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Ability of college students to simulate ADHD on objective measure of attention

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ABILTY OF COLLEGE STUDENTS TO SIMULATE ADHD ON OBJECTIVE MEASURES OF ATTENTION

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DEDICATION

This work is dedicated to Ellen D. Lee.

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ABSTRACT

Complaints of ADHD symptoms in college students are not uncommon and college students frequently self-refer for assessment of ADHD. Some may seek out a diagnosis to obtain academic accommodations and/or stimulant medication. Diagnosing ADHD in college students is largely reliant on self-report measures, and to a lesser extent, objective measures of attention. The typical college student has easy access to information about ADHD, potentially facilitating efforts to simulate self-reported symptoms. The present study examined the ability of college students to effectively simulate ADHD on objective and self-report measures of attention, and examined the relationship between knowledge of ADHD and ability to simulate. It was hypothesized that knowledge of ADHD would be significantly correlated with ability to simulate ADHD on self-report measures but would be less strongly correlated with ability to simulate ADHD on objective measures of attention. Results show that college students were able to successfully simulate ADHD on a retrospective self-report measure of childhood symptoms, but were not as able to simulate ADHD on a commonly used self-report measure of current ADHD symptoms. On objective measures of attention, college students asked to simulate ADHD, scored similarly to participants with ADHD on four subtests of the WAIS-III that have been found to be sensitive to attentional difficulties, but scored markedly worse than ADHD participants on a computerized test of sustained attention and a commonly used test of alternating attention. Clinicians are cautioned against reliance on the WAIS-III for objective measurement of ADHD symptoms.

INTRODUCTION

The most commonly diagnosed psychological disorder of childhood today is Attention-Deficit/Hyperactivity Disorder (ADHD), with an estimated prevalence rate between 3 and 5% of all children (American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders, 1994). Once considered a disorder exclusively of childhood, current research indicates between 50 and 65% of diagnosed children continue to experience core clinical symptoms or related behavior problems into adulthood (Rapport, 2001).

This dissertation examines the ability of college students to simulate ADHD on objective measures of attention and discusses relevant implications for assessment of ADHD in college students. A historical perspective of ADHD and current research on the pathogenesis, course, differential diagnosis, and treatment of ADHD in adults, as well as discussion of some special issues pertaining to ADHD in college populations is presented. The problem of malingering in neuropsychological assessment and its relationship and implications for the assessment of ADHD is also addressed.

Historical Perspectives

ADHD is a behavioral syndrome characterized by a persistent pattern of inattentiveness and/or hyperactivity/impulsivity that is maladaptive and inconsistent with normal developmental patterns (DSM-IV-TR). Although serious clinical attention to children with the disorder first appeared in the early 20th century, references to individuals with attention and/or impulse maladies can be found much earlier in Shakespeare's King Henry VIII, German physician Heinrich

Hoffman's19th century poem "Fidgety Phil", and in William James' 1890 Principles of Psychology (Barkley, 1996).

The conceptualization of and terminology for ADHD has changed considerably since the earliest descriptions of children with that symptom constellation were offered. Three published lectures of the English physician George Still (1902) refer to a group of 20 children seen in his clinical practice with symptoms of inattentiveness, impulsivity, lawlessness, aggressiveness, and over-activity. The similarity of Still's clinical sample to current research samples is noted. Still observed greater prevalence in males relative to females, familial predisposition for the disorder, and found increased incidence of alcoholism, criminal conduct, and depression in biological relatives of affected children. Although Still described the children as having "a defect in moral control" (p. 1009), he conceptualized the disorder as a physical condition, rather than a moral failing, possibly due to heredity or acquired nervous system damage.

Early in the 20th century, North American researchers and clinicians also assumed an association between brain damage and behavioral disturbance in children. This connection had been observed in child survivors of the encephalitis pandemic in the early 20's and also in instances of birth trauma, head injury, toxin exposure, and cerebral infection, giving rise to concept of a brain–injured child syndrome. This soon evolved to the moniker "minimal brain damage" to refer to children who would now be diagnosed with ADHD (Barkley, 1996; Ehrenfest, 1926; Oltmanns & Emery, 1995). The term minimal brain damage persisted into the early 50's and was applied to children with and without measurable brain damage alike. However, the concept gradually fell into disuse due to the absence of evidence of brain damage in many symptomatic children. The term minimal brain dysfunction was subsequently used until the mid 60's, reflecting a shift in paradigm from an assumption of brain damage to a hypothesis of brain dysfunction to explain the behavioral disturbance associated with ADHD (Rapport, 2001).

During the same period, 1950-1960, researchers and clinicians focusing on the hyperactive and impulsive features of the disorder labeled the condition hyperkinetic impulse disorder, postulated to be due to thalamic dysfunction resulting in cortical overstimulation (Knobel, Wolman, & Mason, 1959). The increasing focus on excessive motor movement led to the notion of a hyperactive child syndrome (Chess, 1960). Though many still believed the condition to be primarily neurological in nature, the second edition of the American Psychiatric Association's Diagnostic and Statistical Manual (1968) used the label hyperkinetic reaction of childhood. This label implies rejection of the equivocal hypothesis of brain dysfunction and embraced the prevailing psychoanalytic theory of that time which held that all mental disorders of childhood were "reactions" (Barkley, 1996; Rapport, 2001). Hyperkinetic reaction of childhood was thought to diminish in adolescence. The DSM-III (1980) classified the condition under Disruptive Behavior Disorders and retitled the disorder Attention Deficit Disorder (ADD) focusing on attentional deficits as the core features with the component of hyperactivity being neither necessary nor sufficient on its own to establish the diagnosis. Two types of ADD were differentiated based on the presence of hyperactivity (ADDH) or its absence (ADD).

The DSM-III-R (1987) renamed the disorder Attention Deficit Hyperactivity Disorder returning to the notion that both attention difficulties and hyperactive/impulsive symptoms characterized the disorder. ADHD without hyperactivity was relegated to a category referred to as undifferentiated attention deficit disorder (UAD). The DSM-IV (1994) reapplied the distinction between attention deficit disorder with and without hyperactivity, naming the disorder Attention-Deficit/Hyperactivity Disorder.

Defining ADHD

ADHD is currently defined by the criteria contained in the DSM-IV-TR (2000), which defines ADHD according to two behavioral domains: inattention and hyperactivity-impulsivity, each domain containing nine possible symptoms. Four types of ADHD are defined: Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type, in which at least 6 core symptoms of inattention are present; Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type, in which at least 6 core symptoms of hyperactivity-impulsivity are present, and Attention-Deficit/Hyperactivity Disorder, Combined Type, in which at least 6 symptoms of inattention and 6 symptoms of hyperactivity-impulsivity are present. These symptoms must have persisted for at least 6 months to a degree that is maladaptive and developmentally deviant and must cause significant impairment in social, academic, or occupational settings, with impairment in at least 2 settings. Some of the symptoms that cause impairment must have been present before age 7. The symptoms do not occur exclusively within the course of a Pervasive Developmental Disorder or Psychotic Disorder, and are not better accounted for by another mental disorder (e.g. Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder). The fourth type, Attention-Deficit/Hyperactivity Disorder, Not Otherwise Specified, is a category reserved for individuals with prominent symptoms of inattention or hyperactivity that do not meet full criteria for the disorder, such as, individuals with onset of the disorder after age seven.

The inattentive symptoms include: (a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities (b) often has difficulty sustaining attention in tasks or play activities (c) often does not seem to listen when spoken to directly (d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions) (e) often has difficulty organizing tasks (f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework) (g) often loses things necessary for tasks or activities (h) is often easily distracted by extraneous stimuli (i) is often forgetful in daily activities.

The symptoms of hyperactivity include: (a) often fidgets with hands or feet or squirms in seat (b) often leaves seat in classroom or in other situations in which remaining seated is expected (c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness) (d) often has difficulty playing or engaging in leisure activities quietly (e) is often “on the go” or often acts as if “driven by a motor” (f) often talks excessively. The symptoms of impulsivity include: (g) often blurts out answers before questions have been completed (h) often has difficulty awaiting turn (i) often interrupts or intrudes on others (e.g., butts into conversations or games). A coding note, applying especially to adolescents and adults, recommends the qualifier “In Partial Remission” should be used for individuals who have symptoms, which no longer meet the full criteria. As the coding note implies, a reduction in degree of severity of some symptoms with increasing age has been found. Although the Practice Parameters for the Assessment and Treatment of Children, Adolescents, and Adults with Attention-Deficit/Hyperactivity Disorder (Dulcan & Work Group on Quality Issues, 1997) recommend that the DSM-IV criteria for ADHD be used to identify adults with the disorder, researchers have questioned the applicability of the criteria to adults. The field trials associated with development of the DSM-IV criteria consisted of individuals between the ages of 4 and 17 years from 11 sites across the United States (Lahey et al., 1994). Some of the current literature on adult ADHD suggests the DSM criteria thresholds are too high when applied to adults in general (Barkley, 1996) and university students specifically (Heiligenstein, Conyers, Berns, Miller & Smith, 1998).

Murphey and Barkley (1995) collected norms for the DSM-IV item lists on a sample of 467 community-living adults ages 17 to 84 years and found the symptom threshold required to place an individual at the 93rd percentile for their respective age group decreased significantly with age. Barkley (1996) suggested ADHD likely represents a developmentally relative deficit, much like mental retardation, and noted the DSM-IV criteria contain items developmentally appropriate for the relatively young age group used in the field trial, but not necessarily for individuals falling outside of that age group. He suggested that the identified subtypes of the disorder (e.g., primarily inattentive, primarily hyperactive-impulsive, and combined type) may actually represent the manifestations of the same disorder at different stages of development. Hyperactivity is more prominent in affected children relative to affected adults while symptoms of inattention, disorganization, and impulsivity typically persist into adulthood (Pary et al., 2002).

Conversely, O'Donnell, McGann, and Pluth (2001) found that adults reporting a prior childhood diagnosis of ADHD are more likely than controls to make extreme self-ratings on 7 of the 9 inattention, and 5 of the 9 hyperactivity-impulsivity symptoms of the DSM-IV, suggesting the DSM-IV thresholds may be appropriate for young adults. But these respondents were not blind to their diagnostic history, and therefore quite likely to be familiar with the diagnostic criteria. Despite the findings of O'Donnell, McGann, and Pluth, the DSM-IV-TR symptom clusters, especially the criteria for hyperactivity/impulsivity, generally appear to describe the clinical presentation of children and adolescents more accurately than the clinical presentation of adults with ADHD.

Epidemiological studies incorporating diagnostic interviews and careful review of symptoms indicate the childhood prevalence rate for ADHD is between 3% and 5% (American Psychiatric Association, 1994; Rapport, 2001). However, this estimated prevalence rate is based on the number of individuals who present to mental health professionals for diagnosis and some researchers have suggested it may underestimate the true number of afflicted children (Shaywitz, Shaywitz, Sebrechts, & Anderson, 1990). Currently, ADHD is the most commonly diagnosed psychological disorder in children (Barkley, 1998; Pelham & Gnagy, 1999). The reported ratio of males to females is about 3:1 though the ratio varies depending on ADHD subtype and setting (clinic or community). The syndrome may be manifested differently in the sexes, with males exhibiting more oppositional behavior and conduct disturbance than females, while females have been found to have greater intellectual impairment than males. (Dulcan and the Work Group on Quality Issues, 1997). A higher prevalence rate across both sexes has been associated with lower socioeconomic status and urban living (Rapport).

Pathogenesis of ADHD

Although many separate and often conflicting theories have been posited regarding the etiology of ADHD, biological abnormalities are generally presumed to be the primary cause, and environmental factors are thought to contribute to the maintenance and severity of symptoms over time. Popular theories of ADHD have supported an organic basis of the disorder; however, the research findings are equivocal. Researchers have considered the role of brain structure, function, and neurotransmitters in the etiology and expression of ADHD, and have looked to twin studies for genetic contributions to the disorder.

Various brain structures and types of brain dysfunction have been investigated. Much emphasis has been placed on studies which indicate dysfunction in the cortical and subcortical structures that serve the frontal/striatal system (Bradley & Golden, 2001; Rapport, 2001), though evidence has also been provided for involvement of the posterior right parietal, left temporal, and callosal regions in children with ADHD (Bradley & Golden, 2001). Studies supporting the notion of frontal/striatal system dysfunction include work by Lou, Hendrickson, and Bruhn (1984) demonstrating bilateral hypoperfusion in the frontal lobes of ADHD children as assessed by computed tomography and regional blood flow studies, and Zametkin & Liotta, (1998) who found hypofunction and low metabolic activity at the prefrontal and caudate nucleus area of the brain in ADHD participants using positron emission tomography and single-photon emission tomography functional neuroimaging techniques. Other proposed etiologies include dysfunction of cerebral monoamines or neurotransmitter systems involving dopamine, norephinephrine, and/or serotonin (Pary et al., 2002). Research with other disorders has demonstrated a potential role of some neurotransmitters in attention problems. For example, deficiency in mesocortical dopamine has been postulated as being related to defective information processing, executive functioning, memory, and poor attention to detail in schizophrenia (Davis, Kahn, Ko, Davidson, 1998).

Concordance rates of ADHD in families, adopted children, and monozygotic (MZ) versus dizygotic (DZ) twins have demonstrated genetic factors play a significant role in the etiology of ADHD for a substantial number of children. In a review by Bradley & Golden, (2001) it was reported that between 10% and 35% of family members of children with ADHD have been found to have the disorder. Across multiple twin studies, concordance rates for MZ twins range from 50% to 80%, and rates for DZ twins range from 0% to 33%, with heritability accounting for up to 40% of the variance in symptom presentation. Overall, controlled studies have suggested a significant genetic contribution to the development of ADHD,

Research efforts to identify specific environmental contributions to ADHD have covered many areas including: pre- and perinatal cerebral pathology, exposure to toxins, such as maternal smoking and alcohol consumption, and food allergies. (Bradley & Golden, 2001).

Smoking during pregnancy is a risk factor for the development of behavioral and cognitive impairments in children, due to the effects of nicotine on the developing fetus including possible changes in the dopanergic activity of the developing brain and fetal brain damage secondary to prolonged hypoxia (Fielding, 1985, Milberger, Biderman, Faraone, Chen & Jones, 1996). Milberger, Biederman, Faraone, & Jones (1998) used a regression analysis to predict ADHD symptomotology among children who had siblings with ADHD and control subjects and found that maternal smoking accounted for 29% of the variance across participants. A study by Miberger, Biederman, Faraone, and Jones (1997) examining pre- and perinatal factors potentially related to the development of ADHD found significantly higher rates of maternal smoking in children with ADHD relative to children without the diagnosis, no significant differences were found in rates of maternal alcohol consumption or use of illicit drugs. Despite this, other researchers have reported a link between prenatal exposure to alcohol and ADHD. O'Malley & Nanson (2002) conducted a review of animal and human research addressing fetal alcohol spectrum disorders (FASD) and ADHD and reported many FASD patients, through out the lifespan, present with symptoms consistent with ADHD, though symptoms are especially prominent during childhood. ADHD in FASD patients is more likely to be of early onset, primarily inattentive type, and associated with developmental, psychiatric, and medical disorders. Frequently co-occurring psychiatric disorders include anxiety, mood, conduct, and explosive disorders. Various developmental disabilities are often present including mixed expressive-receptive language disorder, deficits in social cognition, working memory, and mathematics.

Feingold (1975) was the first to postulate the possibility that hyperactivity in children may result from intolerance or allergic reaction to food additives. Though some researchers have demonstrated marked behavioral improvement for some children following restricted diets, Bradley & Golden (2001) point out that positive behavioral response to dietary interventions is likely to occur only in a subset of children with ADHD who demonstrate food allergies.

Course of ADHD

Rapport (2001) reviewed several studies and described the course of ADHD from early childhood through adulthood. During early childhood, children with ADHD have been described by their parents as overactive, fearless, disobedient, highly curious, and requiring high levels of adult supervision. Symptoms of the disorder tend to be exacerbated upon entry into elementary school as children are expected to sit still, pay attention, and participate in organized activities for extended periods of time. Additionally, more than 25% of children with ADHD exhibit significant difficulties in reading and/or other academic areas. Difficulty completing homework assignments may contribute to family conflict further complicating the clinical picture. Children with ADHD may experience poor peer relationships and interpersonal difficulties due to problems with inattention, impulsivity, and hyperactivity. Their increased likelihood of social isolation may promote development of low self-esteem in later years.

Approximately 30-80% of children with ADHD continue to meet criteria for the disorder as adolescents (Barkley, 1996; Rapport, 2001). Though problems with obvious overactivity may transition to fidgeting and restlessness, difficulties with attention/concentration, impulsivity, and following directions remain prominent (Rapport). High rates of conduct disorder, characterized by a pattern of serious and pervasive antisocial behaviors, have been reported for adolescents who have ADHD with estimates ranging from 35% to 60% (Biederman, Newcorn, & Sprinch, 1991; Rapport). Adolescents with comorbid ADHD and Conduct Disorder are particularly vulnerable to problems with alcohol and substance abuse (Horner & Scheibe, 1997; Milin, Loh, Chow, & Wilson, 1997; Rapport), once again complicating the clinical picture.

Core clinical symptoms, related behavioral problems, and suboptimal outcomes, such as social skills deficits, antisocial behaviors, poorer work records, lower job status, lower socioeconomic status, and unstable marriages as adults persist into adulthood for approximately 30% to 70% of children diagnosed with ADHD (Klein & Mannuzza, 1991; Rapport, 2001; Weiss et. al., 1985). Prospective controlled naturalistic longitudinal studies of hyperactive children have reported that only about 50% function well as adults (Dulcan and the Work Group on Quality 1997). Only 5 to 12% of children diagnosed with ADHD earn a college degree relative to 41% of control students without the disorder who are enrolled in college.

Diagnosing ADHD in Adults

There are no unequivocal laboratory tests or physiological markers for diagnosing ADHD; accurate diagnosis rests on clinician judgment. ADHD is a behaviorally based disorder and behavioral observations are required to identify and diagnose the disorder. Ideally, this clinical judgment is based on information from multiple sources including patient report, corroborated report from relative or significant others, direct observation of the patient in multiple settings, and patient performance on objective tests of cognitive abilities (Dulcan & Work Group on Quality Issues, 1997).

A thorough clinical interview should assess past and current medical, psychosocial, and academic functioning as well as presence of criteria for ADHD. The ADHD subscale of The Mini International Neuropsychiatric Interview (Sheehan, 1998) and rating scales such as the Attention Deficit Scale for Adults (Triolo & Murphey, 1996), the Brown Attention Deficit Disorder Scales (Brown, 1996), and the Conners' Adult ADHD Rating Scales (Conners, Erhardt, & Sparrow, 1999), may be useful in assessing ADHD and associated symptoms in adults. Retrospective self-report of childhood symptoms can be attained by the Wender Utah Rating Scale (Ward, Wender, & Reiher, 1993). Additionally, parents of college students can complete an ADHD childhood symptom checklist (Barkley, 1990) retrospectively to establish the presence of ADHD in childhood. Although retrospective self-reports tend to have good predictive power in identifying adults with ADHD in settings in which the prevalence rate of ADHD is high, such as ADHD clinics, retrospective diagnosis made exclusively on the basis of self-reports is likely to produce false positives in three out of four cases when the prevalence rate of ADHD more closely approximates that of the general population, in primary care facilities, for example (Mannuzza, Klein, Klein, Bessler, & Shrout, 2002). Additionally, in most research the accuracy of self-reports, current or retrospective, has tended to be examined within the context of studies in which participants did not stand to profit from obtaining a diagnosis of

ADHD. When patients are motivated by external gains such as access to stimulant medication, or academic accommodations, the accuracy of self-report should be more carefully considered and corroborated by others with an even greater degree of diligence.

Tests of cognitive abilities, such as the Wechsler Adult Intelligence Scale (Wechsler, 1997), or Woodcock Johnson Tests of Cognitive Abilities (Mather & Woodcock, 2001), memory measures, such as the Wechsler Memory Scale (Wechsler, 1997), California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1987), achievement tests, such as the Woodcock Johnson Tests of Achievement (Mather & Woodcock, 2001) or Wechsler Individual Achievement Tests (Wechsler, 1992), and objective neuropsychological tests of attention, concentration, executive functioning and problem solving ability are commonly used in assessment of ADHD in adults. Such tests may help to assess cognitive strengths and weaknesses, help in treatment planning, and may assist in ruling out differential diagnoses such as learning, cognitive, or amnestic disorder. Tests of executive functioning such as the Stroop Screening Tests, Wisconsin Card Sorting Test, Category Test, and Trial Making Test are often used in assessment of ADHD, though they have not been found to reliably distinguish ADHD groups from controls. Computerized tests of sustained attention, such as the Test of Variables of Attention (TOVA) and Connors' Continuous Performance Test (CCPT) generally provide indices of response time, omission errors, and response speed variability. Research shows continuous performance tests have only low to moderate sensitivity and low specificity in detecting ADHD (ECRI, Health Technology Assessment Information Service, 2000). However, some studies have indicated continuous performance tests can discriminate simulated malingerers (that is, participants instructed to respond as if they had ADHD, as they understood it) from controls in college students. Tests of psychological functioning and personality can assist in differential diagnosis and in detection of comorbid disorders, such as depression, anxiety, and personality disorder.

Differential Diagnosis

Attention deficits can occur in many Axis 1 conditions other than ADHD and overlapping symptoms between disorders can result in misdiagnosis. Adults suffering from mood disorders may demonstrate impaired concentration and task completion but usually also present with disturbances in mood, sleep, appetite, energy, and interests. In affective disorders such as depression, the problems with concentration are usually traced to the onset of the illness. The hyperactivity, distractibility, and impulsivity associated with hypomania and mania presents with distinct changes in sleep, mood, and behavior.

Adults suffering from anxiety disorders may present with restlessness, irritability, and difficulty concentrating. Concentration problems related to an anxiety disorder, however, unlike the concentration problems experienced in ADHD, would likely occur in combination with other behaviors, such as worry and apprehension, and would likely abate with treatment for anxiety. The differential diagnosis of ADHD in adults should also consider alcohol and substance abuse or withdrawal. Determining the onset and course of inattentive and/or hyperactive/impulsive symptoms is key in differentiating ADHD from other Axis I disorders. In ADHD at least some of the core symptoms and resulting impairment are persistent from childhood (Pary et al., 2002).

Comorbidity in Adults with ADHD

In adults with ADHD, anxiety and mood disorders, substance abuse, and antisocial personality have been reported to frequently co-occur. About 75% of adults with ADHD have some comorbid condition (Biederman et al., 1993). Biederman, (1998) reported anxiety disorders are present in 50% of adults with ADHD, substance abuse occurs in 27-46% and antisocial personality in 12-27%. Downey et al. (1997) reported similar findings with regard to substance abuse, and antisocial personality, but also reported depressive orders were found in 37% of their sample of 78 adults with ADHD. ADHD is significantly overrepresented in persons with substance abuse (Horner & Scheibe, 1997; Schubiner et al., 2000) and in prison populations (West, 1999).

Milin, Loh, Chow, & Wilson (1997) examined symptoms of conduct disorder, antisocial personality disorder, and ADHD in a group of inpatient substance abusers (without evidence of any major current psychiatric disorder except substance abuse and ADHD) and obtained evidence supporting the notion that ADHD is an independent risk factor for substance use disorders. A prevalence rate of approximately 25% has been found among adults in substance abuse treatment. Additionally, some research suggests presence of ADHD predicts poor treatment response for substance abuse. Cocaine abusers with a history of childhood ADHD were found to have poorer treatment outcome than cocaine abusers without history of ADHD (Milin, Loh, Chow, & Wilson).

Prevalence of ADHD in Adults and College Students

The prevalence of ADHD in adult and college populations has not been nearly as well established as the prevalence in childhood. Assuming a 4%

prevalence of ADHD in childhood, Hill and Schoener (1996) examined 9 longitudinal studies of children with ADHD and found that the rate of ADHD in a given age group appeared to decline by 50% approximately every 5 years. By extrapolating this rate of decline, they computed a prevalence rate of 0.8% at age 20. Other estimates based on the continuation of childhood symptoms are significantly larger. Wender (1998), for example, estimated a 2% prevalence rate in adults. Longitudinal studies of children with ADHD suggest even less decline in symptoms with age. For college students, recent surveys assessing ADHD symptoms have suggested prevalence rates ranging from .5 to 8% depending on the measures, degree of significance (1.5 versus 2 standard deviations above the mean), inclusion of reported childhood symptoms, and use of age-adjusted threshold for hyperactive symptoms (Weyandt, Linterman, & Rice ,1995). These estimates seem high given the childhood prevalence rate, the low percentage of children with ADHD believed to complete college, and the consideration that at least some symptoms may diminish with age.

Although it is now recognized that symptoms of ADHD may persist into adulthood for many individuals, it is difficult to estimate the prevalence of ADHD in adulthood in the absence of established base rates of inattentive, hyperactive, and impulsive symptoms in the general adult population. Earlier research has demonstrated the importance of establishing base rates of symptoms in non-clinical populations prior to drawing conclusions about symptoms in clinical populations. Gouvier, Cubic, Jones, Brantley, & Cutlip (1992) and Gouvier, Uddo-Crane, & Brown (1988) found no significant differences in the number of post-concussional symptoms reported by head-injured and control groups, offering a caveat regarding assessment: the presence of symptoms alone, without consideration of frequency, intensity, and duration, should not be considered sufficient to establish a diagnosis. Additionally, base rates exert a significant influence over the diagnostic accuracy of any assessment instrument (Gouvier, 2000). This influence may explain the high prevalence rates found for ADHD in college students when self-report measures are used to assess for symptoms

Academic Functioning and Psychopathology in College Students with ADHD

Research has indicated college students with ADHD experience academic impairment and may be more vulnerable to psychological distress. Heiligenstein, Guenther, Levy, Savino, & Fulwiler (1999) found that college students meeting criteria for ADHD during adulthood reported significantly more academic problems, were more likely to be on academic probation, and had a significantly lower mean grade point average relative to a control group. Students with active comorbid psychological disorders were excluded from the study, so that differences between groups appear to be related to ADHD rather than another psychological disorder, such as anxiety or depression. Unfortunately, students were not screened for learning disabilities; however, the authors reported most participants did not have apparent academic problems during childhood. There were no differences between groups for reported psychosocial problems, but this is not surprising since those with comorbid psychological disorders were excluded from the study. Other researchers have reported an association between ADHD and psychological distress. Downey et al. (1997) compared adults with ADHD to adults with ADHD and a comorbid Axis 1 disorder. As expected, the comorbid patients endorsed significantly elevated scores on measures of psychological distress relative to the ADHD only group. However, even the noncomorbid ADHD patients produced significant elevations relative to norms on some subscales of the Tridimensional Personality Questionnaire (TPQ) novelty seeking and harm avoidance scales and generated moderate elevations (T scores between 58 and 64) on scales F, 4, 6, & 8 of the Minnesota Multiphasic Personality Inventory-2nd edition (MMPI-2).

Richards, Rosen, and Ramirez (1999) found that college students with confirmed ADHD and ADHD by self-report only, produced very similar profiles on the Symptom Check List (SCL-90-R), scoring significantly higher than a control group on all scales of the SCL-90-R except for the Paranoid Ideation Scale. The self-report ADHD group consisted of students whose parents', serving as informants for respective participants on retrospective and current symptom checklists, disconfirmed or did not significantly endorse ADHD symptoms on the checklists completed. The confirmed ADHD group consisted of students meeting both childhood and current diagnostic criteria of the disorder and had parental confirmation on self-report measures. The authors suggested the self-report group may have experienced symptoms which mirrored ADHD, or that the parents were poor historians. In either case, these results suggest that reliance on self-report measures in the assessment of ADHD in college students may be problematic.

Turnock, Rosen, & Kaminski (1998) compared the academic coping strategies of college students who self-reported many symptoms of ADHD to college students who reported few symptoms of ADHD. They found that high symptom (HS) students used significantly fewer academic coping behaviors relative to their low symptoms (LS) peers. HS students were less organized and methodical while studying, procrastinated more, and employed fewer self-control or self-disciplinary behaviors. HS students achieved significantly lower grades and dropped out of classes more often than LS students. Moreover, academic success of HS students was not related to the use of coping strategies, though intelligence predicted success for HS students. For LS students, intelligence was not significantly correlated with academic success; coping strategies, specifically delay avoidance, were significant predictors of GPA. In other words, for college students with many ADHD symptoms, academic achievement was more strongly associated with intelligence, than with study skills.

Weyandt, Linterman, & Rice (1995) speculated there may exist a group of capable ADHD college students that due to their compensatory abilities, are not identified during childhood and attain adequate achievement in elementary and secondary school yet experience greater difficulty during college due to increased demands for sustained attention and inhibition. The authors administered several neuropsychological tests (Wisconsin Card Sorting Test, Stroop Screening Test, Visual Search Attention Test, and Raven's Coloured Progressive Matrices) to two groups of students reporting significantly high or low symptoms of ADHD. There were no differences between the groups on any neuropsychological measure except for the Raven's Coloured Progressive Matrices, on which the high symptom group performed better; this single finding is the basis of their speculation regarding capable ADHD college students.

Treatment of ADHD

Psychosocial Treatments

Behavioral treatments such as parent training, school interventions, contingency management techniques, intensive treatments, and cognitive-behavioral techniques such as self-instructional training, problem-solving strategies, cognitive modeling, self-monitoring, self-evaluation, social skills training, and anger control have been researched extensively with children (Pelham & Gnagy, 1999) but little research has examined the effectiveness of these strategies with ADHD adults. Although some of the techniques, such as parent training, are impractical for use with an adult population, cognitive-behavioral strategies, such as self-instructional training, which focuses on improving attention and self-control through self-mediated strategies, may be appropriate for use with adults.

Self-instructional training usually consists of four basic steps: cognitive modeling, overt guidance, faded self-guidance, and covert self-instruction (Blandford & Lloyd, 1987). These four steps are used to generate six types of self-statements to help individuals guide their work through the stages of problem completion including problem definition, focusing of attention, planning response guidance, self reinforcement, self-evaluation, coping, and error corrections (Pindiprolu, 1997).

Ratey, Greenberg, Bemporad, & Lindem (1992) suggest a psychoeducational model that includes identifying deficits associated with ADHD and how they affect the patient, reducing self-blame, and devising coping strategies which maximize the patient’s strengths and the fit between the individual and environmental demands. Weinstein (1994) reported that cognitive remediation or the direct teaching and practice of strategies for improving attention and memory, and solving problems may be helpful for adults with ADHD. Morgan (2000) developed a time-limited group treatment program for adults which addresses a variety of common symptoms and problems associated with ADHD. The group is designed to meet for 60-75 minutes a week for about 10 sessions and includes the following components: (a) psychoeducation (b) referral for pharmacological and specialized treatments (c) behavioral self-management skills training (d) cognitive behavior therapy for emotional control and coping with stress (e) relationship and social skills training (f) group interactions to provide mutual support, encouragement, reinforcement, exchange of ideas and information.

Self-monitoring and scheduling daily activities may help adults with ADHD impose structure in their daily lives and facilitate adherence to goals and commitments (Pary et al., 2002). Comorbid disorders, such as substance abuse, adjustment disorder, learning disorder, and anxiety, should be appropriately addressed through rehabilitation or therapy. The focus of therapies should match the behavioral difficulties, anger management groups or marital counseling may be appropriate. Many colleges offer study skills, time management, and/or college adjustment classes or orientation programs. Psychosocial treatment strategies for treating ADHD are low risk and have very little potential for harm due to misuse by college students, and may help adults learn problem solving strategies that can be applied to many situations. However, many college students would rather take medication than learn self-instructional training or practice organizational strategies.

Pharmacology

Stimulants, such as methylphenidate and dextroamphetamine are considered first-line pharmacological treatments for adults who do not abuse alcohol or illicit drugs (Pary et al., 2002). However, despite clear evidence of temporary beneficial effects of stimulant medications on daily classroom performance, disruptive behavior, and peer interactions in children, there is no evidence of enhanced long-term changes in academic achievement, interpersonal relationships, or long-term prognosis in adolescents and adults (Pelham & Gnagy, 1999). Side effects from these stimulants include insomnia, anorexia, abdominal discomfort, headaches, and irritability. Stimulants may exacerbate coexisting disorders of anxiety, panic, psychosis, or mania (Pary). Two antidepressant drugs, Bupropion and Venlafaxine, have been reported to have efficacy in ADHD. Guanfacine, an alpha-2-adrenergic agonist has also been found to be effective in reducing ADHD symptoms in adults (Taylor & Russo, 2001). Atomoxetine, a nonstimulant, selective noradrenaline reuptake inhibitor is the first drug approved specifically for treatment of ADHD in adults and has shown greater efficacy than placebo in two large controlled trials with adults (Simpson & Plosker, 2004). Nonstimulant medications for ADHD may be more appropriate than stimulant medications for adults at risk for substance or alcohol abuse.

Current research indicates methylphenidate is a common drug of abuse on high school and college campuses. Moline and Frankenberger (2001) surveyed 651 students between the ages of 11 and 18, regarding use of and attitude toward stimulant medications. Fifty students reported being treated with stimulant medication to treat ADHD. Of the fifty, thirty-four percent reported being approached to sell or trade their medication. Fifty-three percent of the students not taking stimulant medication reported that some students taking stimulant medication gave away or sold their medication. Babcock and Byrne (2000) distributed a survey regarding recreational methylphenidate use to the student body of a public liberal arts college in Massachusetts. About 17% of the 283 respondents reported using methylphenidate recreationally, with about 13% reporting intranasal administration. These rates of stimulant abuse are significantly higher than the rates reported in a survey completed about a decade earlier. In that survey of 683 students enrolled at a major research university located in the Southwestern United States during the 1986-87 academic year assessed use of alcohol, marijuana, LSD, amphetamines, tranquilizers, and cocaine, and found less than 3% of the participants reported using any amphetamine in the past year (Clifford, Edmundson, Koch, & Dodd, 1989). Abuse of methylphenidate is likely to rise as it becomes increasingly accessible. Given this, college students who self-refer for assessment of ADHD and appear to be seeking stimulant medication need careful examination to consider the possibility of malingering.

Defining Malingering

Malingering is listed in the DSM-IV (1994) as an additional condition that may be a focus of clinical attention. It is defined as the intentional production of false or grossly exaggerated physical or psychological symptoms, motivated by external incentives such as avoiding work or military duty, obtaining financial compensation or drugs, or evading criminal prosecution. The presence of external gain distinguishes malingering from factitious disorder, wherein an individual has a psychological need to assume the sick role, and other clinical disorders such as somatoform disorder, wherein motivations are presumed to be unconscious. However, it has been acknowledged that it is difficult to distinguish between conscious and unconscious symptom production (Soniat, 1967; Travin & Potter, 1984). Additionally, external gains, such as special attention from others or escape from work, often accompany assumption of the sick role.

College students who malinger or exaggerate symptoms of ADHD to obtain a clinical diagnosis may be motivated by several various factors, both internal and external. The specific academic accommodations for students with disabilities vary depending on type and severity of clinical diagnosis, state guidelines, university policy, and specific clinical recommendations. College students diagnosed with ADHD may receive various academic accommodations such as priority registration, preferential seating, extended time for assignments and exams, admission to study skills classes or tutoring, a distraction free environment during testing or individual test administration versus group examinations. Similar accommodations may also be granted for high stakes standardized tests used in part to determine entrance into specific fields of study, colleges, or for credentialing purposes, such as the Scholastic Achievement Test, Teachers' Praxis Examination, or Graduate Record Examination.

While the accommodations granted to students with some disabilities, such as presenting testing materials in larger print for visually impaired students, are logically and specifically related to disability; many of the accommodations typically granted to college students diagnosed with ADHD, such as extended time, would benefit most students regardless of disability status. Hence, the type of academic accommodations typically granted to ADHD students may be desirable to students without any disability. When these accommodations are offered to unimpaired students, they represent an unfair advantage in otherwise highly competitive academic situations.

A diagnosis of ADHD may fulfill an internal motivation by providing a self-handicapping explanation, excuse, or crutch for college students experiencing academic difficulty. It may also serve to lower the expectations of parents, instructors, or the self, and lessen perceived pressure to perform well in college. For many, a diagnosis or ADHD is preferable to alternative explanations of academic difficulty, which might imply limited cognitive ability, specific learning disability, poor fit between curriculum or university and student, or lack of effort.

Lipman (1962) described four distinct types of malingering: patients without any symptoms may fabricate or "invent" them; patients may claim to have symptoms that actually occurred at one time but have since ceased; patients may exaggerate current symptoms; and patients may falsely attribute actual symptoms to a specific injury, event, or disorder. Three of these strategies for malingering apply to the college student attempting to feign ADHD. Most individuals experience periods of excessive or problematic inattention at some point, so malingerers would rarely have to claim having inattentive symptoms they have not actually experienced, although those knowledgeable about the diagnostic criteria for ADHD may be able to do so. College students with a history of ADHD may claim continued symptoms or exaggerate residual symptoms. Finally, college students may be experiencing inattention as a feature of another clinical syndrome, such as anxiety, mood disorder, substance abuse, or sleep disturbance, and consciously or unconsciously attribute their symptoms to ADHD.

Assessing Malingering

The research literature is replete with studies on the detection of malingering of memory and neuropsychological impairment. Although malingering of memory and attention problems on neuropsychological tests have been studied extensively, the focus of most studies has been on malingering of cognitive deficits after head injury; studies examining malingering of attention impairment in assessment of ADHD are rare. However, the stakes associated with malingering attention problems in pursuit of an ADHD diagnosis, relative to malingering cognitive deficits in pursuit of financial compensation following head injury, may make it a safer disorder to fake, possibly increasing the base rate of malingering in this situation. Additionally, individuals with antisocial personality disorder and/or substance abuse disorders, which are frequently comorbid with ADHD, have been found to be more prone to malinger than other individuals (Sierles, 1984), introducing another factor which could possibly increase the base rate of malingering in ADHD assessment.

Incentive to malinger, exaggerated complaints of impairment or distress, inconsistent performance on test batteries, and poor performance on effort tests all indicate the possibility of malingering. The diagnosis of malingering, like other diagnoses, is based on information from multiple sources and clinician judgment.

Nies and Sweet (1994) have outlined several basic strategies consistent with the current research evidence that are useful in detecting malingering. They recommend evaluating patterns of performance on neuropsychological testing measures as well as using specific tests of malingering.

Performance that falls below chance levels on forced choice tests, such as true and false tests, for example, may indicate malingering. Nonsensical test patterns or excessive inconsistency within or across evaluation measures, such as better performance on free recall relative to recognition in memory tests, are another indication of malingering. Inconsistencies in performance should generally not extend beyond what would be expected based on the known test-retest reliability, standard error of measure, or practice effects associated with respective measures and the testing situation.

Patterns of performance on the Wechsler scales have been examined extensively and multiple studies have reported that large performance differences between selected subtests or subscales of the WAIS and WMS batteries are indicative of malingering (Hilsabeck et al., 2003; Iverson, Slick & Franzen, 2000; Iverson & Tulsky, 2003; Langeluddecke & Lucas, 2003; Mittenberg, Azrin, Millsaps, & Heilbronner, 1993; Mittenberg, Theroux-Fichera, Zielinski, & Heilbronner, 1993; Mittenberg,Thompson, Schwartz, 1991). The analog malingerers of Mittenberg et al., (1993) scored significantly poorer on Attention/Concentration Index of the WMS-R than on the General Memory Index, a pattern opposite what is typically seen in head injured patients. Similarly, a large difference score between the Vocabulary and Digit-Span subtest of the WAIS-R and WAIS-III is also suggestive of malingering (Mittenberg et al., 1993).

Using such difference scores to detect malingering in assessment for ADHD is problematic, however, since the norming studies for the WAIS-III indicate scores on subtests measuring attention and processing speed tend to be among the lowest subtest scores for that population and, to date, there are no empirical studies evaluating difference scores and malingering in the ADHD population.

Tests of malingering or effort utilized in neuropsychological assessment employ several strategies to assess malingering. Many tests present a simple memory task or attention task presented as being more difficult than it actually is or may utilize a forced choice paradigm that relies on probability to determine score, with scores falling below chance level suggesting malingering. For example, the Portland Digit Recognition Task presents a consecutive series of 5 digit numbers. After each number is presented, the patient is given a brief distraction task (counting backward) and then asked to choose the presented number from a set of two numbers. A similar problem may apply to the use of effort tests in assessment of ADHD as with the use of attention-vocabulary difference scores: malingering tests often require participants to perform relatively simple tasks or attend/respond to a simple stimulus, as do many objective measures of attention; hence, the similarity in task demands may yield similar patterns of performance. Preliminary research by Booksh, Dixon, Fabian, & Gouvier (2003) found a significant correlation between performance on a task designed to measure inattention and a task designed to measure malingering, indicating that the capacity for sustained effort may underlie performance on both. Additionally, there is little empirical evidence supporting the use of malingering tests in assessment of ADHD.

Malingering and ADHD

Few studies have addressed the problem of malingering and ADHD in college students, Leark, Dixon, Hoffman, & Huynh (2002) investigated the effects of simulating attentional disorders on the Test of Variables of Attention (TOVA) by having college students complete the measure under normal and simulation conditions. The authors found that simulated malingerers produced high scores on indices of omission and commission errors, response time, and variance. Quinn (2003) investigated the ability of college students to feign ADHD on a self-report and a continuous performance test (CPT) and found that college students could successfully feign ADHD on the ADHD Behavior Checklist but not on the Integrated Visual and Auditory Continuous Performance Test. The CPT impairment index results revealed good sensitivity and specificity, 94% and 91%, respectively, as well as good positive predictive power and negative predictive power in discriminating an actual ADHD group from the simulated malingering group.

PURPOSE OF STUDY

The purpose of the present study is to investigate the ability of college students to simulate ADHD symptoms on commonly used objective measures of attention and self-report measures of ADHD symptoms. Although a few research studies have compared the performance of simulated malingerers to ADHD and control subjects on self-report and continuous performance tests, none have evaluated the relationship between knowledge of ADHD and symptom production or performance on other objective tests of attention and effort. Additionally, the present study evaluates the appropriateness of using traditional effort tests in assessment of ADHD in college students. The answers to these questions are important given the prevalence of reported ADHD symptoms in college students, and the potential for abuse of stimulant medication on college campuses.

Research Questions and Hypotheses

Question 1

Do simulated malingerers perform differently than persons with ADHD and control subjects without a diagnosis of ADHD on objective tests of attention and self-report measures? Or stated differently, are college students able to effectively simulate ADHD symptoms on objective measures of attention and self-report measures of ADHD symptoms?

Hypothesis: Simulated malingerers will endorse significantly more symptoms than control subjects on self-report measures, performing similarly to ADHD controls. However, simulated malingerers will perform more poorly than ADHD controls on objective measures of attention. Previous research indicates simulated malingerers have greater difficulty feigning disorders on objective attention tests than on self-report measures (Leark et al., 2002; Quinn, 2003). Martin, Hayes, & Gouvier (1996) reported similar findings with regard to postconcussive disorder; simulated malingerers were able to accurately replicate symptoms on self-report measures. This hypothesis is congruent with the finding of previous research, but uses many measures heretofore untested with simulated malingerers in assessment of adult ADHD.

Question 2

Is knowledge of ADHD related to ability to simulate ADHD on objective measures of attention and self-report measures? This question addresses the potential mediating effects of knowledge on the performance of simulators on self-report versus objective measures of attention. The influence of knowledge on effort tests will also be investigated.

Hypothesis: Knowledge of ADHD will be significantly correlated with performance on self-report measures but will not be significantly correlated with performance on effort tests or on objective measures of attention within the simulated malingering group. Knowledge of ADHD will be measured by the ADHD Knowledge and Opinions Survey- Revised (AKOS-R: Rostain, Power, & Atkins, 1993). No relationship is expected between ADHD knowledge and performance on self-report, objective, or effort measures within the control group.

There is no prior research addressing the influence of knowledge on ability to malinger ADHD. It seems logical that knowledge of a disorder would aid a malingerer in simulating a disorder on self-report measures. However, earlier research has demonstrated that personal experience with a disorder does not always increase knowledge about the disorder. O’Jile et. al., (1997) found that head-injured and non head-injured participants demonstrated very similar performance on a test measuring misconceptions about head-injury. The media attention given to ADHD has likely educated the public and decreased popular misconceptions about the disorder.

Earlier research has found that prior experience and knowledge of head injury does not significantly influence ability to feign mild head injury symptoms on objective measures of neuropsychological functioning (Hayes, Martin, & Gouvier, 1995). This finding suggests that even when malingerers are sufficiently familiar with the symptoms of a disorder to successfully fake the self-report, they may be unable to mimic impairment on objective measures.

Question 3

Are traditional tests of memory malingering and/or effort sensitive to malingering in college students attempting to feign ADHD?

Hypothesis: No directional hypothesis is postulated. The sensitivity of effort tests to malingering in ADHD assessment is important considering ADHD assessment relies so heavily upon self-reported symptoms and college adults may have many incentives to obtain a diagnosis. To further investigate the sensitivity of effort tests in detecting malingering in ADHD assessment, the use of effort tests in detecting malingering will be compared to the use of clinical judgment alone to detect malingering. To facilitate this comparison, the data will be masked and the primary researcher and an independent licensed clinical neuropsychologist will make judgments as to the group membership of each participant, individually, based on the participant’s performance on the objective measures of attention and the Wender Utah Rating Scale.

METHOD

Participants

Related literature (Downey, Stelson, Pomerleau, & Giordani, 1997; Inman & Berry, 2000; Leark, Dixon, Hoffman, & Huynh, 2002; Martin, Hayes, & Gouvier, 1996; Quinn, 2003; Weyandt, Rice, Linterman, Mitzlaff & Emert, 1998) was reviewed and effect sizes were estimated using partial eta squared, as earlier studies included both F and T tests. Preliminary power analysis findings showed one hundred eight participants total is needed to find a difference between groups at power = 0.80, alpha = .05 .

Participants were undergraduate students enrolled in psychology courses at Louisiana State University at Baton Rouge who responded to notification on the LSU research website. Students volunteers received class extra credit for their participation in this study. Exclusion criteria were age less than 18 years, history of Learning Disability, ADHD or current complaint of significant problems with inattention, impulsivity, or hyperactivity; moderate or severe brain trauma within the past five years, neurological disease, or seizure disorder. Participants were randomly assigned to either the control condition or the simulated malingerer condition. Archival testing data from students diagnosed with ADHD at the LSU Psychological Services Center was used as an ADHD comparison group when available. Testing data was used only from students who had signed a voluntary consent to the anonymous use of their testing data at the time of their assessments.

Materials

The materials used in this study included a structured clinical interview and feedback questionnaire designed by the primary researcher, a questionnaire assessing knowledge of ADHD, a structured interview for ADHD symptoms, objective measures of attention, self-report measures of ADHD symptoms, and effort tests. The objective measures included the Connor's Continuous Performance Test, The Trail Making Test, and four subtests from the Wechsler Adult Intelligence Scale: Digit Symbol Coding, Digit Span, Symbol Search, and Letter-Number Sequencing. The self -report measures included the Wender Utah Rating Scales and Attention-Deficit Scales for Adults. The effort measures included the Memorization of 15 Items, and Word Memory Test. Descriptions of each measure follow:

Interviews and Questionnaires

Structured Clinical Interview

A structured clinical interview was developed and was administered to all test participants to obtain the following information: gender, race, age, education, college major and minor, grade point average, socioeconomic status, knowledge of ADHD, and screening for exclusion criteria.

Feedback Questionnaire

A brief feedback questionnaire was developed asking participants to summarize task instructions and provide a rating, on a scale of 0 to 10, with 0 being the lowest rating and 10 being the highest rating, of compliance with instructions, and perceived success on the task.

ADHD Knowledge and Opinions Survey- Revised

The AKOS-R is a questionnaire designed to assess parental knowledge of and attitude regarding ADHD and treatment interventions. A modified version of the Knowledge Scale of the AKOS-R, comprised of 17 true or false statements regarding childhood ADHD, including etiology, course, pharmacological intervention, and academic functioning, was administered to all participants. Three statements added to the measure by Rebecca Owen Currier (2004) for use in a previous dissertation were retained. The original measure was designed for parents and uses the word “child” or “children” as the participant in many items. The items were reworded to replace all instances of the word(s) child or children with “people” or “persons” as appropriate for use with college students.

Mini International Neuropsychiatric Interview

The MINI is a structured diagnostic psychiatric interview for DSM-IV and ICD-10. The ADHD adult subscale assesses retrospective childhood symptoms and current symptoms of ADHD experienced by adults. Questions in the current section are phrased to assess the symptoms as they are experienced in adulthood so that questions reflect problems with work, marriage, underachievement, etc., and take into account a lessening in the severity of some symptoms, such as hyperactivity, with age.

Objective Measures of Attention

Connors’ Continuous Performance Test

The CCPT is a computer-based test designed to measure inattention, impulsivity, and response time variability by having participants respond to visually presented stimuli. “Target” stimuli and non-target stimuli are presented in rapid succession. Participants are required to press the space bar on the computer keyboard whenever a “target” appears and to inhibit responding to “non-targets”. Omission errors, commission errors, response time, and several indices of response time variability are reported. Omission errors represent inattention and commission errors reflect impulsivity. Response speed and response speed variability is recorded in milliseconds and is designed to measure consistency of performance and sustained vigilance over the course of the test.

Trail Making Test (TMT)

The TMT was originally part of the Army Individual Test Battery originated in 1944. This paper-pencil test 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 alternate between and connect in sequential order (i.e. I-A-2-B-3-C, etc.). Scores are based on time to complete the measure. A significant difference in time to complete part A and part B is thought to reflect difficulty alternating attention, although poor scores for either part A, or part B, may be indicative of an attentional problem.

Wechsler Adult Intelligence Scale-Third Edition (WAIS-III): Digit Symbol-Coding (DSC), Digit Span (DS), Symbol Search (SS), and Letter-Number Sequencing (LNS) subtests

The ADHD sample in the normative studies for the WAIS-III was found to perform relatively more poorly on the DSC, DS, SS, and LNS subtests (Technical Manual for WAIS-III). The DSC subtest is a timed paper and pencil symbol substitution or coding task. Participants use a key of paired numbers and nonsense symbols to complete the task, which requires participants to draw the corresponding symbols below rows of numbers. The DS subtest is a brief test of auditory attention, which consists of two parts. The first part requires participants to repeat increasingly long strings of numbers orally presented by the examiner and the second part requires participants to recall the string of presented numbers in reverse order. The SS subtest is a timed orthographic measure of visual attention, scanning, and motor speed. Participants must determine if a target nonsense figure is present in a string of figures and mark a corresponding "yes" or "no" box presented at the end of each item. The LNS subtest is a verbal working memory task. The examiner presents increasingly long strings of randomly arranged numbers and letters which the participant must repeat back in alphabetical and numerical order.

Self-report Measures of ADHD Symptoms

Attention-Deficit Scales for Adults

The ADSA is a 54 item self-report designed to assess symptoms of ADHD in adults. The measure contains 9 clinical subscales, an internal consistency measure, and a total score. The clinical subscales represent the multiple areas thought to be effected by ADHD in adults and are labeled: 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. In a validation study reported in the ADSA manual, the mean total score for ADHD adult participants (N = 87) was 45 points higher than that of the normative group (N = 306).

Wender Utah Rating Scale

The WURS is a 61 item self-report questionnaire designed to measure adults' retrospective rating of the presence and severity of childhood symptoms associated with ADHD. The DSM-IV diagnostic criteria for ADHD specifies that some hyperactive-impulsive or inattentive symptoms that cause impairment were present before age 7. The WURS provides a quantitative way of assessing this criterion. Ward et al. reported 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).

Effort Tests

Memorization of 15 items

The MFIT is a technique for measuring participant cooperation or malingering. The participant is told the task is a memory test for 15 different items and is presented with a sheet of paper containing five rows of three characters to study for 10 seconds before copying what they remember. The test is presented as being more difficult than it actually is by stressing the number of items to be remembered. The items are so closely related that participants need remember only three or four ideas to recall most of the items. For example one row contains the letters 'A B C' and another contains the same letters in lower case print.

The Word Memory Test

The WMT measures both verbal memory and effort. The task involves learning a list of 20 semantically linked word pairs with each pair presented for 6 seconds each on the computer screen. The list is presented twice and then an immediate recognition (IR) task is presented in which word pairs, containing only one of the stimulus words are presented. The participant must choose the original stimulus word from the new pairs. A similar delayed recognition (DR) task is presented 30 minutes later, which presents the same stimulus word with a different foil. The IR and DR comprise the effort tasks and are relatively easy and are completed with 95% accuracy by adults with severe brain injury or neurological diseases (Green & Allen, 1999). Consistency of responding to the IR and DR tasks is also computed. Following the effort tests, a series of memory tests is completed including a multiple choice (MC) test in which the participant is given the first word and must select the other word of the pair from 8 choices, a paired associate test, in which the participant is told the first word of the pair and must name the second word, and a delayed free recall (DFR) task, in which the participant recalls as many words from the list as possible, in any order, and a long delayed free recall task, which is the same as the DFR task, but occurs after a 20 minute delay.

All the measures described above, their scales, and subscales, are presented in Table 1. Table 2 lists all independent and dependent variables, and provides operational definitions.

Table 1

Assessment measures, respective scales/subscales by category

Knowledge of ADHD 1. ADHD Knowledge and Opinions Survey-Revised

Objective Tests of Attention
1. Connors' Continuous Performance Test (CCPT)
    # Hits
    # Omissions
    # Commissions
    Hit Response Time (RT)
    Hit RT Standard Error (SE)
    Variability of SE
    Attentiveness
    Risk Taking
    Hit RT Block Change
    Hit SE Block Change
    Hit RT Inter-stimulus-interval (ISI) change
    Hit SE ISI change
2. Trial Making Test (TMT)
    Part A
    Part B
3. Wechsler Adult Intelligence Scale-Third Edition (WAIS-III)
    Digit Span (DS)
    Letter-Number Sequencing (LNS)
    Symbol Search (SS)
    Digit Symbol-Coding (DSC)
    Processing Speed (PS)

Interview and Self-Report Measures of ADHD Symptoms
1. Mini International Neuropsychiatric Interview (MINI)
    ADHD Adult subscale
2.. Attention-Deficit Scales for Adults (ADSA)
    Internal consistency
    Total score
    Attention-Focus-Concentration
    Interpersonal
    Behavior-Disorganized-Activity
    Coordination
    Academic Theme
    Emotive
    Consistency-Long Term
    Childhood
    Negative-Social
3. The Wender Utah Rating Scale

Effort Tests
1. Memory for 15 Items (MFIT)
2. Word Memory Test (WMT)
    Immediate Recognition (IR)
    Delayed Recognition (DR)
    Consistency (CN)
    Multiple Choice (MC)
    Paired Associate (PA)
    Free Recall (FR)

Table 2
Operationally defined variables by category

Variable	Operational Definitions
Group, the primary independent variable, has three levels.	1. Normal- students asked to do their best 2. Simulate- students asked to simulate ADHD w/out arousing suspicion 3.ADHD- ADHD students' archival data
Knowledge of ADHD, is a 2nd independent variable	1. ADHD Knowledge and Opinions Survey-Revised, total raw score
Self-Reported ADHD Symptoms: 2 dependent variables	1. ADSA Total T-score 2. WURS total raw score for critical items
Performance on Objective Tests of Attention: 6 dependent variables:	1. CCPT mean total T-score 2. CCPT sum of clinically elevated scales 3. TMT part A, T-score 4. TMT part B, T-score 5. WAIS-III Processing Speed (an Index score averaged from DSC and SS subtest scaled scores, converted to T-scores 6. WAIS-III mean of DS and LNS subtest scaled scores, converted to T-scores
Performance on Effort Tests: 3 dependent variables	1. MFIT total raw score 2. WMT average of percent correct for IR and DR 3. WMT percent correct score for CN

Design and Procedure

All research procedures were completed at LSU Psychological Services Center on campus. Undergraduate students registered for PSYC 4999 and undergraduate Chancellor's Aid students were trained as research assistants. All involved researchers were certified in the Human Participant Protections Education for Research Teams course as recommended by the National Institute of Health. The author, a Master's level graduate student, trained all research assistants in clinical interviewing skills and in administration of testing instruments used in the study. Manual directions were followed for all tests administered. Research assistants were observed practicing on non-participants before working with research participants. The primary researcher randomly observed research assistants during the study and provided feedback to research assistants to correct any observed variances from the standardized procedures. Only one minor variance was observed. One research assistant was observed making up examples during the Digit Span test rather than using the examples provided in the manual. The research assistant was instructed to follow the manual. The primary researcher and an assistant reviewed scored protocols and data entry for accuracy. Data from three participants was excluded from analysis due to incorrect administration, incorrect scoring, or failure of the participant to follow instructions.

The consent form was presented orally and in writing to each participant. Participants were given a copy of their signed consent form, which included the investigators' names and contact numbers. Four extra credit points for participating psychology classes were awarded to each participant for complete participation in this study. Participants in the simulated ADHD group were encouraged to successfully simulate ADHD without arousing suspicion. Both groups were informed that many measures in the study contained validity indices or measures of effort and honesty. As an incentive to comply with performance instructions, participants were told that all participants with acceptable validity scores would be entered in a drawing at the end of the semester for a $50 gift certificate to a local restaurant. All participants were entered into the drawing regardless of response style.

Participants were randomly assigned to the control condition or the simulated malingering condition after providing informed consent and being screened for exclusion criteria via the structured clinical interview. The AKOS-R was administered before all other assessment instruments to measure participants' knowledge of ADHD before participation in the remainder of the experiment. The control group received the following instructions:

> You will be taking a battery of neuropsychological tests. Some of the tests contain validity measures of effort and honesty that indicate whether you are putting forth good effort. It is important that you apply maximum effort and attention while taking the tests and perform to the best of your ability. Participants with acceptable validity scores will be entered in a drawing at the end of the semester for a $50 gift certificate to a local restaurant.

The simulated ADHD group received the following instructions:

> Imagine that you have significant problems with inattention, impulsivity, and/or hyperactivity that are interfering with your academic performance. You believe that if you are diagnosed with ADHD you may be given some academic accommodations, such as extended time for tests, or medication, such as Ritalin, that will improve your grades. Your job in this experiment is to successfully convince the experimenter that you have ADHD, so you want to perform on these tests as if you actually have ADHD. Some of the tests you will take contain validity measures of effort and honesty that indicate whether you are putting forth good effort. You want to fool the experimenter, that is, you want it to look as if you

have ADHD, without arousing any suspicion. You should appear to be putting forth a good effort. Participants that successfully simulate ADHD and have acceptable validity scores will be entered in a drawing at the end of the semester for a $50 gift certificate to a local restaurant.

The first test in the battery was a malingering measure, either the WMT or the MFIT was administered, as it has been suggested that malingerers may perform more poorly on the first test in a battery due to not having any means for comparing the difficulty level of the first test with other testing procedures (Inman & Berry, 2002). The remaining measures were presented randomly. Following completion of all measures, participants completed a brief feedback questionnaire assessing malingering strategy and level of perceived success on the task. All participants were thanked for their participation, provided with documentation of their participation, and given an opportunity to ask questions about the experiment after completing the assessment procedures.

RESULTS

Demographic Characteristics

One hundred sixteen participants signed up to participate in the study. Of these, five did not meet the inclusion criteria due to having current diagnoses of ADHD, neurological disease, or moderate to severe brain trauma within the past 5 years and one more opted to withdraw from the study stating he was not comfortable simulating ADHD. Of the remaining 110 participants, 80% were female (n = 88) and 20% were male (n = 22). Participants ranged in age from 18 to 31 years, the mean age of participants was 20.44 (*SD* = 2.08) and the average years of formal education was 13.63 (*SD* = 1.27). The mean reported grade point average was 3.11 (*SD* = .5). Seventy-nine percent were Caucasian (n = 87), 18% were African American (n = 20), 2% were Native American (n =2), and 1% did not indicate race (n = 1).

Archival testing data from students diagnosed with ADHD at the LSU Psychological Services Center was used as a comparison ADHD group. Students had consented to use of their testing data at the time of their evaluation. The archival database contained 650 client files. Of these 650 client files, 107 persons diagnosed with ADHD were identified. Clients were excluded from the ADHD comparison group if they were less than 18 years of age, did not complete a standard psychoeducational test battery, or had received a diagnosis of ADHD "by history" only.

The resultant ADHD comparison group was composed of 56 students, age 18 or older, who underwent a complete psychoeducational assessment and received a diagnosis of ADHD. Seventy percent were female (n = 39) and 30%

were male (n = 17). The mean age of the ADHD group was 21.11 (*SD* = 3.1). Participants ranged in age from 18 to 29 years and the mean reported years of completed formal education was 13.41 (*SD* = 1.82). Ninety-three percent were Caucasian (n = 51), 5.4% were African American (n = 3), 1.8% were Asian (n = 1) and 1.8% did not report race (n = 1).

The psychoeducational battery used in assessing participants in the archival ADHD group included all of the objective tests used with the simulate ADHD and control groups but the ADHD group did not complete the feedback questionnaire, ADHD Knowledge and Opinions Survey-Revised, Mini International Neuropsychiatric Interview, or effort measures. Additionally, only nine of the ADHD participants completed the ADSA self-report, and one of the ADSA protocols from this group was incorrectly scored and therefore was not used.

Preliminary Analyses

There were two independent variables. The main independent variable, group, consisted of three levels: control, simulate, and ADHD. A second independent variable, Knowledge of ADHD, was measured by total number correct on the AKOS-R. The dependent measures included three categories of psychological tests: objective measures, self-reports, and effort tests. All test protocols were scored according to manual instructions and conventional scores were used in the analyses unless otherwise noted. Total mean scores were calculated for all the conventional scores on the objective measures, self-report measures, and effort tests, and are reported by group in the respective tables presented in the results. However, not every conventional score was used as a dependent variable in subsequent analyses because many of the tests chosen yield multiple scores, which amounted to more than forty possible scores per participant. Composite scores, total scores, and/or averages were used as the dependent variables on measures that generated multiple scores. All assessment measures and their respective scales/subscales are presented in Table 1.

There were eleven total dependent variables used in the subsequent analyses. Six dependent variables were derived from the objective measures. Two dependent variables came from the self-report measures and three dependent variables came from the effort tests. All independent and dependent variables used in this study are operationally defined in Table 2.

Objective Measures

The six dependent variables derived from the objective measures included scores or score combinations from the Connors' Continuous Performance Test (CCPT), Trail Making Test (TMT), and the four WAIS-III subtests used in the study: Digit Span (DS), Letter-Number Sequencing (LNS), Digit Symbol Coding (DSC), and Symbol Search (SS). The CCPT and TMT yield results in T-score form. Scores on the WAIS-III subtests were converted to standardized T-scores to allow for easier comparison and interpretation across measures in this category. Two dependent variables were derived from the CCPT, the TMT, and the WAIS-III each, in the following manner:

The CCPT produces over ten scores per participant, eight of which were represented in the data collected. The more scores that fall in the deviant range on this test, the greater the likelihood that the participant has ADHD. Two scores were computed from the CPT data that reflect this principle and were used as the dependent variables from this measure: a mean total score and a sum of the number of total clinically significant score elevations (T-scores greater than 65).

On the TMT, the T-scores from part A and part B were used as the two dependent variables. These two scores are based on the time taken to complete a simple sequencing task and a complex sequencing task, respectively.

The remaining two objective dependent variables were derived from the four subtests of the WAIS-III. One of the dependent variables, Processing Speed, is a WAIS-III index score averaged from the SS and DSC subtest scaled scores. The other dependent variable computed for this study is the average of the DS and LNS subtests, which represents a combination of immediate auditory attention and auditory working memory.

Self-Report Measures

Two dependent variables were obtained from the self-report measures, the Attention-Deficit Scales for Adults (ADSA), and the Wender Utah Rating Scale (Wender). The ADSA provides a mean total score, a consistency score, and nine subscale scores for each participant. The mean total score was used as the dependent variable as it is a composite score. The Wender's total score of the critical items was used as the dependent variable (DV) for that measure.

Effort Measures

The final three dependent variables were derived from the two effort tests, the Word-Memory Test (WMT) and the Rey Memory for 15 Items (MFIT). Two of the dependent variables were from the WMT, which provides three effort scores and three memory scores. The three effort scores are Immediate Recognition

(IR), Delayed Recognition (DR), and Consistency (CN). The first two scores, IR and DR, are generally very similar for participants giving a good effort, hence the third (CN) score. Accordingly, the average of the IR and DR scores was used as one dependent variable and the CN score was used as 2^{nd} DV from this test. The total number of 15 items recalled was used as the dependent variable on the MFIT.

Multivariate Analysis of Variance (MANOVA)

Three multivariate analyses of variance (MANOVA) were conducted. Groups of similar variables (objective, self-report, or effort tests) were tested in a mixed design, similar to the research designs used in related studies comparing the performance of two or more populations on multiple psychological measures (Tinius, 2003; McGee, Clark, & Symons, 2000, Inman & Berry, 2002). First, a 3 x 6 MANOVA was conducted with group condition (control, simulate, and ADHD) as the independent variable and test scores previously described from the objective tests of attention as the dependent variables. Second, a 3 x 2 MANOVA was conducted with group condition (control, simulate, and ADHD) as the independent variable and test scores from the self-report measures as the dependent variable. A third 2 x 3 MANOVA was conducted with group condition (control and simulate) as the independent variable and test scores from the effort tests as the dependent variable. The archival ADHD group did not complete the effort tests and was not included in this analysis. All significant findings were followed up with post-hoc univariate F-tests with Bonferroni adjustments as recommended by Bland and Altman (1995).

Six multivariate linear regressions were conducted with scores from the AKOS-R as the dependent variable and the objective, self-report, and effort total test scores from the control and simulate groups, respectively, as the independent variables to test the relationship between knowledge of ADHD and performance on the relevant tests. In other words, performance on the objective, self-report, and effort tests, separately, was used to predict scores on the AKOS-R for the control and simulate groups.

Primary Analyses

Question 1

Do simulated malingerers perform differently than ADHD and control subjects on objective tests of attention and self-report measures?

Hypothesis number 1 stated, “Students simulating ADHD will score worse than control participants and ADHD controls on objective measures of attention.” On self-report measures, it was hypothesized that simulators would endorse more symptoms than control participants and would score similarly to ADHD controls.

Objective Measures

The 3 x 6 between group MANOVA multivariate effect for group (control, simulate, ADHD) on objective measures of attention was significant, F (12, 310) = 9.387, p =.000, η^2 =.267. Review of the group means (Table 3) shows that for all objective tests of attention, the simulate group scored worse than the control participants, and the ADHD participants. The means for the objective variables are shown in Table 4. The simulate group performed the worst of all three groups. The control group performed the best of the three groups, as would be expected (simulate<ADHD<control).

Table 3

T-Scores on Objective Measures of Attention by Group

Objective Dependent Measures	Group 1 Normal		Group 2 Simulate		Group 3 ADHD Group		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Digit Span	52.65	7.91	44.00	11.53	46.07	8.33	47.53	10.04
DS Coding	55.93	8.50	43.75	13.05	45.53	8.51	48.34	11.50
Let-Num Seq.	53.82	9.99	45.87	9.64	46.42	7.24	48.66	9.67
Symbol Sea.	55.61	7.57	46.72	13.52	47.02	8.56	49.73	10.96
Pro. Speed	56.67	8.16	44.96	12.72	45.68	8.43	49.06	11.29
Trails A	44.95	10.77	35.73	15.12	42.04	9.16	40.91	12.47
Trails B	49.75	9.39	44.05	13.05	44.70	10.35	46.16	11.26
CPT Comm.	51.35	11.18	66.06	13.47	63.37	14.65	60.24	14.59
CPT Hit RT	54.52	10.74	52.27	15.08	52.16	10.37	52.98	12.10
CPT Hit Rt. S.E.	59.23	13.48	81.68	25.11	67.22	14.68	69.30	20.53
Variability of SE	52.81	10.29	72.10	16.89	62.40	11.60	62.38	15.31
Hit RT Block	47.62	13.36	54.65	27.59	52.27	15.31	51.50	19.58
Hit SE Block	54.01	10.92	57.05	20.59	57.12	15.34	56.06	16.04
Hit RT ISI	62.81	10.94	80.77	20.47	64.13	13.47	69.14	17.39
Hit SE ISI	55.47	7.73	63.83	11.62	56.29	10.85	58.49	10.81
CPT # of ele.	1.47	1.34	3.40	1.25	2.39	1.66	2.41	1.63

Table 4

Mean T-scores for Objective Variables by Group

Measures		Normal	Simulate	ADHD
Trail A T scores	M	44.98	35.98	42.44
	SD	10.87	15.14	9.08
Trail B T scores	M	49.80	43.98	44.96
	SD	9.47	13.17	10.38
WAIS PS T-scores	M	56.67	45.00	45.86
	SD	8.16	12.84	8.40
DS AND LN T-scores	M	53.24	44.81	46.26
	SD	8.02	9.79	7.26
CPT T-scores	M	54.79	66.05	59.76
	SD	6.02	9.64	6.88
Sum of CPT elevations	M	1.5	3.4	2.4
	SD	1.3	1.25	1.63

Multiple post hoc pair-wise comparisons using T`-tests with Bonferroni adjustments to correct for the number of analyses were conducted. These analyses indicated the differences between the simulate group and the control group were significant for all six dependent variables derived from objective tests of attention (see Table 5). The simulate group performed significantly worse than control participants on all the dependent variables from objective tests as predicted.

The differences between the simulate group and ADHD group, however, were only significant for three of the six objective dependent variables. That is, the simulate group performed significantly worse than the ADHD group on the Trial Making Test part A, and the two dependent variables derived from the

Connors' Continuous Performance Tests. The simulate group scored worse than the ADHD group on the other three measures, but not significantly so.

Table 5

Post Hoc Multiple Comparisons for Objective Measures

Dependent Variable	Mean Difference	Standard Error	Significance	95% Con. Int	
Trial A Scores				Lower	Upper
Normal – Simulate	9.00*	2.304	.000	3.43	14.57
Normal – ADHD	2.54	2.304	.817	-3.04	8.11
Simulate - ADHD	-6.48*	2.304	.017	-12.04	-.89
Trail B T-scores					
Normal – Simulate	5.81*	2.140	.022	.64	10.99
Normal – ADHD	4.83	2.140	.076	-.35	10.01
Simulate - ADHD	-.98	2.140	1.00	-6.16	4.20
WAIS PS T-scores					
Normal – Simulate	11.67*	1.932	.000	7.00	16.35
Normal – ADHD	10.81*	1.932	.000	6.13	15.49
Simulate - ADHD	-.86	1.932	1.00	-5.53	3.81
DS AND LN T-scores			.		
Normal – Simulate	8.42*	1.621	.000	4.50	12.34
Normal – ADHD	6.97*	1.621	.000	3.05	10.89
Simulate – ADHD	-1.45	1.621	1.00	-5.37	2.47
CPT Mean T-scores					
Normal – Simulate	-11.26*	1.47	.000	-14.83	-7.68
Normal – ADHD	-4.97*	1.47	.003	-8.54	-1.39
Simulate - ADHD	6.29*	1.47	.000	2.71	9.86
Sum of CPT elev.					
Normal – Simulate	-1.90*	.273	.000	-2.56	-1.24
Normal – ADHD	-.981*	.273	.001	-1.64	-.320
Simulate - ADHD	.925*	.273	.003	.265	1.58

$F(12,310) = 9.387$, $p. = .000$, $\eta^2 = .26$

The simulate group did not exaggerate impairment on the three other measures as was predicted. The simulate groups' performance on the TMT part B, and the two dependent variables derived from the WAIS-III subtests was not significantly worse than the performance of the ADHD group.

Comparison of the control group to the ADHD group on the objective dependent variables indicated the ADHD group performed significantly worse than the control group on the two dependent variables derived from the WAIS-III, and the two dependent variables from the CPT. An unexpected finding was that the ADHD group and the control group were not significantly different in their respective performance on the TMT, part A, or part B. It appears that the TMT was not sensitive to ADHD in this study. In light of this finding, the ability of the simulate group to perform similarly to the ADHD group on the TMT part B, cannot be inferred to mean they are able to simulate ADHD on this measure.

Self-Report Measures

The 3 x 2 MANOVA between group and self-report measures was significant for main effect of group F (4, 224) = 9.387, p. =. 000, η^2 =. 258. It was hypothesized that the simulate group would successfully simulate ADHD on self-report measures of ADHD symptoms. It was predicted the simulate group would endorse more symptoms than the control group and would score similarly to the ADHD group on the Wender Utah Rating Scale and the Attention Deficit Scales for Adults (ADSA).

Table 6

Mean T-scores for Self-Report Variables by Group

		Normal	Simulate	ADHD
Wender Utah Rating	M	18.11	48.60	37.50
	SD	11.69	19.10	20.92
ADSA Total Score	M	50.72	73.67	59.83
	SD	12.73	13.02	13.15

Pair-wise comparisons of the means using T-tests with a Bonferroni adjustment, revealed that the simulate group endorsed significantly more childhood symptoms than did the control group on the Wender Utah Rating Scale and on the total score from the ADSA, as predicted (see Table 7).

Table 7

Post Hoc Multiple Comparisons for Self-Report Measures

Dependent Variable	Mean Difference	Standard Error	Significance	95% Con. Int	
Wender Utah Rating				Lower	Upper
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	.36	27.32

$F\ (4,224) = 19.305$, $p. = .000$, $\eta^2 = .256$

Comparisons of the simulate group to the ADHD group on the self-report measures were inconsistent. T-tests of the difference between the means (adjusted by Bonferroni procedures) of the simulate group and the ADHD group were not significant for the Wender. However, there was a significant difference between these two groups on the ADSA total score. The simulate and ADHD groups did not report significantly different rates of ADHD symptoms on retrospective self-report, but the simulate group reported significantly more current symptoms than the ADHD group on an adult self-report measure. This finding is partially explained by an unexpected trend in the ADHD group.

An unanticipated finding was revealed in the post hoc comparison between the mean of the control group and the mean of the ADHD group on the dependent measures derived from self-report tests. While the ADHD group endorsed significantly more childhood symptoms on the Wender, the ADHD group did not endorse significantly more symptoms on the ADSA. In fact, the ADHD group did not even endorse clinically significantly ADHD symptoms on the ADSA (T-score < 60). It was expected that the ADHD group would have scored significantly higher on this measure than control participants.

Question 2

Is knowledge of ADHD related to ability to simulate ADHD on self-report versus objective measures of attention?

Hypothesis 2 stated, "Knowledge of ADHD will be significantly correlated with performance on self-report measures but will not be significantly correlated with performance on objective measures of attention within the simulated ADHD group. No relationship is expected between ADHD knowledge and performance on either self-report or objective measures within the control group."

Results of the multivariate linear regressions were mixed with regard to the hypothesis. The expected relationship between knowledge of ADHD and performance on the self-report measures was not found within the simulate group F (2, 52) = 1.339, p. =. 271. Consistent with the hypothesis, no relationship was found between knowledge and performance on the self-report measures within the control group F (2, 52) =. 141, p. = .869. The control and simulate groups demonstrated similar knowledge of ADHD prior to completing the objective and self-report measures, with mean group scores and standard deviations of 12.75 (1.84) and 13.02 (1.90), respectively.

There was an unexpected significant relationship between knowledge of ADHD and performance on objective measures of attention within the control group, *F* (6, 45) = 2.731, *p.* = .024, which is counter to the predicted results. This relationship was not significant in the simulate group *F* (6, 45) = 1.104, *p*. =374.

There was no relationship between knowledge of ADHD and effort within the control group, *F* (1,50) = 1.21, *p.* =.276, or the simulate group, *F* (2,52) =.179, *p.* =.897.

Question 3

Are traditional effort tests sensitive to malingering in college students attempting to feign ADHD?

Hypothesis 3: No directional hypothesis was postulated. The 2 x 3 MANOVA conducted with group (control and simulate) as the independent variable and performance on the 3 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 simulate group were 80.63 on the WMT average of recognition scores, 78.04 on the WMT consistency scores, and 13.80 for the MFIT while the means for the control group were considerably higher at 99.32 on the WMT average of recognition scores, and 98.65 on the WMT consistency score, and nearly the same at 14.69, for the MFIT.

To further explore the sensitivity of the Word Memory Test 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 and the primary researcher and an independent licensed clinical neuropsychologist, made judgments as to the group membership of each participant, individually, based on the participant's performance on the objective measures of attention and the Wender (see table 8). The data used in this decision process was recorded in a separate database, and it did not include or reveal in any other way, the participant's group or scores from the effort tests. The same dependent variables were used for each group so that there were not any clues to group membership.

Table 8

Scores on Self-Report Measures of ADHD symptoms by Group

Self-Report	Normal			Simulate			ADHD		
Measures	Mean	SD	N	Mean	SD	N	Mean	SD	N
Wender *	18.27	11.65	55	48.60	19.10	55	42.11	17.59	38
ADSA Total	50.67	11.38	54	54.35	10.22	55	49.89	9.54	9
Internal Cons.	50.72	12.73	54	73.67	13.02	55	61.25	11.57	8
Attention-Focus-Con	55.46	12.41	54	76.76	12.73	55	72.56	12.57	9
Interpersonal	48.54	12.33	54	63.58	13.95	55	50.78	12.10	9
Beh.-Dis. Activity	51.22	11.97	54	70.29	13.90	55	64.44	12.83	9
Coordination	51.85	12.06	54	66.31	14.60	55	59.33	13.64	9
Academic-theme	46.83	10.80	54	59.16	11.08	55	55.67	10.97	9
Emotive	50.61	11.75	54	65.67	12.50	55	51.78	10.68	9
Con/Long-term	51.06	14.05	54	70.84	13.34	55	64.22	11.09	9
Childhood	47.85	11.56	54	62.33	10.28	55	54.78	11.63	9
Neg. Social	48.72	12.32	54	62.85	15.46	55	49.33	11.43	9

*Wender scores are raw scores; all other scores are T-scores

The independent psychologist correctly identified 33 control participants, 24 participants from the simulate group, and 23 participants from the ADHD group. Twenty-four participants, nearly 44% the simulate 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 simulate condition, and 22 participants in the ADHD condition. Thirteen participants from the simulate group were misclassified by the researcher as belonging to the ADHD group.

Using the Word Memory Test published cutoff scores for response bias (less than 79% for IR, less than 75% for DR, and less than 82% for Consistency) 55 participants, the entire control group, were correctly classified as putting forth a good effort, and therefore, belonging to the control group. Thirty-two participants (58%) of the simulate group were correctly classified. Using the WMT response bias cutoff scores to classify participants resulted in the misclassification of twenty-three participants (42%) from the simulate group. Using the WMT to classify participants did improve the accuracy rate of group assignment over clinician judgment alone. Table 9 presents scores for effort tests by group, while Table 10 presents the respective judgment of group membership using masked data.

Table 9

Scores for Effort Tests by Group

Effort Tests	Normal N = 54		Simulate N= 55	
	Mean	SD	Mean	SD
Memory for Fifteen	14.69	.94	13.80	2.33
Word Memory Test	99.25	1.34	80.63	21.28
Imm. Recognition	99.38	1.60	80.63	17.90
Delayed Rec.	98.65	2.26	78.04	16.61
Consistency Score	99.48	6.26	69.36	24.32
Multiple Choice	96.11	6.49	69.90	24.02
Paired Associates	63.10	14.8	43.45	16.57
Free Recall	63.10	14.81	43.45	16.57

Table 10

Judgment of Group Membership using Masked Data

Judgment of Group	Independent Psychologist		Blinded Researcher	
	Frequency	Percent	Frequency	Percent
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
	N = 166		N = 166	

DISCUSSION

The present study examined the ability of college students to simulate ADHD on objective tests of attention and also examined the relationship between knowledge of ADHD and ability to simulate ADHD on objective tests of attention and self-report measures of associated symptomotology or ADHD criteria. The sensitivity of effort tests to simulation attempts in the assessment of ADHD was also explored. Three main hypotheses were investigated.

The first hypothesis concerned the ability of college students to simulate ADHD on objective tests of attention and self-report measures predicting that college students would be able to successfully simulate ADHD on self-report measures but would exaggerate impairment on objective measures of attention and score significantly worse than an ADHD group on objective tests of attention. The performance of college students in the control group, college students asked to simulate ADHD, and college students with ADHD on objective tests of attention, and self-report measures of ADHD symptoms was compared via 3 X 6 group MANOVA.

The results partially confirmed the first hypothesis, and also revealed some unexpected findings. The pattern of group mean differences was generally in the expected direction. That is the simulate group performed the poorest on all six of the dependent variables which were derived from objective tests of attention. The ADHD group performed better than the simulate group, but worse than the control group, and the control group performed better than both the ADHD and simulate groups.

Post-hoc pair-wise comparisons showed that the simulate group performed significantly worse than the control group on all six of the objective dependent variables analyzed. The simulate group performed significantly worse than the ADHD group on three of the six dependent variables derived from the objective measures: the Trail Making Test part A, the CPT mean score, and the sum of CPT elevations.

The ADHD group, as expected, performed significantly more poorly than the control group on the two dependent variables derived from the WAIS-III subtests: the average for the scores on the Digit Span and Letter-Number Sequencing mean, and the Processing Speed Index. The ADHD group also scored more poorly than the control group on the dependent measures derived from the Connors' Continuous Performance Test: CCPT mean score, and the number of CCPT scale elevations.

Contrary to findings in previous studies, the ADHD group did not score significantly worse than the control group on the TMT, parts A and B. In hypothesizing that the simulate group would score worse than the control group and the ADHD group on objective measures of attention, it was presumed that the ADHD group would score significantly worse than the control group on the these measures as well.

It is important to note that the ADHD group diagnosed in this study completed an extensive clinical interview and psychoeducational test battery, which included objective measures of personality and mood. Testing was administered by graduate students enrolled in a doctoral program in clinical psychology at Louisiana State University. All testing, interpretation, and diagnoses were reviewed by a practicum team of graduate students and were supervised by a licensed clinical neuropsychologist, who made the final diagnosis. The overall pattern of scores obtained by a client was considered (so that performance on any one test of attention was not overly weighted), and all clients diagnosed with ADHD met the DSM-IV TR criteria for ADHD. A very high standard was used in diagnosing students in the ADHD group, however, this group consisted only of college students enrolled in Louisiana colleges and universities and the findings in this study may limited in their generalizability.

Although the group means in this study were significantly different on the objective tests of attention, for some of the objective measures, the differences are not clinically meaningful. For example, the differences between the group means for the WAIS-III subtests was generally within a standard deviation, and even the lowest scores were within average limits.

The greatest score discrepancies between the simulate and ADHD group were observed on a CPT index of response time variability, which was often as many as three standard deviations above the mean, and for the TMT, part A. On the objective tests of attention measured, college students attempting to simulate ADHD were most successful, or scored most similarly to ADHD participants, on the four WAIS-III subtests: Digit Span, Digit Symbol Coding, Letter-Number Sequencing, and Symbol Search.

As with earlier studies (Quinn, 2003; Leark, Dixon, Hoffman, & Huynh, 2002), simulators, as a group, tended to overestimate the level of impairment that would be expected on the sustained task of attention, the Connors' Continuous

Performance Test, and produced excessively poor scores that were worse than the scores produced by the ADHD group.

Simulators also fared poorly attempting to simulate on the Trail Making Test, part A, which is a very simple test of number sequencing and psychomotor speed. The difference in the test demands between the four WAIS-III subtests, the CPT, and the TMT, suggests two other factors that may be related to a simulator's ability to successfully feign inattention on psychological tests. In addition to ability to accurately judge the degree of impairment expected for an individual with ADHD on a particular task, test simplicity and level of interaction between the examiner and the participant may be related to the simulator's comfort with performing poorly, or ability to simulate ADHD on a particular task. For example, simulators may have been more comfortable simulating ADHD on the CPT because it is a computerized test that requires little interaction between the examiner and the individual taking the test and it may be easier to perform poorly when there is not an examiner watching as closely. (Similarly, it may be easier to simulate ADHD on self-report measures that are written versus administered in interview format.)

The data regarding college simulators and objective tests of attention is complicated and many factors need to be considered in making inferences that can be generalized to assessment situations. Although some of the complexity arises, in part, due to the large number and different type of objective measures of attention studied, the data regarding simulation and self-report looked at fewer variables, but still yielded mixed findings.

It was postulated that college students would be able to effectively simulate ADHD on self-report measures, as has been found in previous studies. On the self-report measures, the group means score profile showed the same pattern as for the objective measures. The 3 x 2 MANOVA examining group by self-report measure indicated there were significant differences between the groups on the self-report measures.

The control group reported the fewest symptoms, the ADHD group reported more symptoms than the control group, and the simulate group reported the most symptoms for both the Wender and the ADSA. It was hypothesized that the simulate group would endorse significantly more symptoms than the control group and score similarly to the ADHD group on self-report measures.

Post hoc multiple comparisons of the observed means confirmed that this is what happened on the Wender Utah Rating Scale. On this scale, the mean difference between the control group and the simulate group, and between the control and ADHD group was significant, while the difference between the simulate group and the ADHD group was not significant. On the Wender, the simulate group scored significantly higher than the control group but did not differ significantly form the ADHD group, as the hypothesis predicted.

The hypothesis regarding self-report measures was not confirmed on the ADSA, although the mean group differences were in the same order (i.e. control<ADHD<simulate), the ADHD group and the control group did not differ from each other significantly, while simulate group mean was significantly larger than the ADHD group mean and the control group mean.

Interestingly, the archival ADHD group means for self-report measures were lower than would be expected. The ADHD group had a mean T-score of 61.25 (n = 8) for the ADSA total score, which is a little more than one standard deviation from the mean. The ADHD group mean score for the Wender was 42.11 (n = 38), which is above the raw score cutoff of 36 used to differentiate control participants from ADHD participants.

One limitation of this study is that so few participants in the ADHD group had completed the ADSA. The relatively low mean group scores for the ADHD self-report measures may be due to the small sample for that measure, or if truly representative of college students with ADHD, the findings would support the arguments by Barkley (1996), Heligenstein et al., (1998) and other researchers that the DSM criteria thresholds are too high when applied to adults, especially college students. Only 21 of 50 adults in the simulate group, which as a whole tended to exaggerate the number and degree of severity of ADHD symptoms that are typically reported by adults with ADHD, endorsed the necessary number of symptoms required to meet criteria for ADHD diagnosis during the MINI, which is based on current DSM criteria. Thirty-six of the simulators reported having had 6 or more symptoms during childhood. Of these 36, 25 were apparently aware of the DSM requirement that some symptoms be present before age 7 years.

The second hypothesis addressed the relationship between knowledge of ADHD and performance on self-report measures of ADHD symptoms. It was predicted that a significant relationship between knowledge and performance on self-report measures would exist for simulators, but not for college students in the control group.

It was expected that knowledge of the disorder, such as the most common symptoms, and associated features, would facilitate attempts to simulate on self-report measures, such as the Wender, via familiarity with what types of symptoms to endorse. On the other hand, knowledge of ADHD was not expected to enhance ability to simulate ADHD on objective measures, such as the Digit Span and Symbol Search subtests of the WAIS-III, or the Connors' Continuous Performance Test.

Knowledge of ADHD was not expected to be correlated with performance on self-report measures or performance on objective measures of attention in the control group because no relationship between one's best effort on objective measures of attention, processing speed, auditory attention, and one's knowledge of the disorder ADHD was expected. In other words, knowledge of the impairments associated with ADHD was not expected to be related to performance on objective tests of attention when one is putting forth a full effort.

The hypothesized relationship between knowledge and ability to simulate ADHD on self-report measures was not demonstrated in the current study. This hypothesis was rationally derived from earlier findings which suggested that 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).

Although earlier research has demonstrated that prior knowledge of a disorder via personal experience 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 the disorder (O'Jile et al., 1997), still it would seem that knowledge might improve one's chance of endorsing the appropriate symptoms on a symptom checklist.

It remains possible that the relationship between knowledge of ADHD and ability to simulate ADHD on self-report measures may not have been accurately encompassed in this study, or accurately measured with the AKOS-R survey and the Wender and/or ADSA questionnaires. There was a restricted range of scores on the AKOS-R, and the control and simulate groups means did not differ significantly on the AKOS-R, suggesting this measure may not be sensitive to differences in knowledge of ADHD in a college population.

Although this study is rare among college studies in that the sample actually came from the population of interest, at least demographically: college students, it still has the same limitations as analog malingering studies or other simulation designs completed with college students. Specifically that participants asked to simulate a disorder for college credit are not working with the same motivation as college students simulating ADHD to gain access to academic accommodations and stimulant medication.

The correlation between knowledge of ADHD and performance on the objective measures of attention could possible be due to a triangular relationship between general intelligence, knowledge of ADHD, and performance on the WAIS-III subtests, LN, DS, DSC, and SS. This explanation would be consistent with the lack of relationship between knowledge of ADHD and the performance on objective measures of attention within the simulate group. It could be that the relationship between intelligence and performance on the WAIS-III subtests used in this study was obscured by simulators intentionally not doing their best on the WAIS-III subtests in attempting to simulate ADHD.

The last issue addressed by this study was the sensitivity of malingering tests to simulation in the assessment of ADHD. The Word Memory Test cut-off scores for response bias were able to correctly identify 27 of the simulators and all of the control participants. Twenty-two simulators were able to pass the WMT. Six of the simulators that were judged as “honest” by the WMT were misclassified as ADHD by the blind researcher, and 13 of the 22 were misclassified as ADHD participants by the independent clinician. Every participant in the simulate group was able to pass the MFIT, making the scores on that measure virtually meaningless in terms of identifying malingerers in the context of an ADHD assessment.

It is difficult to find effort tests that are sensitive enough to use with a bright college population. The fact that simple attention and effort have been shown to be difficult to distinguish in prior research correlating performance on the Portland Digit Recognition Test (PDRT) to some indices on the CPT, highlights the complexity of assessing effort in an ADHD population. The PDRT is very much like the computerized CPT in terms of the demand for chronic, sustained attention. Children diagnosed with ADHD, age 10 years old, had a mean correct percentage rate above 90% on the WMT, even when the scores from children who failed the measure due to poor effort were averaged in with the rest of the group (Green & Allen, 1999). This indicates that the confound of simple effort and attention is not a problem with this test. Although the WMT only correctly classified 27 of the simulators, it did better than the blinded researcher or the independent clinician using masked data.

CONSLUSION

This study examined the ability of college students to simulate ADHD on objective tasks of attention and self-report measures of ADHD symptoms. The hypothesis that college students would be able to successfully simulate ADHD on self-report measures but would overestimate the degree of impairment associated with ADHD and would actually score significantly worse than participants with ADHD on objective tasks was only partially confirmed.

Some of the self-report and objective measures were found to be generally insensitive to differences between the groups' performance in this study. The WAIS-III subtests, at least when studied in isolation, did not appear as sensitive to attentional deficits was reported in the WAIS-III technical manual. The difference in findings may be due to sample size of this study and the significantly larger WAIS-III norms.

In this study, computer tests were more sensitive to attempts at simulation than were clinical judgment, orthographic measures, or verbal tests or attention. The greatest mean differences between the groups on objective measures of attention was for the CPT. This test was useful as both a valid measure of attention, when scores are between one and two standard deviations, and as an indication of malingering, when scores exceed two standard deviations above the mean. The WMT also fared better at detecting simulators than did clinical subjects. The addition of computer tests to a psychoeducational battery is recommended in the clinical assessment of ADHD.

College simulators did score similarly to ADHD participants on a retrospective self-report of childhood symptoms, but endorsed significantly more symptoms than both the control students and students with ADHD on an ADHD scale for adults. The unexpected finding that participants in the ADHD group did not endorse significantly more symptoms than the control group on the adult ADHD scale challenges the assumptions underlying the study's hypothesis or may simply challenge the validity of the scale.

It has been proposed by some researchers that there is a subgroup of college students with ADHD who are able to compensate for their attentional impairments due to above average intelligence. Many researchers have argued that the current criteria for ADHD do not accurately describe adults with the disorder due to a decrease in symptoms with age in ADHD patients. The findings of this study are consistent with both of these arguments.

It would seem that before trying to answer the question, "Are college students able to simulate ADHD?" ADHD in college students must be better defined and base rates of inattention, impulsivity, and hyperactivity must be described in college students without ADHD. The ability of college students to simulate ADHD is difficult to examine when there is so much controversy as to the course of the disorder in adults. Additionally, analog simulators are not motivated by the same factors as college students attempting to feign the disorder to gain access to stimulant medications or academic accommodations.

The relationship between ability to simulate ADHD and knowledge of ADHD was not clearly revealed in this study. Again, we must be able to define ADHD better in adults before we can judge simulation of the disorder. One inherent weakness in the design of this study is that the knowledge base of true simulators, college students who are unequivocally attempting to feign the disorder, may differ dramatically from college students asked to simulate the disorder for course credit. In this study there was no difference in scores for knowledge of ADHD in the simulate group and the control group.

Real simulators may be more likely to take advantage of the easy access to information about the disorder that is available on the internet and in college libraries and may know more than the typical college student about how to simulate the disorder. Future studies may want to increase the motivation of analog simulators, and give them time to prepare for the task. Additionally, manner of recruitment may influence the type of student who volunteers for a simulation study. The recruitment announcements for this study simply stated the study was looking at “cognitive abilities” of college students.

In retrospect, students attracted to this study may have been more likely to want to do well than not. Although the rationale behind the recruitment method for this study was that the study wanted to look at the ability of college students in general to simulate, not the ability of students who would be drawn to materials that asked for students to simulate a disorder. However, actually asking for simulators may result in the recruitment of volunteers who more closely resemble simulators.

Examiners in this study were aware of subject condition, or group placement. It may be that examiners had some demand effect on subjects, though this could not be tested in the current study. Future studies may want to use examiners who are blind to the subject condition.

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APPENDIX A
CONSENT FORM

Louisiana State University

236 Audubon Hall

Baton Rouge, LA 70803-5501

(225) 578-1494

1. Study Title:

Ability of College Students to Simulate Attention-Deficit/Hyperactivity Disorder on Objective Measures of Attention.

2. Performance Sites:

Louisiana State University in the Psychological Services Center.

3. Contacts:

The investigators listed below are available to answer questions about the research, Monday through Friday, 8:00 a.m.– 4:00 p.m.

Wm. Drew Gouvier, Ph.D. (225) 578-1494

Randee Lee Booksh, M.A (504) 237-7614

4. Purpose of the Study:

The purpose of this research project is to investigate the ability of college students to simulate Attention-Deficit/Hyperactivity Disorder(ADHD)on.

5. Subjects:

A. Inclusion Criteria: At least 18 years old

Current undergraduate at LSU

B. Exclusion Criteria:

History of Learning Disorder, ADHD, or current complaint of significant problems with inattention, hyperactivity, or impulsivity; moderate or severe head injury within the past five years, neurological disease or seizure disorder.

C. Maximum number of subjects: 200

6. Study Procedures:

Each subject will be interviewed about their medical and psychological history, complete self-report measures of ADHD, objective tests of attention, tests of cognitive abilities, and effort tests. The interview and testing will be completed during one scheduled appointment and should not exceed 2 hours.

7. Benefits:

Each subject will receive four (4) extra credit points for participation in this two (2) hour study. Subjects who perform within average limits on effort tests will be entered in a drawing for a chance to win a $50.00 gift certificate to a local restaurant. Information gained from this study may help to improve the accuracy of assessment for ADHD in college students.

8. Risks/Discomforts:

There is no known risk associated with participation in this study above what might be experienced during an average day.

9. Measures taken to reduce risk

To assure that subject privacy is respected, this study will be anonymous.

10. Right to Refuse:

Participation in this study is completely voluntary and subjects may decide to withdraw from the study at any time without penalty.

11. Privacy:

Subjects' names on consent forms will not be able to be linked to interview, questionnaire, or test responses. Consent forms will be stored separately from data.

The LSU Institutional Review board (which oversees university research with human subjects) and Wm. Drew Gouvier, Ph.D. may inspect and/or copy the study records.

Results of this study may be published, but no names or identifying information will be included in the publication

12. Financial Information:

There is no cost to subjects for participation. Subjects will receive four(4) extra credit points for participation in this study.

13. Withdrawal:

You may withdraw from this study at any time. However, extra credit points will not be given for less than full participation. To withdraw, inform the principal investigator or research assistant of your decision.

14. Removal:

If it becomes apparent that a subject meets exclusion criteria at any point in the study, the subject will be removed from the study without his or her consent.

Part 5: Signatures

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692. I agree to participate in the study described above and acknowledge the researchers’ obligation to provide me with a copy of this consent form if signed by me.

Subject Signature ________________________Date ______________

Subject Name (Print)_______________________________________

Subject phone number or email address (for gift certificate purposes only)_____________________

Witness Signature _________________________Date ______________

APPENDIX B
STRUCTURED CLINICAL INTERVIEW

Date:__________ Age: _________ Gender: male female

Race: Caucasian, African American, Hispanic, Asian, Other___________________

Years of education and college status:______________________________________

College major and minor:____

Current grade point average:____

<u>Rule outs</u>

Have you ever had a head injury? Yes No

(Have you ever been hit on the head hard enough to make you see stars [dizziness, trouble concentrating after, confused] lose consciousness, or seek medical treatment?) Yes No

If yes, describe head injury(ies): type of injury, length of unconsciousness, medical treatment, diagnosis, hospitalization, and post-traumatic amnesia.

____

Do you have any neurological conditions? Yes No

If yes, please describe____

Do you have a seizure disorder? Yes No

Have you ever been diagnosed with Attention-Deficit/Hyperactivity Disorder? Yes No

Do you currently have significant problems with inattention, impulsivity, or hyperactivity that interfere with your academic functioning, social life, or work performance? Yes No

APPENDIX C
FEEDBACK QUESTIONNAIRE

1. Please write one sentence that summarizes the instructions provided to you at the beginning of the study.

____

____

2. On a scale from 0 to 10, how much effort did you put forth in following the instructions?

0 1 2 3 4 5 6 7 8 9 10

0= I did not even try to follow the instructions. 10 = I did my best to follow the instructions.

3. On a scale from 0 to 10, how successful do you believe you were in following the instructions?

0 1 2 3 4 5 6 7 8 9 10

0= I think I did very poorly, 10= I think I did very well.

VITA

Randee Lee Booksh earned her Bachelor of Arts in psychology at the University of New Orleans in 1995. She earned her Master of Arts in psychology in 1999 from Southeastern Louisiana University. She is currently a Doctor of Philosophy candidate in the Department of Psychology at Louisiana State University and Agricultural and Mechanical College in Baton Rouge, Louisiana. She is in the Adult Clinical Psychology program and is specializing in neuropsychology under the supervision of Wm. Drew Gouvier, Ph.D. Mrs. Booksh completed her predoctoral internship at the Southern Louisiana Internship Consortium.