the ADHD sample, and individuals with psychiatric concerns often have attention and concentration complaints (Harrison, 2004; McCann & Roy-Byrne, 2004; Roy-Byrne et al., 1997). In fact, our findings are consistent with other literature suggesting that poor CPT performance is not specific to ADHD (Advokat, Martino, Hill, & Gouvier, 2007; Cohen & Shapiro, 1998; Epstein et al., 1998; Riccio et al., 2001; Solanto et al., 2004). In addition, the psychological symptom controls had all referred themselves specifically for concerns that they might have ADHD. In any event, similarity in performance between these groups is consistent with data showing that neuropsychological tests are not generally useful in diagnosis of ADHD (Stefanatos & Baron, 2007). It should be pointed out, however, that the same criticism can be drawn about self-reported ADHD symptoms. Diagnosis of ADHD in adults is complicated by difficulty establishing whether childhood symptoms and dysfunction were present outside of self-report, although such evidence is crucial to diagnosis (Murphy & Schachar, 2000). In addition, it is difficult to document whether past or current self-reported symptoms are related specifically to ADHD or a myriad of other potential disorders that can cause ADHD-like complaints (Harrison, 2004; McCann & Roy-Byrne, 2004; Roy-Byrne et al., 1997). Further complicating the matter, ADHD-like symptoms are reported with a high base rate in the nonclinical population (DuPaul et al., 2001; Faraone & Biederman, 2005; Heiligenstein, Conyers, Berns, Miller, & Smith, 1998; Lewandowski, Lovett, Codding, & Gordon, 2008; Murphy & Barkley, 1996; Weyandt, Linterman, & Rice, 1995), even when assessed using structured clinical interviews rather than self-report measures (Mannuzza, Klein, Klein, Bessler, & Shroot, 2002). It is possible that poor diagnostic specificity for both symptom report and neuropsychological tests is related to the lack of control for noncredible presentations in the vast majority of adult ADHD studies.

The present study was limited in that the measure of interest in analyses may have played a role in the diagnosis of the participants. It is noteworthy that, for the present analysis, data were taken systematically from clinical charts and each participant was reviewed for inclusion for the present study based on the criteria for group placement given above; in some cases, this led to a different group placement than may have been made at the time of the evaluation (e.g., individuals who failed only one WMT subtest were not included in the study groups regardless of diagnosis given at the time of their evaluation). Because this was an archival data set, there was no control for which tests were administered or in what order (or on what day of testing), which is also a study limitation. Furthermore, although individuals who had been taking ADHD medications were asked to refrain (with physician’s permission) from taking them at the time of the neuropsychological evaluation at both sites, and at one site, individuals were specifically asked to refrain from alcohol, drugs, and caffeine intake at least 16 h prior to assessment, there was no careful control for or assessment of adherence to these restrictions. In addition, as the sample was predominantly young adults in the early years of undergraduate education, the results may not generalize to broader samples of adults referring themselves for concerns about ADHD.

A final limitation was the predominant reliance on the WMT for placing individuals in the Noncredible group. This measure was the one with the most overlap in the two samples combined for the present study, although in each site, other measures of noncredible performance (freestanding, embedded, noncredible symptom report measures) were included in any given individual’s assessment. By setting more stringent criteria for failure of the WMT than is called for in the manual, however, we sought to limit the effect of reliance on only the WMT for placing individuals into the Noncredible group. In addition, we were not using the WMT to diagnose malingering, but rather to identify individuals who were behaving in a noncredible fashion. Furthermore, the effort subtests of the WMT are passed by adults with intellectual disability (Brockhaus & Merten, 2004), children with severe developmental disabilities (Green & Flaro, 2003), dementia patients (P. Green, personal communication, July 5, 2010) and adults with amnesia related to hippocampal lesions (Goodrich-Hansaker & Hopkins, 2009); these populations represent individuals with severe real-word dysfunction requiring assistant and supervision in daily living, quite different from the present population of independently living individuals primarily attending university and self-presenting for evaluation. Nevertheless, the present authors encourage use of multiple measures of noncredible responding during clinical evaluations, in addition to considering evidence for external motivations for behaving noncredibly, before concluding that someone is consciously presenting in a noncredible fashion in order to obtain external gain (i.e., malingering).
Future studies should create Psychological Control groups based on specific diagnoses (e.g., mood disorders, anxiety disorders) in order to see whether there is some specificity to CPT performance in specific psychological disorders that might be helpful in differential diagnosis of ADHD in adults. Similarly, in future work, neuropsychological profiles associated with specific ADHD subtypes should be examined (once noncredible performance has been controlled for), although studies do suggest that both inattentive and combined ADHD subtypes show deficits on some CPT subscales (Egeland, 2007).

Overall, present results are consistent with existing literature on the importance of assessing for noncredible performance in order to understand and interpret neuropsychological test data. Our findings are consistent with prior studies showing the large effects of noncredible performance on neuropsychological test findings in other populations (Green et al., 2001; Iverson, 2005; Ord, Boettcher, Greve, & Bianchini, 2010). There are major potential societal implications when lack of control for noncredible performance leads to misdiagnosis of ADHD. There is evidence of a substantial increase in diagnosis of undergraduates with ADHD and in the number of undergraduates seeking ADHD accommodations and services for ADHD (National Center for Educational Statistics, 1999). As these services are expensive for universities to administer and provide, provision of such services to individuals who are inaccurately diagnosed with ADHD could harm those who legitimately need access to limited resources. Furthermore, provision of accommodations such as extended test time or priority registration to individuals inaccurately diagnosed with ADHD is unfair to other college students who do not have ADHD and who do not receive such services. There is also growing evidence of misuse and abuse of stimulant medication on college campuses across the nation, with some evidence that the main suppliers are individuals with ADHD diagnoses (Hall, Irwin, Bowman, Frakenberger, & Jewett, 2005; McCabe, Knight, Teter, & Wechsler, 2005; Teter, McCabe, Cranford, Boyd, & Guthrie, 2006; White, Becker-Blease, & Grace-Bishop, 2006). Thus, the possible overdiagnosis of young adults with ADHD is a "legitimate concern" (Murphy, 1994); at least some of this overdiagnosis might be addressed by assessing for noncredible effort during evaluation.

**Conflict of Interest**

None declared.

**References**


