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Ability of College Students to Simulate ADHD on Objective Measures of Attention

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Objective: The authors examined the ability of college students to simulate ADHD symptoms on objective and self-report measures and the relationship between knowledge of ADHD and ability to simulate ADHD. **Method:** Undergraduate students were assigned to a control or a simulated ADHD malingering condition and compared with a clinical AD/HD group. The authors used several clinical attentional measures and symptom validity tests to differentiate experimental groups via a series of multivariate procedures. **Results:** Simulators successfully feigned ADHD symptoms on a retrospective self-report measure. Moreover, knowledge of ADHD was unrelated to objective attentional measure performance. Overall, participants who simulated ADHD on some objective measures (i.e., specific Wechsler Adult Intelligence Scale–III [WAIS-III] subtests) showed similar performance to the clinical ADHD comparison sample. **Conclusion:** The implications of these findings highlight the importance of relying on multiple vectors of information, be it objective, observational, self-report, or reports by others, when diagnosing ADHD and assessing factors related to potential secondary gain. *(J. of Att. Dis. 2010; 13(4) 325-338)*

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ADHD is the most commonly diagnosed psychological disorder in childhood with an estimated prevalence rate between 3% and 5% (American Psychiatric Association [APA], 1994). ADHD is defined as inattention and/or hyperactivity-impulsivity with accompanying symptoms, which is delineated into four types (i.e., inattentive, hyperactive-impulsive, combined, and not otherwise specified). Although ADHD was once considered a disorder specific to childhood, researchers have indicated that children meeting criteria for ADHD continue to experience core clinical symptoms or related behavior problems into adulthood (Goldstein, 2002), with estimates ranging between 50% and 65% (Rapport, 2001). Although the practice parameters for the assessment and treatment of children, adolescents, and adults with ADHD (Dulcan & Work Group on Quality Issues, 1997) recommended that *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision; APA, 2000) criteria be used to identify adults with ADHD, researchers have suggested that the threshold for meeting criteria may lack sensitivity when applied to adults and university students (Barkley, 1996; Heiligenstein, Conyers, Berns, Miller, & Smith, 1998). One reason for this is that many of the symptoms are not defined according to age appropriate terms. As a result, the prevalence of some symptoms is likely underestimated in that population.

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Correspondingly, the prevalence of ADHD in adults and college students has not been as well established as it has been in children, and the area of research is far from uncontroversial. For example, recent prevalence estimates in adults range from 2% to 8% as noted in a review of 23 studies conducted by Weyandt and DuPaul (2006). Research has also suggested that prevalence rates range from 0.5% to 8% in college students in particular (Weyandt, Linterman, & Rice, 1995). Weyandt et al. (1995) speculated that some ADHD college students may not be identified until they reach a university setting due to highly adaptive skills during childhood, which may be mediated by a high intelligence level in college students. However, those compensatory skills learned in childhood may not be as adequate at the university level, where students function without supervision, face ever increasing academic demands, and are required to develop advanced time management skills. Another factor that may affect diagnostic rates is that identification likely increases as a function of age-adjusted diagnostic criteria (DuPaul et al., 2001) more applicable to adults, rather than relying on *DSM-IV-TR* criteria.

An additional challenge with estimating the prevalence of ADHD in college students is the lack of gold standard diagnostic tests. Rather, accurate diagnosis rests on clinician judgment based on information gathered from multiple sources including client report, report from relative or significant others, direct observation of the client in multiple settings, and performance on objective tests of cognitive abilities (Dulcan & Work Group on Quality Issues, 1997). Among those tests that are well regarded, one commonly used methodology for identifying ADHD in adults is the retrospective self-report to assess childhood symptoms. Although this type of report tends to have good predictive power in identifying adults with ADHD, and may be useful in comprising groups for research study, diagnoses made exclusively on the basis of self-report have shown to produce high rates of false positives in the general population (Mannuzza, Klein, Klein, Bessler, & Shrout, 2002). Another potential weakness of using such reports is that their validity may be compromised when clients are motivated by external gains.

Although there is an availability of psychosocial interventions to manage symptoms of ADHD, pharmacological treatments (e.g., methylphenidate & dextroamphetamine) are widely considered to be first-line treatments for ADHD (Pary et al., 2002). Prescription of amphetamine-based psychostimulant medications (dextroamphetamine/racemic, methylphenidate) for attentional disorders (ADHD) has increased to high levels for students with documented attentional problems (McCabe, Teter, Boyd, & Guthrie, 2004). Moreover, research has indicated that methylphenidate is a commonly abused drug among high school and college students. In fact, researchers have reported high rates of students either knowing someone who was prescribed a stimulant or had personally taken and/or sold one themselves (Advokat, Guidry, & Martino, 2008; Babcock & Byrne, 2000; McCabe, Teter, & Boyd, 2006; White, Becker-Blease, & Grace-Bishop, 2006). Moline and Frankenberger (2001) reported that 34% of the college students prescribed medication for ADHD reported being approached to sell or trade their medication. Furthermore, 53% of students not taking stimulant medication reported knowing students who gave away or sold their stimulant medication, and several students have reported using methylphenidate recreationally (Babcock & Byrne, 2000). However, despite widespread acceptance for clinical usage, there is no clear evidence of enhanced long-term changes in academic achievement, interpersonal relationships, or long-term prognosis in adolescents or adults (Pelham & Gnagy, 1999).

The high rate of medication-seeking behavior is also troubling given that stimulant abuse rates are also higher than rates reported nearly a decade earlier, with just less than 3% reporting amphetamine use within the past year (Clifford, Edmundson, Koch, & Dodd, 1989). Because of the increased diagnostic rate of ADHD and the popularity of the diagnosis among high school and college students, abuse of methylphenidate is likely to rise as it becomes increasingly accessible. Given this growing trend, college students who are referred for ADHD assessments, especially those who appear to be seeking stimulant medication, warrant careful, valid examination.

ADHD Malingering

Just as demonstrating impairment (i.e., posttraumatic stress disorder [PTSD], brain injury) is a factor in determining damage awards in forensic settings, being diagnosed with ADHD is often a prerequisite for obtaining medication and/or academic accommodations for the classroom or examinations (e.g., altered exam format, provision of a note taker; Evans, Serpell, Schultz, & Pastor, 2007). To that end, clinicians are compelled to consider the possibility that students seeking psychoeducational evaluations may be motivated by a combination of substantial external incentives (see Boone, 2007b; Larrabee, Greiffenstein, Greve, & Bianchini, 2007; Slick, Sherman, & Iverson, 1999), which likely influences the pretest probability of symptom feigning and exaggeration (i.e., malingering; Mittenberg, Patton, Canyock, & Condit, 2002).

This possibility is becoming increasingly germane in the university setting as there has been a significant rise in the number of adults and postsecondary students complaining of cognitive problems and seeking disability status (Nichols, Harrison, McCloskey, & Weintraub, 2002). The number of individuals between the ages of 3 and 21 receiving support from federally funded educational programs for the disabled has nearly doubled within the past 20 years to more than 6.7 million, and 1.7 million (8.7%) postsecondary students were considered disabled in 2000 (U.S. Department of Education, 2005).

Despite this set of issues, there are currently no established measures or methods available that have been validated to assess feigned deficits in ADHD assessment, and there is only one recently devised preliminary experimental measure to investigate effort in learning disorder (LD) assessments (Osmon, Plambeck, Klein, & Mano, 2006). Of the few studies that have examined this matter in students seeking evaluation, most have employed simulation designs and/or have used small samples. For instance, Quinn (2003) showed that simulators of ADHD produce higher rates of attentional complaints and diagnostic symptoms of ADHD on self-report measures than controls or those diagnosed with ADHD. She also reported that the simulated ADHD group performed substantially lower on cognitive testing than both the control and clinical samples. Thus, her pioneering study revealed that test performance characteristic of ADHD can indeed be feigned through experimental manipulation. Other case reports in this area have also appeared in the literature and have suggested that malingered ADHD may be associated with behavioral problems (Conti, 2004).

More recently, Harrison, Edwards, and Parker (2007) examined the effects of instructions to feign ADHD symptoms and performance on a combination of self-report symptom inventories and measures of thinking speed. Similar to other simulation malingering studies, they reported that their feigning group endorsed more symptoms than controls and a criterion clinical ADHD group. The feigning group also performed much lower on measures of thinking speed than the ADHD group and control participants. Thus, instruments typically employed in an ADHD evaluation are sensitive to feigned poor performance and symptom exaggeration. Other simulation and clinical research has also shown that measures of thinking speed and attentional focus may be susceptible to feigned poor performance in typical neuropsychological evaluations (Henry, 2005; Leark, Dixon, Hoffman, & Huynh, 2002; Lu, Boone, Jimenez, & Razani, 2004; Willison & Tombaugh, 2006).

In a study of 67 consecutive referrals to a university-based psychological assessment clinic, Sullivan, May, and Galbally (2007) investigated potential symptom exaggeration of students complaining of either ADHD and/or LD. They reported that 15 (22.4%) of the clients evaluated for those diagnoses and included in their analyses (N = 66) demonstrated failure on at least one index from the Word Memory Test (WMT), a validated measure of effortful responding. Sullivan et al. reported 10 of 21 evaluated for ADHD, 2 of 13 evaluated for LD, and 3 of 32 clients failed at least one index. They also partially replicated positive relationships between WMT performance and intellectual functioning in those failing the WMT. A positive relationship was demonstrated in clients who failed the WMT and the California Verbal Learning Test–Second Edition. Thus, although neuropsychological testing in isolation may be equivocally associated with attentional dysfunction associated with ADHD (in studies employing parametric analyses; Weyandt & DuPaul, 2006), students referred for such examinations who demonstrated noncredible performance on malingering tests have shown decreased performance on objective neuropsychological measures typically administered in psychoeducational evaluations, thereby altering the credibility of the results. Although Sullivan et al. provided initial data regarding noncredible performance in clients evaluated for ADHD/LD, additional simulation and clinical research designs are needed to explore additional factors associated with noncredible performance. Moreover, they failed to account for participants' knowledge of ADHD which may affect how clients approach testing; however, it should be noted that their retrospective design precluded such analyses.

Purpose

The paucity of literature regarding ADHD prevalence in college students is even more evident with regard to malingering the condition. Thus, the purpose of the present study was to further investigate the ability of college students to simulate ADHD symptoms on commonly used objective neuropsychological and self-report measures commonly employed during comprehensive evaluations, and to assess performance on traditional cognitive malingering tasks. As with initial study in other areas of malingering (i.e., brain injury, psychosis; Greve & Bianchini, 2004; Iverson, Franzen & McCracken, 1991; Iverson, Franzen & McCracken, 1994), works with simulation designs to study noncredible presentation of clients presenting for ADHD evaluations plays an important role in solidifying relevant facets of the topic. With this in mind, as no well validated method to detect noncredible performance in ADHD evaluations have been offered, one goal was to evaluate the potential of neuropsychological malingering tests to detect symptom

faking in this population, although they have been validated for use with other populations and clinical questions. In doing so, we investigated three hypotheses:

Hypothesis 1: Malingerers will perform more poorly than ADHD controls on objective measures of attention-laden tasks.

Hypothesis 2: Simulated malingerers will endorse significantly more symptoms than control subjects on self-report measures, and all will perform similarly to students diagnosed with ADHD.

Hypothesis 3: Simulated malingerers' knowledge of ADHD will be significantly correlated with performance on self-report measures but not with effort tests or objective attentional measures.

Method

Participants

Participants were undergraduate students enrolled in psychology courses at a southern university who responded to an advertisement on a university research Web site. Volunteers received extra course credit for their participation and, as an incentive to comply with instructions, were entered in a drawing for a US$50 gift certificate to a local restaurant. Because it is assumed that a number of those malingering during an ADHD evaluation do not actually meet criteria for ADHD, the researchers thought it was necessary to use participants from a normative sample to obtain a more generalizable sample. So too, we elected to screen out other conditions that may otherwise account for participants' performance on the cognitive measures. Therefore, exclusion criteria were as follows: age less than 18 years, history of LD, and diagnosis of ADHD or current complaints of significant problems with ADHD-related symptoms or neurological problems. After completing a participant data sheet that included a history and background form, participants were screened for current and previous LD and ADHD by review of symptoms. Those participants were randomly assigned to either the control condition or to form the ADHD malingerer condition. In the clinical sample, archival data from a university psychological clinic (1999-2003) were used to form a comparison group comprised of individuals diagnosed with ADHD according to strict *DSM-IV-TR* criteria. Diagnoses were derived by conducting a full psychoeducational evaluation with in-depth clinical interview and integration of results through diagnostic case formulation grounded in contemporary conceptualization of ADHD. Examiners also assessed the temporal onset of symptoms as well as the impact of symptoms on social, academic, occupational, and other life domains. Moreover, other *DSM-IV-TR* diagnoses were concomitantly assessed to rule out disorders that may otherwise account for attentional and relevant behavioral correlates.

Materials

Structured clinical interview. A structured clinical interview was developed and administered to participants to obtain the demographic information (i.e., gender, race, age, etc.), ADHD knowledge, and to screen for exclusion criteria.

Feedback questionnaire. Participants were asked to summarize instructions and rate, on a 10-point Likert-type scale from 0 (*low*) to 10 (*high*), compliance with instructions and perceived success on experiment tasks.

ADHD Knowledge and Opinions Survey–Revised (AKOS-R). The AKOS-R (Rostain, Power, & Atkins, 1993) is a questionnaire designed to assess parental knowledge of and attitude toward ADHD issues, and it comprises 17 true or false statements regarding childhood ADHD, including etiology, course, pharmacological intervention, and academic functioning; AKOS-R was administered to all participants. For purposes of this study, several items were adapted to suit a university population by replacing all referents to children with referents appropriate for college students.

Mini international neuropsychiatric interview (MINI). The MINI (Sheehan et al., 1998) is a structured diagnostic interview for *DSM-IV-TR* and *International Classification of Diseases* (10th revision; ICD-10) containing an ADHD module for retrospective previous and current symptoms. Questions also assess symptoms experienced specifically in adulthood reflecting problems with work, marriage, underachievement, and so on. Moreover, the ADHD module was administered to ensure diagnostic integrity.

Conners' Continuous Performance Test (CPT). The CPT (Conners, 1995) is a computer-based measure of visual inattention, impulsivity, and response time variability. Participants are to respond to target stimuli while inhibiting responses to rapidly presented nontarget stimuli distracters. Omission errors, commission errors, response time, and several other indices are reported. Some errors represent inattention, whereas others measure impulsivity, response speed, and vigilance over time.

Trail Making Test (TMT). This paper–pencil test (Army Individual Test Battery, 1944) of motor speed and attention consists of two parts. Part A requires the participant to draw lines connecting sequentially numbered circles. Part B presents both numbered and lettered circles, which the participant must connect in sequential alphanumeric order.

Scores are based on time to complete the measure. A significant discrepancy between these may reflect attention difficulty with poor scores on either part typically indicating attentional problems. Although, low performance on the Trails tests has not been shown to be specific to ADHD, they are considered measures employing attention resources and executive sequencing, which may be problematic in those presenting with attentional complaints (Rapport, VanVoorhis, Tzelepis, & Friedman, 2001).

Wechsler Adult Intelligence Scale–III (WAIS-III). The ADHD sample in the normative studies for the WAIS-III (Wechsler, 1997) performed more poorly on the digit symbol coding (DSC), digit span (DS), symbol search (SS), and letter–number sequencing (LNS) subtests, hence these four subtests were employed in the present study. The DSC subtest is a timed paper and pencil coding task of pairing numbers and symbols. The DS is a test of auditory attention wherein participants repeat increasingly longer strings of numbers that the examiner presents orally. The SS subtest is a timed measure that requires participants to determine if a target figure is present in a series of visual arrays. The LNS is a verbal working memory task with increasingly long strings of numbers and letters that the participant must repeat back in alphabetical and numerical order. As with the Trails tests, measures of intellectual functioning have not, through parametric analyses, been shown to consistently differentiate those with ADHD and controls, though they are theoretically relevant to the construct of attention (Cohen, 1993; Kahneman & Treisman, 1984; Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991; Ponsford, 2000; Posner & Rafal, 1987; Shum, McFarland, & Bain, 1990). Moreover, contemporary recommendations suggest administering intellectual measures as part of a broadband evaluation for ADHD (Barkley, 2006).

Attention Deficit Scales for Adults (ADSA). The ADSA (Triolo & Murphy, 1996) is a 54-item self-report of adult ADHD symptoms. Along with nine clinical scales, it also has an internal consistency measure and a total score. The clinical scales include the following: attention–focus–concentration, interpersonal, behavior-disorganized activity, coordination, academic theme, emotive, consistency-long term, childhood, and negative-social. The total score has been found to reliably discriminate ADHD adults from controls with a cutoff of 45 points.

Wender Utah Rating Scale (WURS). The WURS (Ward, Wender, & Reimherr, 1993) is a 61-item self-report questionnaire designed to measure adults' retrospective rating of the presence and severity of childhood ADHD symptoms. The WURS provides a quantitative way of assessing symptoms present before age seven. Ward et al. (1993) reported that the WURS discriminated controls from adults with ADHD with 86% accuracy. Internal consistency as measured by Cronbach's alpha and test–retest reliability coefficients have been reported to be above .85 (Weyandt et al., 1995).

Memorization of 15-items test (MFIT). The participant is told to memorize 15 different items for 10 s before drawing the items from memory. The MFIT (Rey, 1964) test is presented as being difficult; however, many items are conceptually related and simple to recall. This test is regarded as a measure that has relatively low sensitivity but high specificity.

The WMT. The WMT (Green & Allen, 1999) measures both verbal memory and effort through learning a list of 20 word pairs with each pair presented on a computer. After the list presentation trials, an immediate recognition (IR) task requires the participant to choose the words embedded in new pairs. A similar delayed recognition (DR) task is presented 30 min later. These tasks are relatively easy and are completed with 95% accuracy by adults with severe brain injury or neurological diseases (Green & Allen, 1999). Consistency of responding is also computed and a series of multiple choice memory tests is completed. In addition, a delayed free recall task and a long delayed free recall task are administered. This measure is regarded as one with relatively high sensitivity but questionably low specificity.

Procedure

The 110 participants were randomly assigned to the control or simulated malingering conditions. Participants in the simulated ADHD group were encouraged to simulate ADHD without arousing suspicion, whereas participants assigned to the control group were given the measures as described in the respective test manuals. Both groups were informed that many measures in the study contained validity indices or measures of effort and honesty. The first test in the battery was a malingering measure and remaining measures were presented randomly. Participants also completed a brief feedback questionnaire assessing malingering strategy and level of perceived success on the task.

Results

Demographic Characteristics

Of the 116 individuals who signed up to participate in this study, 5 were excluded due to a current diagnosis of

Table 1
Operationally Defined Variables by Category

Variable	Operational Definition
Group: The primary independent variable (three levels)	1. Normal—Students asked to do their best 2. Simulated ADHD—Students asked to simulate ADHD without arousing suspicion 3. ADHD—ADHD students' archival data
Knowledge of ADHD: The second independent variable	1. ADHD Knowledge and Opinions Survey–Revised, total raw score
Self-Reported ADHD Symptoms: Two dependent variables	1. ADSA total *t* score 2. WURS total raw score for critical items
Performance on objective tests of attention: Six dependent variables	1. CPT mean total *t* score 2. CPT sum of clinically elevated scales 3. TMT Part A, *t* score 4. TMT Part B, *t* score 5. WAIS-III processing speed (converted to *t* scores) 6. WAIS-III mean of DS and LNS subtest scaled scores (converted to *t* scores)
Performance on effort tests: Three dependent variables	1. MFIT total raw score 2. WMT average of percent correct for immediate and delayed recognition 3. WMT percent correct score for number correct

Note: ADSA = Attention Deficit Scales for Adults; WURS = Wender Utah Rating Scale; CPT = continuous performance test; TMT = Trail making test; WAIS-III = Wechsler Adult Intelligence Scale–III; DS = digit span; LNS = letter-number sequencing; MFIT = memorization of 15-items test; WMT = word memory test.

ADHD, neurological disease, or recent brain trauma and 1 participant voluntarily withdrew. Of the remaining 110 participants, 88 were women (80%) and 22 were men (20%). Participants ranged in age from 18 to 31 years (M = 20.44, SD = 2.08) and had an average of 13.63 (SD = 1.27) years of education. The mean reported grade point average was 3.11 (SD = .5). Eighty-seven individuals were White (79%), 20 were African American (18%), 2 were Native American (2%), and 1 did not indicate race (1%).

The archival comparison group was derived from archival data of 56 students diagnosed with ADHD as result of a psychoeducational evaluation at the university's psychological services center. Students consented to the use of their testing data at the time of their evaluation. Individuals were excluded if they were less than 18 years of age, did not complete the standard test battery, or received a diagnosis of ADHD by history. Of the 650 clients, 107 were diagnosed with ADHD. From the 56 clients meeting inclusion criteria, 39 were women (70%) and 17 were men (30%). The mean age was 21.11 years (SD = 3.1) with a range from 18 to 29 years. Mean reported years of completed formal education was 13.41 (SD = 1.82). Fifty-one individuals in this group were White (93%), three were African American (5.4%), one was Asian (1.8%), and one did not report race (1.8%).

The psychoeducational battery used in assessing participants in the archival ADHD group included all of the objective tests used with the simulated ADHD and control groups except for the feedback questionnaire, AKOS-R, MINI, or effort measures. In addition, only eight of the archival group completed a valid ADSA.

Analyses

The group variable consisted of three levels: control, simulated ADHD, and ADHD. Knowledge of ADHD was measured by the AKOS-R. Dependent measures also included three categories of psychological tests: objective measures, self-reports, and effort tests. Mean scores were calculated and are reported by group. Composite scores, total scores, and/or averages were used as dependent variables on measures that generated multiple scores. There were 11 total dependent variables used in the subsequent analyses. Six dependent variables were derived from the objective measures, 2 from self-report measures, and 3 were derived from the effort tests. Please see Table 1 for a listing of all independent and dependent variables and accompanying operational definitions.

Objective measures. A 3 × 6 MANOVA was conducted with group condition (control, simulate, and ADHD) as the independent variable and objective test scores as dependent variables. A significant main effect was found, $F(12, 310) = 9.387$, $p = .000$, $\eta^2 = .267$; the simulated ADHD group scored lower than the control participants and the ADHD participants. As a significant multivariate finding was present, a follow-up post hoc analysis was conducted with univariate F tests and Bonferroni adjusted t tests

Table 2
Post Hoc Multiple Comparisons for Objective Measures

Dependent Variable	Mean Difference	Standard Error	Significance	95% Confidence Interval	
				Lower	Upper
Trail A *t* scores					
Normal—simulate	9.00*	2.30	0.00	3.43	14.57
Normal—ADHD	2.54	2.30	0.82	–3.04	8.11
Simulate—ADHD	–6.48*	2.30	0.02	–12.04	–0.89
Trail B *t* scores					
Normal—simulate	5.81*	2.14	0.02	0.64	10.99
Normal—ADHD	4.83	2.14	0.08	–0.35	10.01
Simulate—ADHD	–0.98	2.14	1.00	–6.16	4.20
WAIS processing speed *t* scores					
Normal—simulate	11.67*	1.93	0.00	7.00	16.35
Normal—ADHD	10.81*	1.93	0.00	6.13	15.49
Simulate—ADHD	–0.86	1.93	1.00	–5.53	3.81
DS and LN *t* scores					
Normal—simulate	8.42*	1.62	0.00	–4.50	12.34
Normal—ADHD	6.97*	1.62	0.00	–3.05	10.89
Simulate—ADHD	–1.45	1.62	1.00	–5.37	2.47
CPT mean *t* scores					
Normal—simulate	–11.26*	1.47	0.000	–14.83	–7.68
Normal—ADHD	–4.97*	1.47	0.003	–8.54	–1.39
Simulate—ADHD	6.29*	1.47	0.000	2.71	9.86
Sum of CPT elevation					
Normal—simulate	–1.90*	0.27	0.000	–2.56	–1.24
Normal—ADHD	–0.98*	0.27	0.001	–1.64	–0.320
Simulate—ADHD	0.93*	0.27	0.003	0.27	–1.58

Note: $F(12, 310) = 9.387$, $p = .000$, $\eta^2 = .26$. WAIS = Wechsler Adult Intelligence Scale; DS = digit span; LNS = letter-number sequencing; CPT = continuous performance test.
*$p = .000$.

(Bland & Altman, 1995). The simulated ADHD group performed the lowest of all three groups. As expected, the control group performed the highest of the three groups (simulated ADHD < ADHD < control). Multiple post hoc pairwise comparisons using *t* tests with Bonferroni adjustments indicated that the differences between the simulated ADHD group and the control groups were significant for all six objective tests of attention (see Table 2) even with Bonferroni correction in place. The simulated ADHD group also performed significantly poorer than control participants on all objective tests.

The differences between the simulated ADHD group and clinical ADHD group on the objective measures were mixed. For instance, the simulated ADHD group performed significantly lower than the ADHD group on the TMT Part A and the two variables from the CPT. Although the simulated ADHD group scored lower than the ADHD group on the remaining three measures, the results did not reach significance. The simulated ADHD group's performance on the TMT Part B and the two dependent variables derived from the WAIS-III subtests were not significantly lower than that of the clinical ADHD group. The finding of six objective measures lower in the simulated group than the ADHD group does represent a nonparametric pattern-wise significant deviation.

A comparison of the control group and clinical ADHD group on the objective dependent variables indicated that the ADHD group performed significantly poorer than the control group on the two variables from the WAIS-III and CPT. An unexpected finding was that the ADHD group and the control group were not significantly different on the TMT. Thus, it appears that the TMT was not sensitive to ADHD. This suggests that the ability of the simulated ADHD group to perform similarly to the ADHD group on the TMT Part B does not necessarily imply they are able to simulate ADHD on this measure but rather that the measure may be somewhat insensitive to ADHD.

Self-report measures. The 3 × 2 between groups MANOVA with self-report measures (WURS and ADSA)

Table 3
Post Hoc Multiple Comparisons for Self-Report Measures

Dependent Variable	Mean Difference	Standard Error	Significance	95% Confidence Interval	
				Lower	Upper
Wender Utah rating					
Normal—simulate	–30.49*	3.09	.000	–38.00	–22.98
Normal—ADHD	–19.39*	6.94	.018	–36.27	–2.51
Simulate—ADHD	11.10	6.93	.000	–5.76	27.96
ADSA total					
Normal—simulate	–22.95*	2.47	.00	–28.96	–16.95
Normal—ADHD	–9.11	5.55	.310	–22.60	4.38
Simulate—ADHD	13.84*	5.54	.042	0.36	27.32

Note: $F(4, 224) = 19.305$, $p = .000$, $\eta^2 = .256$. ADSA = Attention Deficit Scales for Adults.
*$p = .000$.

as the dependent variables showed a significant main effect $F(4, 224) = 9.387$, $p. = .000$, $\eta^2 = .258$. Pairwise comparisons of the means by the three groups revealed that the simulated ADHD group (WURS: $M = 48.60$, $SD = 19.10$; ADSA: $M = 73.67$, $SD = 13.02$) endorsed significantly more childhood and current symptoms than the control group (WURS: $M = 18.11$, $SD = 11.69$; ADSA: $M = 50.72$, $SD = 12.73$). Comparisons of the simulated ADHD group to the clinical ADHD group on the self-report measures were inconsistent (see Table 3). For instance, the simulated ADHD group did not report more previous symptoms than the clinical ADHD group ($M = 37.50$, $SD = 20.92$) according to the WURS, but it did endorse a higher level of current symptoms on the ADSA ($M = 59.83$, $SD = 13.15$).

ADHD knowledge. Six multivariate linear regressions were conducted with scores from the AKOS-R as the dependent variable and the objective tests, self-report measures, and effort test scores as the independent variables. In other words, performance on the objective, self-report, and effort tests served as predictor variables for the AKOS-R for separate analyses for control and simulated ADHD groups. Beta weights and R^2 values are reported only for significant multivariate model findings. Both the control ($M = 12.75$, $SD = 1.84$) and simulated ADHD groups ($M = 13.02$, $SD = 1.90$) demonstrated similar knowledge of ADHD.

The expected relationship between knowledge of ADHD and self-reported symptoms was not found within the simulated ADHD group, $F(2, 52) = 1.339$, $p = .271$ or control participants, $F(2, 52) = .141$, $p. = .869$. Similarly, there were insignificant findings for knowledge of ADHD and performance on the WMT and MFIT in either group—control, $F(1, 50) = 1.21$, $p = .276$, and simulated ADHD group, $F(2, 52) = .179$, $p = .897$. The only significant relationship between ADHD knowledge and the measures was an unexpected relationship within the control group, $F(6, 45) = 2.731$, $p = .024$, $sr^2 = .214$. Specifically, significant relationships were found for mean of DS and LNS, $t(52) = 2.70$, $p < .01$, $\beta = .38$, and the mean score of the CPT indices, $t(52) = –2.19$, $p < .05$, $\beta = –.44$. Although those results were unexpected, they may reflect chance findings due to the small number of subjects utilized and inflated Type I error secondary to multiple comparisons. Moreover, the relationship between knowledge and objective test performance was not present in the simulated ADHD group, $F(6, 45) = 1.104$, $p = 374$.

Malingering sensitivity. The clinical ADHD group did not complete the effort tests and those participants were not included in this analysis. The 2 × 3 MANOVA conducted with group (control and simulated ADHD) as the independent variable and performance on the three effort measures as the dependent variables revealed a significant group effect, $F(3, 105) = 28.468$, $p = .000$, $\eta^2 = .449$. The means for the simulated ADHD group were 80.63 ($SD = 17.90$) on the WMT recognition scores, 78.04 ($SD = 16.61$) on the WMT consistency scores, and 13.80 ($SD = 2.33$) for the MFIT. Control group means were higher on the WMT recognition ($M = 99.32$, $SD = 1.60$) and on the WMT consistency score ($M = 98.65$, $SD = 2.26$) and nearly the same for the MFIT ($M = 14.69$, $SD = 0.94$).

To further explore the sensitivity of the WMT to attempts at simulation of ADHD, and to see how well the WMT fared at identifying simulators relative to clinical judgment, the data were masked. The primary researcher and a licensed clinical neuropsychologist then independently made judgments as to the group membership of each participant based on the objective attentional measures and the WURS. The independent psychologist correctly identified 33 control participants, 24 participants

Table 4
Judgment of Group Membership Using Masked Data

	Independent Psychologist		Blinded Researcher	
	Frequency	Percentage	Frequency	Percentage
Correct normal	33	19.9	45	27.1
Normal classified as simulator	9	5.4	5	3.0
Normal classified as ADHD	14	8.4	4	2.4
Correct simulator	24	14.5	31	18.7
Simulator classified as normal	6	3.6	12	7.2
Simulator classified as ADHD	24	14.5	13	7.8
Correct ADHD	23	13.9	22	13.3
ADHD classified as normal	12	7.2	19	11.4
ADHD classified as simulator	21	12.7	15	9.0

from the simulated ADHD group, and 23 participants from the ADHD group. Twenty-four participants, nearly 44% the simulated ADHD group, were misclassified by the psychologist as participants belonging to the ADHD group. The blinded researcher correctly identified 45 control participants, 31 participants in the simulated ADHD condition, and 22 participants in the ADHD condition. Table 4 presents the respective judgment of group membership using masked data.

All participants in the control group were correctly classified using the WMT published cutoff scores for response bias (<82.5% for IR, <82.5% for DR, and <82.5% for consistency). Thirty-two participants (58%) of the simulated ADHD group were correctly classified. Using the WMT response bias cutoff scores to classify participants resulted in the misclassification of 23 participants (42%) from the simulated ADHD group. Therefore, using the WMT to classify participants improved the accuracy rate of group assignment over clinician judgment alone.

Discussion

The present study examined the ability of college students to simulate ADHD on objective neuropsychological tests and self-report measures of ADHD symptoms. We also examined the relationship between ADHD knowledge and performance on such measures. Furthermore, this study examined the performance of effort tests used to detect malingering to classify simulated ADHD beyond clinical judgment based on test scores. Three main hypotheses were investigated with mixed results.

We hypothesized that students simulating ADHD would exaggerate impairment on objective measures related to processing speed and attention, and score significantly lower than a clinical ADHD group. The results partially confirmed this hypothesis and also revealed some unexpected findings. Overall, the simulated ADHD group performed the worst on all objective neuropsychological tests as expected. The clinical ADHD group performed better than the simulated ADHD group but lower than the control group, indicating decreased performance as one moves along the control-clinical-simulating continuum. In fact, the simulated group performed significantly lower than the ADHD group on three of the six objective measures: the TMT Part A, the CPT mean score, and the sum of CPT elevations. As a result, the greatest score discrepancies between simulated ADHD and ADHD groups were observed on the CPT index of response time variability and TMT Part A, which were often three standard deviations beyond the mean in the simulated group. As with earlier studies (Leark et al., 2002; Quinn, 2003), our simulators likely overestimated the level of impairment expected for ADHD, resulting in excessively poor scores that were lower than the scores produced by actual clinical ADHD clients. Consequently, those tasks may be the most easily identified as attentional tasks by examinees and therefore the most readily exaggerated to a high level—to such a degree that it would seem implausibly performed by someone putting forth credible effort.

With regard to the WAIS-III subtests (DS, DSC, LNS, and SS), ADHD simulators scored similarly to our ADHD group, which performed lower than the controls. In general, it appears that there is a differential pattern of performance on some, but not all, objective measures of attention by individuals who simulate ADHD and individuals with diagnosed ADHD. As a result, the WAIS subtests may not discriminate simulated ADHD from those diagnosed with ADHD as well as other measures that require sustained attentional focus, response inhibition, and response consistency over extended time as with CPT tasks. Nevertheless, the Wechsler scales may be prone to malingering but not to the obvious degree as other, more sensitive attentional tasks. Thus, although the ADHD group scored lower than the controls on the Wechsler scales, the simulators did not perform significantly lower than the ADHD group, making the differential between credible and noncredible performance based on those measures more difficult.

As expected in other analyses, the ADHD group performed significantly lower than the control group on the WAIS-III subtests as well as the CPT mean score and the number of CPT scale elevations. It was presumed that the ADHD group would also score significantly lower than the control group on the TMT because the performance on this test relies heavily as an attentional resource (Cohen, 1993; Kahneman & Treisman, 1984; Ponsford, 2000; Posner & Rafal, 1987; Mirsky et al., 1991; Shum et al., 1990); however, that group difference did not surface. This may not be surprising as there have been mixed findings in group comparisons using the TMT, partially due to wide variations of individual variances with the test that may mask actual differences (Leininger, Gramling, Farrell, Kreutzer, & Peck, 1990). In contrast, it does lend limited support for inclusion of some Wechsler measures and CPT in attentional evaluations.

The second hypothesis proposed that college students would be able to effectively simulate ADHD on self-report measures. This hypothesis was partially supported as well. Regarding the WURS, significant mean differences occurred (a) between the control group and the simulated ADHD group and (b) between the control and ADHD group. Although, the difference between the simulated ADHD group and the clinical ADHD group on the WURS was in the expected direction, the simulated ADHD group did not differ significantly from the ADHD group as hypothesized. This suggests that the simulators are able to retrospectively fabricate childhood ADHD-related symptoms a similar degree as those actually diagnosed with ADHD (and more than controls) but not to such an exaggerated degree that allows for differentiation of actual ADHD from simulated ADHD.

Interestingly, the clinical ADHD group means for self-report measures were lower than expected on the ASDA. Although the ADHD group mean score for the WURS (M = 38) was above the raw score cutoff of 36 used to differentiate control participants from ADHD participants, that group's performance on the ADSA total score (M = 59.83) was only nearly one standard deviation from the mean. Therefore, in our sample, the ADSA did not optimally distinguish ADHD from controls. This unexpected finding questions either the assumptions underlying our hypothesis or may not support the validity of the ADSA. However, the mean differences fell in the expected direction and our lack of a significant finding may have been due to deflated of statistical power as there were few participants utilized in these analyses. Although the simulator group scored similarly to ADHD participants on a retrospective self-report of childhood symptoms, this group endorsed significantly more current symptoms than both the control and ADHD students on ADSA. Although the hypothesis was not fully confirmed, the group means were again in the expected order (i.e., control < ADHD < simulated ADHD) and suggest that current symptoms may be exaggerated to a higher degree than retrospective report of childhood symptoms. This contrasts with earlier findings that suggested it was easier to feign a cognitive disorder on a self-report than on an objective measure of attention (Leark et al., 2002; Quinn, 2003) as there was evidence in this study that ability to feign occurred across self-report and objective measures. However, reports of previous symptomatology may not have face validity to clients seeking relief from current symptoms.

The hypothesized relationship between ADHD knowledge and simulated ADHD on self-report measures was not demonstrated in the current study. Although earlier research has demonstrated that prior personal experience with a disorder does not necessarily significantly improve ability to feign a disorder on an objective measure (Hayes, Martin, & Gouvier, 1995) or inoculate one against common misconceptions regarding a disorder (O'Jile et al., 1997), it seems that knowledge would lead a simulator to endorse those symptoms. However, this was not the case in this study. One possible explanation for this finding is that the relationship may not have been validly captured by the measures used. That is, the self-report instruments may not have accurately measured the relationship between knowledge and symptom endorsement. For example, AKOS-R had a restricted range thereby decreasing the spread of scores, which may have caused the control and simulated ADHD groups means to be similar. This could suggest that the AKOS-R may not be sensitive to differences in knowledge of ADHD or that university students, in general, have very similar notions of what ADHD is.

This study also investigated the ability of traditional malingering tests to identify simulated ADHD. Results showed that the WMT cutoff scores for response bias correctly identified only 27 of the ADHD simulators, whereas it identified all of the control participants (no false positives). Of the ADHD simulators, 22 were able to pass the WMT, which resulted in lower sensitivity than expected. Furthermore, 6 of the simulators who were judged as honest by the WMT were misclassified as being ADHD by the blind researcher, and 13 of the 22 were misclassified as being ADHD participants by the independent clinician, reaffirming the need to include measures of response bias and performance credibility to avoid diagnosing those who do not put forth credible performance. Although the WMT only correctly classified 27 of the simulators, it performed better than the blinded researcher or the independent clinician using

masked testing data. Every participant in the simulated ADHD group was able to pass the MFIT, making the scores on that measure virtually meaningless in terms of identifying ADHD malingerers as sensitivity was zero. Additional sources of information, such as an in-depth clinical diagnostic interview, review of relevant records, and collateral interview would likely increase clinical judgment in such cases.

Limitations and Future Directions

Our findings not only support previous research in many respects but also failed to find consistent significant performance differences between individuals with ADHD and those simulating, although the finding reflected predicted ordinality. Some of these findings may be due to the inherent limitations in a study that utilizes an artificial analog methodology. Specifically, participants were asked to simulate ADHD for college credit. Obviously, these individuals do not have the same motivation as college students simulating ADHD to gain access to academic accommodations and/or stimulant medication. Another weakness in the design is that the knowledge base of clinical ADHD malingerers may differ dramatically from analog simulators participating for course credit. ADHD simulators in the clinic may be more likely to take advantage of the easy access to information about the disorder that is available on the internet, in college libraries, and health clinics prior to participating in an evaluation. Thus, they are expected to know more than the typical college student about how to simulate the disorder. This may partially explain the lack of difference in scores for knowledge of ADHD in the simulated ADHD group and the control group. Future studies should increase the motivation of analog simulators by giving them information and time to prepare for the task, which would likely accentuate group differences and provide insight into potential coaching and informational effects (Boone, 2007b; Youngjohn, 1995).

Generally, this study found that some of the objective and self-report measures of ADHD were insensitive to differences between groups. Specifically, the WAIS-III subtests did not appear as sensitive to malingered attentional deficits as initially anticipated, but the clinical ADHD group did perform worse than the controls on the measures as is implied in the WAIS-III technical manual (though not consistently supported across the ADHD literature; Weyandt & DuPaul, 2006). However, the finding may also reflect the large gender imbalance of our sample with women far outnumbering men. In this study, computerized indices of attention were far more sensitive to attempts at simulation than clinical judgment, orthographic measures, or verbal tests of attention. In fact, the greatest mean differences between the groups on objective measures of attention was on the CPT. This test was useful as both a valid measure of attention and as an indication of noncredible performance (e.g., when scores exceed two standard deviations above the mean for known ADHD groups).

In future studies, classification rates of noncredible performance based on extreme scores rarely encountered on attentional tasks in ADHD groups should be presented in light of other neuropsychological scores and self-report measures. Moreover, it will also be necessary to assess and report concordance and discordance of such indicators (specific to attentional performance or noncredible ADHD) in terms of failure rates according to derived cut scores. In that way, progress can be made to establish diagnostic certainty with regard to knowing how much confidence to place in a client's performance on measures typically employed in ADHD evaluations (Baldessarini, Finklestein, & Arana, 1983). However, the base rate of noncredible performance in ADHD testing also needs to be addressed to assess confidence in decisions.

The WMT in this study fared better at detecting ADHD simulators than did clinical experts relying on test data alone. Not only that but our blinded experts also had an unacceptably high false positive rate, much above that considered appropriate for determining noncredible performance in neuropsychological testing (Boone, 2007b; Larrabee et al., 2007; Mittenberg et al., 2002, Slick et al., 1999). Such a trend, without additional clinical information (including validity testing), is likely to result in undue stigmatization, which can be particularly devastating in the case of misidentifying someone as a malingerer (Szasz, 1956). However, there are no established cut scores or validity measures specific to ADHD assessment that provides guidance of specificity or sensitivity values.

Although Sullivan et al. (2007) reported 22% failure rate on a symptom validity test, this reflected failure on any one index from Green's WMT (Green, 2003) and not malingering according to standard research criteria for malingered neurocognitive dysfunction (Slick et al., 1999). Therefore, the rates of malingering in this population have yet to be clearly reported but are likely less than 22%. Although Sullivan et al. (2007) implied that their participants may have had external incentive for seeking evaluation in that study, they did not indicate this through formal means. Rather, they indicated that the potential for external secondary gains (i.e., accommodation seeking or medication seeking) in the sample was operant (B. Sullivan, personal communication, April 24,

2008). To address this concern in the future, it is recommended that researchers operationalize and formally assess clients' motivations and potential for external incentive when seeking an ADHD evaluation. Such an operationalization may be initially surveyed by noting referral source (i.e., university disability services, etc.), as referral sources have been shown to be related to pretest probability for malingering (Bigler, 2006, Mittenberg et al., 2002).

As it is assumed that formal validity testing is not yet a uniform standard in ADHD evaluations, it is recommended that future research be conducted with retrospective analyses of embedded measures of noncredible performance of neuropsychological measures in this population. But the lack of symptom validity testing in ADHD cases is likely to decrease due to improved standard of care guidelines for evaluations where secondary gain is a factor (Bush et al., 2005). This will likely occur through the use of multiple validity measures as has been recommended in research with evaluations of pain and brain dysfunction (Larrabee, 2008; Meyers & Volbrecht, 2003; Victor, Boone, Serpa, Buehler, & Zeigler, in press). However, the research on malingered ADHD has yet to empirically establish that such external incentives (medication and/or accommodation seeking) in ADHD evaluations play a role in affecting failure on symptom validity tests, self-report measures, or measures of cognitive functioning.

Nevertheless, other potential factors also have to be ruled out before attributing symptoms of ADHD to malingered behavior as well. For instance, Delis and Wetter (2007) and others (Binder, 2007; Boone, 2007a; Larrabee, 2007) had recognized that factors other than substantial external secondary gain may influence neurocognitive performance and/or failure on symptom validity testing (i.e., cogniform issues). In Delis and Wetter's view, it is possible that clients with no apparent external incentive may fail validity indices because of psychological factors.

As can be seen, several questions concerning the noncredible presentation of ADHD transcend the intent of the current study. However, the current findings replicate the reports that students can feign poor performance on attention laden tasks (both objective and self-report) when instructed via experimental manipulation and that those ADHD simulators also fail traditional symptom validity tests at a fairly high rate compared with controls. We also showed that the ability of clinicians to detect feigned behavior on the basis of test scores is limited in its accuracy. Although we also showed that knowledge of ADHD was not particularly related to feigned performance on testing, we hypothesize that this relationship may be supported in future research employing formal coaching conditions and/or ADHD information-gathering instructions for participants in future simulation designs.

With the increasing trend toward stimulant medication seeking and increasing rates of students seeking some form of cognitive disability, we recommend the addition of symptom validity testing. In addition, based on the current findings, it is recommended that results from university students who seek ADHD evaluations in the context of external incentives and who perform in the extremely impaired range on computer tests of attention be viewed with caution. These recommended additions to a psychoeducational battery in the clinical assessment of ADHD are likely to aid clinicians in identifying individuals who are appropriate for the full treatment options available for attentional disorders including ADHD.

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