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Diagnosis Threat in Adults with Attention Deficit Hyperactivity Disorder

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DIAGNOSIS THREAT IN ADULTS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER

By

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Diagnosis Threat In Adults With Attention Deficit Hyperactivity Disorder

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Attention-Deficit/Hyperactivity Disorder (ADHD) is a complex neurological condition currently defined by the American Psychological Association as "a persistent pattern of inattention and/or hyperactivity/impulsivity" (APA, 2000, p. 85). Currently, there is no DSM-IV diagnosis for ADHD in adults, although some researchers estimate that approximately 50-80% of childhood cases of ADHD carry on into adolescence and adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002). Obtaining an accurate estimation is prevented by several factors, including a lack of an objective diagnostic test for ADHD (Stefanatos & Baron, 2007). One construct that has not been well studied in ADHD populations is the effect of negative expectations on neuropsychological test performance, which researchers have called "diagnosis threat" (Suhr & Gunstad, 2002). This phenomenon has been examined in individuals with mild traumatic brain injury (mTBI); however, there is reason to believe that it can occur with other diagnoses as well. The current study aimed to identify the degree to which diagnosis threat influenced test performance in an adult ADHD population. Seventy participants with a diagnosis of ADHD were randomly assigned to either a control group or a diagnosis threat group. All participants were given then given a test battery. Participants in the diagnosis threat group were told that they were selected to participate on the basis of their ADHD diagnosis, whereas controls were told simply to perform to the best of their ability. As hypothesized, participants who were in the diagnosis threat group performed worse on tests of simple attention, memory, and intelligence when compared to controls. This demonstrates the potential for diagnosis threat to occur in populations other than mTBI and has direct implications for the way clinicians work with patients diagnosed with ADHD.

Dedication

To my father, my fellow researcher.

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Diagnosis Threat in Adults with Attention Deficit/Hyperactivity Disorder

Attention-Deficit/Hyperactivity Disorder (ADHD) is a complex neurological condition currently defined by the American Psychological Association as "a persistent pattern of inattention and/or hyperactivity/impulsivity" (APA, 2000, p. 85). As of 2007, approximately 5.4 million children 4-17 years of age in the United States had been diagnosed with ADHD (CDC, 2007). Currently, there is no DSM-IV diagnosis for ADHD in adults, though some researchers estimate that approximately 50-80% of childhood cases of ADHD carry on into adolescence and adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002). Obtaining an accurate estimation is prevented by several factors, including a lack of an objective diagnostic test for ADHD as well as an inconsistency in how the diagnosis is operationalized from case to case (Stefanatos & Baron, 2007). Further exacerbating the problem is the nonspecificity of symptoms and high incidence of co-occurring disorders in adults with ADHD, including bipolar, anxiety, and substance use disorders (Weisler & Goodman, 2008). There is also a question of the validity of ADHD, and whether its symptoms are merely a consequence of cultural and societal pressures to control one's impulses and behaviors. These and other questions have been a source of controversy regarding the process of differential diagnosis for adult ADHD.

ADHD as a Neurological Disorder

Although there are no laboratory tests or neurological assessments that have been established as diagnostic tools in the assessment of ADHD, various imaging techniques (i.e., PET, MRI, fMRI) have shown functional and developmental differences between brains of individuals with ADHD and those who do not have the disorder (Goodman, 2010). While these imaging studies have not yet been utilized in clinical diagnosis, they provide additional evidence of the neurological basis of ADHD in addition to its current classification as a psychological

disorder. In the meantime, neuropsychological testing data remains essential to making an ADHD diagnosis, as it provides objective measurement of neurological functions that are associated with impairment in individuals with ADHD (i.e., executive functioning). The current theory of the neuropsychological basis of ADHD has historical roots in the idea that disturbances in sustained attention have broad impacts on the behavior, learning ability, and cognitive function in children who are hyperactive (Douglas, 1972). Other neuropsychological data have demonstrated difficulties in several areas of executive functioning, including set shifting, working memory, and planning (Goodman, 2010).

When assessing for an ADHD diagnosis, the primary symptoms considered are inattention and impulsivity/hyperactivity. Currently, common practices for ADHD assessment include obtaining patient and family history, gathering self-report data and data from other sources (i.e., family, teachers) about symptoms through rating scales and/or verbal report, and conducting a battery of neuropsychological tests. An ADHD diagnosis is not established through one test alone, as no independent diagnostic test that confirms ADHD currently exists (Stefanatos & Baron, 2007, NIH Consensus Statement, 1998). Therefore, it is important to consider objective test results with respect to their own roles in discriminating among co-occurring disorders and common patterns seen in ADHD (Stefanatos & Baron, 2007). At the end of the assessment, neuropsychological test data is considered in the context of information gathered through report and rating scales.

Diagnostic Issues and Controversies in ADHD

As mentioned previously, the diagnosis of ADHD comes with much controversy and speculation. In particular, adult ADHD comes with complex diagnostic issues. Some have gone as far as to say that ADHD is not a valid diagnosis in adults (Moncrieff & Timimi, 2010). This

thought is primarily based on the lack of physiological markers, high comorbidity rates, and potential to misclassify normal behaviors as pathological ones. Currently, there is no official diagnosis for adult ADHD in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition Text Revised (DSM-IV TR; APA, 2000). However, research indicates that several cases of childhood ADHD carry on into adulthood (Barkley et al., 2002). Therefore, when considering ADHD in adult patients, it is important to establish a history of the diagnosis in childhood. This can often be a daunting task, as it often means relying on the patient for a self-report of symptoms. Current criteria for childhood ADHD require six symptoms of inattention or hyperactivity-impulsivity present for at least six months (APA, 2000). These criteria have never been validated in adults (Weisler & Goodman, 2008).

ADHD is often diagnosed through exclusion of other potential etiologies (Stefanatos & Baron, 2007). In a study examining the prevalence of co-occurring Axis I and II disorders in males and females with ADHD, researchers found that when compared to those without the disorder, adults with ADHD had higher rates of current and past Axis I and II disorders (Cumyn, French, & Hechtman, 2009). These co-occurring disorders included anxiety disorders, nicotine dependence, antisocial personality disorder, and obsessive compulsive personality disorder. Many of these disorders have symptoms that overlap with ADHD, which has the potential to cloud the ability of the clinician to accurately diagnose ADHD.

In the case of the ADHD diagnosis, researchers suggest that there are significant incentives to being diagnosed with ADHD, particularly within the college student population (Sollman, Ranseen, & Berry, 2010). These include academic accommodations, such as extra time for written work or tests and reduced homework (McGuire, 1998). Perhaps one of the more concerning motivations for an ADHD diagnosis; however, is the desire for stimulant medication.

Several surveys at the university and professional school level suggest that stimulant misuse is aimed to facilitate academic performance, as well as engage in recreational drug use (McCabe, Knight, Teter, & Wechsler, 2005; Sollman et al., 2010). Students may request an evaluation for problems related to ADHD in order to obtain stimulants knowing they do not need them for their intended purpose. Therefore, it is important to consider these factors in light of ADHD assessment. In addition, attention to external factors that may influence testing is also necessary when considering the possibility of individuals trying to successfully simulate ADHD symptoms.

In a study examining detection of feigned ADHD in college students, researchers divided participants into three groups: an honest responding ADHD group, a healthy honest responding group (no diagnosis of ADHD), and a healthy feigning group (no diagnosis of ADHD; Sollman et al., 2010). Participants in both of the honest responding groups were asked to complete study measures honestly and to the best of their ability. Those in the feigning group were given a feigning scenario in which they believed they had undiagnosed ADHD and were asked to research materials about ADHD on Google. These participants were asked to complete testing with the examiner as though they were trying to convince someone that they had the disorder. All participants were asked to complete both self-report symptom measures as well as complete neuropsychological testing.

Results of this study revealed that the self-report checklists were unsuccessful at differentiating between individuals diagnosed with ADHD and those faking the disorder. Interestingly, participants who were asked to fake the disorder responded in a manner that was consistent with profiles of inattention commonly seen in other college students diagnosed with ADHD. The authors concluded that self-report measures should be used with caution as an adjunct to a clinical interview. Similar findings were seen in regards to performance on

neuropsychological tests. Participants in the feigning group exhibited a higher level of cognitive deficits when compared to controls; however, not enough to confidently differentiate from the participants diagnosed with ADHD. In fact, the ADHD group showed little impairment in general. Results of this study highlight the lack of an objective diagnostic test for ADHD as well as the challenge of obtaining accurate data to make the diagnosis.

Non-Neurological Factors in Assessment

Given that accurate assessment and diagnosis of ADHD can be a challenging task, it is important to consider other factors that may influence test performance and thus distort the clinical picture. Factors outside of the neurological condition (i.e., non-neurological factors) have been shown to negatively affect performance on neuropsychological tests. For example, depression (McDermott & Ebmeier, 2009), anxiety (Cohen, Ben-Zur, & Rosenfeld, 2008), premorbid substance abuse (Rimel, Giordani, Barth, Boll, & Jane, 1981), and monetary compensation (McKinlay, Brooks, & Bond, 1983) have all been shown to affect an individual's test performance separate from any neurological history or condition. These non-neurological factors provide context which, if not considered correctly, could lead to diagnostic errors.

Stereotype Threat as a Non-Neurological Factor

The basic concept of threat has been studied across several populations. Perhaps the most well studied subtype of threats created by negative reputations in general is stereotype threat. Steele and Aronson (1995) suggest that any individual belonging to any type of group that has a preexisting negative stereotype can demonstrate behaviors consistent with the stereotype, regardless of whether or not they believe it to be true. This point becomes especially relevant in relation to test performance, as it purports that poor performance is not necessarily linked to the activation of some preexisting or internalized anxiety that an individual may have about being a

part of a stereotyped group. Rather, even someone who is especially confident in the domain of testing may be influenced by stereotype threat. In fact, Steele (1997) asserts that the threat probably affects confident individuals more so than unconfident ones (i.e., those who have not internalized negative stereotypes to the point of doubting themselves).

In a study examining the performance of white males on math tests, researchers attempted to identify the conditions necessary for stereotype threat to impair performance (Aronson, Lustina, Good, & Keough, 1999). In other words, they wanted to find out if individuals must belong to a chronically stereotyped group in order to experience stereotype threat. Participants were white males with high scores on the mathematics portion of the Scholastic Aptitude Test. In one condition, subjects were told that Asian students outperform Caucasian students in math. Control subjects were not told anything about this stereotype. Both groups of participants were asked to complete a challenging math test, and were then given a follow up questionnaire examining anxiety and predicted test performance. Results indicated that participants in the experimental condition performed worse on the math test than controls. No differences were found on measures of anxiety. Researchers were unable to identify the mediator between stereotype threat and test performance in this study. Nonetheless, it was concluded that even individuals from nonstereotyped, high ability groups (i.e., white males who are good at math) could be affected by stereotype threat (Aronson et al., 1999).

In a second study with similar methods, researchers sought to identify what is necessary for stereotype threat to occur (Aronson, Lustina, Good, & Keough, 1999). As discussed in previous studies, an assumption of stereotype threat is that the individual must be identified with the ability domain in question (Steele, 1997). Results indicated that participants who identified strongly with math ability performed worse when confronted with the stereotype of Asians

outperforming Caucasians in math when compared to controls. Again, there were no differences in self-reported anxiety between groups. Together, these studies suggest that individuals do not need to be a target of stereotypes to demonstrate impaired performance on measures of abilities that are of high personal importance. Secondly, it appears that in order for stereotype threat to occur, the individual needs to care enough about performing well to be offset by a stereotype's implication that he or she may lack the ability to do so (Aronson, Lustina, Good, & Keough, 1999). Although there is much evidence to suggest that stereotype threat can impair test performance, there are conflicting ideas about the mechanism or mechanisms behind these effects. It has been thought that the basic controlling mechanism of stereotype threat is a simultaneous occurrence of whether a negative stereotype about one's group becomes relevant to interpreting oneself or one's behavior in a setting with which the individual identifies (Steele, 1997).

Underlying Mechanisms in Stereotype Threat

In a series of three experiments, researchers hypothesized that stereotype threat may interfere with one's ability to perform well on complex cognitive tests because it reduces the individual's working memory capacity (Schmader & Johns, 2003). In the first experiment, participants were all female undergraduate students who had scored 500 or higher on the quantitative section of the SAT. These participants also indicated that they believed that a stereotype existed suggesting that women have a lower math ability than men. All participants were seated in individual rooms and asked to listen to a prerecorded description of the study. The study description served as the manipulation of stereotype threat. In the control condition, participants were told that they were taking a test that would serve as a reliable measure of working memory capacity. In the threat condition, the test was described as a measure of

"quantitative capacity." This was defined to the participant as the ability to solve complex math problems while trying to process multiple pieces of information related to the task. Participants in the threat condition were also told that gender differences in math ability may stem from gender differences in quantitative capacity. Participants in both conditions were then given working memory tasks that involved oral math calculations and word recall. Researchers found that participants' working memory capacity in the stereotype threat condition was significantly reduced when compared to controls.

In the second experiment, researchers recruited 33 Latino and 39 White psychology students solely based on their self-reported ethnicity. Researchers attempted to activate stereotype threat in the Latino group on the basis of the stereotype that Latinos are less intelligent than Whites. In this experiment, the working memory task was framed as a test of general intelligence, and ethnic identity was primed by asking participants to identify their ethnicity on a demographic questionnaire. As with the first experiment, researchers found that participants' working memory capacity in the stereotype threat condition was significantly reduced when compared to controls.

In the third study, researchers examined both working memory and performance on standardized testing. Due to the close relationship between working memory and test performance, researchers attempted to examine whether working memory capacity mediates the effect of stereotype threat on academic test performance (Turner & Engle, 1989; Schmader & Johns, 2003). Participants were females who were placed in either a stereotype threat condition or a nonstereotype threat condition (control). They were then asked to complete both a modified version of the working memory measure from the two previous studies as well as a standardized math test. Women in the threat condition were asked to perform the working memory task as the

sole woman in a session of other male participants and were told that they would later be taking a math test. Results indicated that working memory did in fact act as a mediator between stereotype threat and test performance, suggesting that stereotype threat interfered with the math performance by reducing working memory capacity (Schmader & Johns, 2003).

The Role of Expectations

One mechanism that is not highlighted in the stereotype threat literature is the role of expectations in test performance. Expectations involve the anticipation of one's reaction to a certain situation or behavior (Kirsch, 1999). In the medical field, there has been much research on the effects of negative response expectancies, such as the nocebo effect (Kennedy, 1961). The nocebo effect states that merely having expectations for medical symptoms because of something an examiner does to you or gives you can cause symptoms in the expectant individual (Kennedy, 1961). This phenomenon has been shown to cause pain symptoms, asthmatic attacks, and side effects of medications (Luparello, Lyons, Bleecker, & McFadden, 1968; Myers, Cairns, & Singer, 1987; Schweiger & Parducci, 1981). Although many studies of the nocebo effect focus on medical symptoms, recent research has shown that the nocebo effect may also be revealed in cognitive domains, such as memory (Foerster & Strack, 1998).

The expectation of certain symptoms following an injury has been shown to account for the variance in symptom reporting of some controversial disorders, such as postconcussion syndrome (Ferguson, Mittenberg, Barone, & Schneider, 1999; Mittenberg, DiGiulio, Perrin, & Bass 1992). For example, in a study of head injured patients and healthy controls, a 30 symptom checklist was administered that included affective, somatic, and memory items. The control group was asked to answer these questions while imagining they were involved in a car accident and told to endorse the symptoms they expected to experience following a head injury.

Participants with bona fide head injury were asked to complete the same checklist under two conditions. First, they were told to answer the questions as they would have before their accident and then subsequently indicate if they noticed the symptom at the time of the study (i.e., after the accident). Results demonstrated that participants who had sustained a head injury consistently underestimated the normal prevalence of reported symptoms in their retrospective accounts compared to the base rate reported by normal controls (Mittenberg et al., 1992).

In a similar study of male athletes, researchers attempted to examine the role of expectations in the symptom reports of athletes who had sustained a head injury versus a non-head injured control group (Ferguson et al., 1999). Participants completed a symptom checklist that included symptoms consistent with head injury (i.e., memory difficulties, somatic symptoms, concentration problems). Head injured participants were instructed to indicate which symptoms they were currently experiencing, and then estimate which symptoms they experienced before the head injury. Controls were also asked to indicate which symptoms they were currently experiencing; however, they were then asked to imagine that they had sustained a concussion six months prior and indicate which symptoms they expected to experience following the injury. Overall, it appeared that head injured participants tended to overestimate their symptoms based on the expectation that postconcussion symptoms would follow a head injury. This suggested that they overestimated their post injury symptoms in a manner that was consistent with their symptom expectations (Ferguson et al., 1999).

Diagnosis Threat

One construct that has not been well studied in ADHD populations is the effect of negative expectations on neuropsychological test performance. The construct of diagnosis threat was first described by Suhr and Gunstad (2002) as the “influence of negative expectations on

neuropsychological test performance" (p. 448). Only three studies to date have demonstrated this phenomenon in individuals with mTBI (Suhr & Gunstad, 2002, Suhr & Gunstad, 2005, Ozen & Fernandes, 2010). However, there is reason to believe that this phenomenon can occur with other diagnoses as well.

Stereotype threat and diagnosis threat are examples of the effects of negative response expectancies (Kirsch, 1999). To date, there are few studies that have examined the concept of diagnosis threat. In what is believed to be first study to apply the concept of stereotype threat to a neurological population, Suhr and Gunstad (2002) found that when individuals who had sustained (but fully recovered from) a mild head injury have their attention called to it, they performed significantly worse on neuropsychological tests compared to matched recovered head injured individuals who did not have attention called to their injury. These authors replicated these findings in a subsequent study, finding that the individuals in the diagnosis threat condition performed worse on memory, psychomotor speed, and attention/working memory tests (Suhr & Gunstad, 2005). This study also examined the potential roles of anxiety, effort, and depression as possible explanations for diagnosis threat. Results indicated that none of these constructs were related to cognitive performance. This provides further support for the notion that the diagnosis threat group's poor test performance was due to non-neurological factors (i.e., negative expectations).

A study expanding upon Suhr and Gunstad's studies (2002, 2005) investigated the effects of diagnosis threat on everyday cognitive errors and affective functioning after mild head injury (Ozen & Fernandes, 2011). These researchers also examined test scores and subjective reports of cognitive functioning. This study included undergraduate participants who indicated that they had sustained a mild head injury at least six months prior to testing. The study also included a

non-head injured control group matched by gender, age, education. In the diagnosis threat condition, participants were told that the purpose of the study was to examine the potential long-term effects of mild head injury of memory and attention. The control group was simply told that the intention of the study was to investigate memory and attention in young adults. All participants were given a battery of questionnaires and neuropsychological tests to obtain information on memory and attention. Results of this study demonstrated that head injured individuals in the diagnosis threat condition reportedly significantly more attention and memory-related errors in everyday life compared with non-head injured controls as well as head-injured participants in the non-diagnosis threat condition. Interestingly, head injured participants in the non-diagnosis threat condition reported experiencing higher levels of anxiety during testing when compared to both controls and head injured participants in the diagnosis threat condition. In terms of cognitive performance, controls outperformed head injured participants on one test of attention (Digit Span forward), regardless of group assignment. Trends in both the Digit Span forward and Stroop data suggested that that diagnosis threat may have also impaired attention span and slowed information processing speed in head injured participants (Ozen & Fernandes, 2011). The authors purport that these results suggest that self-reports of everyday attention and memory function may be more prone to diagnosis threat than standardized test performance (Ozen & Fernandes, 2011).

The current study is the first to examine the influence of diagnosis threat in adult individuals with ADHD. Specifically, this research revealed how diagnosis threat affects test performance. In addition, this study examined how diagnosis threat impacts the individual's report of current and childhood symptoms, which is an important aspect of adult ADHD diagnosis (Davidson, 2008). This study is among the first of its kind in examining how diagnosis

threat impacts individuals with ADHD. While a handful of studies have seen diagnosis threat occur in mTBI populations, no studies have examined this construct in individuals with ADHD. This current study has direct implications for the way medical professionals and neuropsychologists work with patients diagnosed with ADHD, as well as how to consider these individuals' assessment data.

Hypotheses

1. Neuropsychological Measures
    a. When compared to controls, participants in the diagnosis threat group were predicted to perform slower on the Trail Making Test – Part A.
    b. When compared to controls, participants in the diagnosis threat group were predicted to perform significantly slower on the Trail Making Test – Part B.
    c. When compared to controls, it was hypothesized that participants in the diagnosis threat group would obtain lower scores on the Digit Symbol—Coding subtest of the Wechsler Adult Intelligence Scale – Third Edition (WAIS-III).
    d. When compared to controls, it was hypothesized that participants in the diagnosis threat group would obtain lower scores on the Digit Span subtest of the WAIS-III.
    e. When compared to controls, it was hypothesized that participants in the diagnosis threat group would obtain lower scores on the Information subtest of the WAIS-III.
    f. When compared to controls, it was hypothesized that participants in the diagnosis threat group would obtain lower scores on the immediate recall section of the California Verbal Learning Test (CVLT).

g. When compared to controls, it was hypothesized that participants in the diagnosis threat group would obtain lower scores on the delayed recall section of the California Verbal Learning Test (CVLT).

h. When compared to controls, it was hypothesized that participants in the diagnosis threat group would perform slower on Condition 3 – Inhibition of the Color-Word Interference Test of the D-KEFS.

i. When compared to controls, it was hypothesized that participants in the diagnosis threat group would make more errors on Condition 3 – Inhibition of the Color-Word Interference Test of the D-KEFS.

j. When compared to controls, it was hypothesized that participants in the diagnosis threat group would have a higher number of Omission Errors on the Conners' Continuous Performance Test (CPT).

k. When compared to controls, it was hypothesized that participants in the diagnosis threat group would have a higher number of Commission Errors on the Conners' Continuous Performance Test (CPT).

2. Self-Report Measures

a. It was expected that participants in the diagnosis threat group would report more frequency of occurrence of current symptoms on the Barkley Adult ADHD Rating Scale (BAARS-IV). This would be reflected in the Total ADHD Count.

b. It was expected that participants in the diagnosis threat group would report more frequency of occurrence of childhood symptoms on the BAARS-IV. This would be reflected in the Total ADHD Count.

3. Manipulation Check Questionnaire
    a. It was hypothesized that participants in the diagnosis threat group would rate the effort they put forth on the tests as less than participants in the control group.
    b. It was hypothesized that participants in the diagnosis threat group would rate the tests as more difficult than participants in the control group.
    c. It was hypothesized that participants in the diagnosis threat group would report experiencing more pressure during testing than the control group.
    d. It was hypothesized that participants in the diagnosis threat group would report lower confidence in their performance than the control group.
    e. It was hypothesized that participants in the diagnosis threat group would report that they performed worse than participants in the control group.

Methods

Participants

A power analysis based on a moderate effect size was conducted in order to estimate necessary sample size. An effect size of .71 (Cohen's *d*) was estimated based on previous research by Barkley, Murphy, and Kwasnik (1996). For analyses with independent samples *t*-tests (two-tailed test, *alpha* = .05) with moderate effect size to have a power of .80, a total of 66 subjects were needed, with 33 participants in each group.

Upon completing a large screening, 74 study-eligible students from The University of Montana completed the current study. All participants reported that they carried a diagnosis of ADHD or ADD that was given by a medical or mental health professional (i.e., psychiatrist, psychologist, etc.). This information was obtained from items 19 and 21 of the Neuropsychological Lab Screening (see Appendix A). Participants were recruited from

Psychology 100 Screening Day as well as other undergraduate Psychology courses. In addition, participants were recruited through flyers posted on campus and campus wide emails that directed them to a web address to complete an online screening form. Participants were either given research credits or had their names entered in a raffle drawing for a chance to win a gift card as an incentive for their participation.

Three participants were excluded from the study because they did not correctly identify why they were chosen for the study on the Manipulation Check Questionnaire despite being in the diagnosis threat group. One participant was excluded after revealing that she had been informed of the details of the study from another participant prior to her study appointment. The majority of the sample was male (n = 41) and Caucasian (n =57). Age ranged from 18-45 years old, with an average age of 21 years (SD = 4.84). Of the 70 participants who participated, 36 were randomly assigned to the control group and 34 to the diagnosis threat group.

Instruments

General Lab Screening Form. A general lab screening form was developed for the purposes of screening for all studies being conducted in the Neuropsychology Lab at The University of Montana. This form includes information about education as well as medical and health history (i.e., psychological, neurological; See Appendix A). Thirty-five participants indicated significant neurological or psychological problems and were therefore excluded from the current study.

Depression. The PHQ-8 is adapted from the PHQ-9, a nine item depression scale that assesses the severity of depressive symptoms (Kroenke, Spitzer, & Williams, 2001). The PHQ-8 includes all items of the PHQ-9 except for the item regarding self-harm. Items are rated on a 0 to 3 scale, providing a 0 o 24 severity score. There is research to suggest that using a shorter

version of this screener is a good "first step" approach to depression screening and may reduce the chances of and individual reporting on overlapping symptoms (Kroenke, Spitzer, & Williams, 2003). This version is called the PHQ-2 and involves asking the first to questions of the PHQ-8. These items inquire about the frequency of depressed mood and anhedonia (which are required symptoms for depression). Researchers have identified a PHQ-2 cutoff score of 3 as the optimal cut point for screening purposes. If the participant scores above a 3 on the first two items, the remaining 6 items are examined. Total scores equal to or above 10 are indicative of clinical depression, and warranted exclusion in the current study. If the participant scored below a 3 on the first two items, the remaining 6 items were not counted, as depression was not indicated. Four participants were excluded from the current study on the basis of this measure.

Anxiety. The Beck Anxiety Inventory (BAI; Beck, 1990) is a 21-item measure that assesses the severity of anxiety symptoms. Items are rated on a 0 to 3 scale, providing a 0 to 63 severity score. Symptom severity is determined by ranges of scores: 0-7 is considered minimal anxiety, 8-15 is mild anxiety, 16-25 is moderate anxiety, and 26-63 is considered severe anxiety. Participants will be excluded from the current study if they obtain a score of 13 or higher. In other words, only those participants reporting anxiety on the lower end of the mild range will be included in the current study. It is reasonable to expect that participants walking into a testing situation that they know little about would be experiencing mild levels of anxiety. Previous research using the BAI with purely anxious and non-anxious groups identified a mean score of 13.27 for the non-anxious group (Beck, Epstein, Brown, & Steer, 1988). Nine participants were excluded on the basis of the BAI.

Substance Use (See Appendix B). This measure was adapted from the Michigan Alcohol Screening Test (Selzer, 1971) and the Drug Abuse Screening Test (National Institute on

Drug Abuse, 1982). Participants who scored a 12 or above on this measure were excluded from the current study (n = 13).

Standard Neuropsychological Measures. The following measures were included in the battery of the current study and were administered in uniform order. These tests were chosen because of they are considered to be particularly demanding of attention and may be seen in an ADHD assessment battery.

The California Verbal Learning Test—Second edition (CVLT-II); Delis, Kramer, Kaplan, & Ober, 2000) is a measure of verbal memory. Participants are asked to recall a list of several words that are read to them by the examiner. Sections from this measure that will be included in the current study are Immediate Recall Total and Long Delay Free Recall. Test-retest reliability for these sections were high (r = .82, .88, respectively). Split-half reliability CVLT-II falls within the moderate to high range.

The Conners' Continuous Performance Test II (CPT II; Conners, 2004) is a computerized measure of sustained and selective attention and impulsivity. It is commonly used as a measure of simple sustained attention (Sollman et al., 2010). The participant is asked to attend and respond to relevant stimuli by hitting the spacebar every time a letter other than "X" appears on the screen (i.e., target items). Once an "X" appears, the participant is asked to inhibit response. If the participant fails to hit the spacebar when instructed (i.e., anytime a letter other than an "X" is shown), this is recorded as an error of omission. If the participant hits the spacebar in response to an "X", this is recorded as an error of commission. Omission errors represent inattention, and commission errors represent impulsivity (Barkley & Murphy, 2011; Quinn, 2003). Test-retest reliability for the CPT II ranges from moderate to high for errors of omission (r = .84) and commission (r = .65), and both coefficients were significant beyond the .01 level.

The Trail Making Test—Parts A and B (TMT A, TMT B; Reitan & Wolfson, 1985) is commonly used in neuropsychological test batteries as a measure of visual attention, task switching, and divided attention. Test-retest reliability has been found to be moderate for both Part A (r = .70) and Part B (r = .89; Dikmen, Heaton, Grant, & Temkin, 1999). The TMT A & B has been shown to have low specificity, but high sensitivity, suggesting that its utility is best seen in detecting the presence of deficits, but not in specifically identifying them (Cicerone & Azulay, 2002).

The Digit Span subtest of the Weschler Adult Intelligence Scale –Third edition (WAIS-III; Weschler, 1997a) is a measure of working memory that asks the participant to recall a list of numbers recited to them by the examiner. Depending on age, internal consistency reliability coefficients for Digit Span ranged from r = .84 to .93. Test-retest reliability ranges from r = .75 to .85, depending on age.

The Digit Symbol—Coding subtest of the WAIS-III (Weschler, 1997a) is a timed task that is particularly sensitive to neurological dysfunction. The participant is asked to copy symbols into boxes that are paired with numbers in a key. This measure taps into executive functioning, and of particular interest is its focus on processing speed. Depending on age, internal consistency reliability coefficients for Digit Symbol—Coding ranges from r = .81 to .87. Test-retest reliability ranged from r = .80 to .91, depending on age.

The Information subtest of the WAIS-III (Weschler, 1997a) is a test of general knowledge. The participant is asked to respond orally to a series of questions about common events, objects, places, and people. Depending on age, internal consistency reliability coefficients for Information ranged from r = .89 to .93. Test-retest reliability ranges from r = .92 to .94, depending on age.

The Color-Word Interference Test of the Delis-Kaplan Executive Functioning System (D-KEFS; Delis, Kaplan, & Kramer, 2001) is an adaptation of the Stroop Test (Stroop, 1935). It is a measure of response inhibition, processing speed, and cognitive flexibility. The test is composed of four conditions: two baseline conditions (Color Naming and Word Reading) and two higher-level conditions (Inhibition and Inhibition/Switching). The current study's hypothesis for the Color-Word Interference Test is in regards to Condition 3 – Inhibition. Test-retest reliability for the Color-Word Interference Test is $r = .75$ for Condition 3.

With the exception of the CPT II, paper-and-pencil versions of all instruments were administered according to standardized procedures by trained examiners. Raw scores were used for all measures.

Self-Report. The Barkley Adult ADHD Rating Scales-Fourth Edition (BAARS-IV) is an empirically developed scale based on the diagnostic criteria of the DSM-IV TR (APA, 2000). The scale includes self-report of the frequency of both current and childhood symptoms, and items are rated on 1 (*never or rarely*) to (*very often*) Likert-type scales. Examples of current symptoms include, "Forgetful in daily activities" and "Spacey or in a fog." Childhood items include similar symptoms and ask the participant to recall how often the symptom occurred between ages 5 and 12 to the best of his or her ability. The questionnaire takes the average adult approximately 5-7 minutes to complete and will provide an ADHD Total score which was used in the current study. Internal consistency (Cronbach's alpha) for the Current ADHD Total score is .914. Internal consistency (Cronbach's alpha) for the Childhood ADHD Total score is .947. Test-retest reliability ranges from moderate to high and all coefficients were significant beyond the .001 level. The BAARS-IV has also been found to have moderate convergent validity.

Due to the nature of the study, it was less than ideal that the term "ADHD" appeared in copyright and "Office Use Only" sections of the scale. This could have led to diagnosis threat being induced in the control group, who should have remained unaware that they were chosen to participate based on their ADHD diagnosis. This also meant that the subheadings of Inattention, Hyperactivity, Impulsivity, and Sluggish Cognitive Tempo were potentially problematic. Permission was obtained from the publisher (Guilford Press) to remove these subheadings as well as the term "ADHD" from the copyright and “Office Use Only” portions of the scale in an attempt to conceal its purpose. No scale items or instructions were altered.

ADHD Threat Check. In order to assess how strongly participants identify with their diagnosis, participants were asked to rate how accurately the diagnosis of ADHD depicts them on a seven point Likert-type scale (0 being “not accurately at all” and 7 being “perfectly accurately.” (See Appendix C).

Manipulation Check (MCQ). This measure was adapted from Suhr and Gunstad (2002) to assess how much effort participants put into the tasks, how difficult they thought the tasks were, how confident they were in their performance, and how well they thought they performed (Suhr & Gunstad, 2002; See Appendix D).

Diagnosis Check. This form was completed at the end of the study in order to verify that the information obtained from the screening form regarding ADHD diagnosis was accurate. This form included questions 19 through 23b from the Neuropsychological Lab Screening Form (see Appendix A).

Design and Procedures

At the study appointment, participants were given the PHQ-8, BAI, and the Alcohol and Drug Questionnaire following informed consent. They were then asked for their current GPA

which was later used to determine whether academic performance was equal between the groups. Participants were then given an envelope with a letter inside. This letter contained instructions that served as group assignment in addition to the induction of diagnosis threat in the experimental group. Participants were given different instructions based on group assignment. Those in the control group were told to perform to the best of their ability, while those participants in the diagnosis threat group were told that they were chosen due to their ADHD diagnosis (see Appendices E and F). The examiner left the room while the participant read the instructions, thereby ensuring that the examiner was unaware of group assignment at the time of testing. After reading the instructions, participants were required to sign them, place them back into the envelope, and seal the envelope. The examiner then reentered the room and administered a brief neuropsychological battery. Upon completion of the battery, participants completed the BAARS-IV self-report measures, Manipulation Check, ADHD Threat Check, and Diagnosis Check. The session concluded with a debriefing statement (see Appendix G).

Statistical Corrections

The 18 proposed hypotheses were treated as three separate "families" of hypotheses in the analytic process (e.g., 11 Neuropsychological measures, 2 Self-Report measures, and 5 MCQ hypotheses). Due to the fact that all hypotheses were planned comparisons, each with a theoretical basis, no statistical corrections were used. It was determined that a using a correction would unnecessarily increase the risk of committing a Type II error.

Results

Groups were not significantly different in age or years of education; however, they were significantly different with respect to self-reported Grade Point Average (GPA), with the control group's GPA being .43 points higher, on average, than the diagnosis threat group (see Table 1

for demographic comparisons). Due to the control group's GPA being higher than the diagnosis threat group, it may be difficult to ascertain whether a poorer performance by the diagnosis threat group would be due to diagnosis threat or simply a lower academic potential. It should be noted that seven participants (n = 4 in the diagnosis threat group and n = 3 in the control group) were unable to provide GPAs because these individuals were in their first semester of college.

The majority of participants in the current study indicated that they had been diagnosed with ADHD by a doctor (n = 39). The average age of diagnosis was 12.94 years (SD = 5.34). Most participants indicated that they were not receiving treatment for their disorder (n = 40). All 30 participants who did report receiving treatment indicated that they were taking medication. Two of these participants were also engaged in talk therapy/counseling.

As expected, participants in the diagnosis groups correctly identified that they were chosen based on having an ADHD diagnoses when asked on the MCQ. However, somewhat unexpectedly, some participants in the control group correctly identified why they had been selected for the current study on the MCQ, indicating that they realized that their selection had something to do with their ADHD diagnosis. It is possible that once these participants were given an opportunity to reflect on why they were chosen for the study (i.e., when they were administered the MCQ at the conclusion of the test battery) they were able to guess correctly that they were chosen due to their ADHD diagnosis. For example, when asked to indicate why she was selected to participate in the current study, one participant responded, "I believe I was selected because I indicated alcohol use and attention problems on the screening survey." When asked what led her to that response, she indicated, "Because some of the tasks placed before me required careful attention to detail and lots of paying attention. Also some of the questions on the survey were about alcohol use." Some of these individuals indicated that they were able to guess

due to some familiarity with the testing material (i.e., "I have had these tests before."). It is important to note that these individuals were given no instruction or information on how they were expected to perform on testing, unlike the participants who were assigned to the diagnosis threat group. Individuals in the control group who correctly guessed why they were chosen were compared to those who did not using independent samples *t*-tests (see Table 2). These individuals' test data did not significantly differ from those controls that remained unaware as to why they were selected. For these reasons, it was determined that control participants who guessed would be included as a part of the overall control group.

Mean Comparisons Using Analyses of Covariance

It was determined that GPA would be treated as a covariate in the analyses of neuropsychological measures due to its potential relationship to the dependent variables in the first set of hypotheses. A series of one-way between groups analyses of covariance (ANCOVAs) were conducted to test all hypotheses. Participants' GPAs were used as the covariate in these analyses in order to boost sensitivity and increase power to detect group differences. Preliminary checks were conducted to ensure that there was no violation of the assumptions of normality, linearity, homogeneity of variances, homogeneity of regression slopes, and reliable measurement of the covariate. Means and standard deviations for the first set of hypotheses (neuropsychological measures) are presented in Table 3.

After adjusting for GPA, there was no significant difference between the control and diagnosis threat groups on TMT A, F (1, 60) = .01, p = .92, partial eta squared = .00. However, the diagnosis threat group performed significantly worse when compared to controls on TMT B, F (1, 60) = 4.37, p = .04, partial eta squared = .07. There was no significant difference between the control and diagnosis threat groups on Digit Symbol—Coding after adjusting for GPA, F (1,

60) = 1.67, p = .20, partial eta squared = .03. Similarly, there was no significant differences between the control and diagnosis threat groups on Digit Span, F (1, 60) = .002 p = .96, partial eta squared = .00. No significant differences were found between the control and diagnosis threat groups on Information, F (1, 60) = 1.26, p = .26, partial eta squared = .02.

There was also no significant difference between the control and diagnosis threat groups on the CVLT-II Immediate Recall after adjusting for GPA,, F (1, 60) = 1.28, p = .26, partial eta squared = .02. Similarly, no significant differences were found on the CVLT-II Delayed Recall, F (1, 60) = .84, p = .36, partial eta squared = .01.

After adjusting for GPA, there was a significant difference between the control and diagnosis threat groups on the Color-Word Interference Test of the D-KEFS in terms of time to complete, with the diagnosis threat group performing slower than controls, F (1, 60) = 4.62, p = .04, partial eta squared = .07. However, there was no significant difference between the control and diagnosis threat groups on this task in regards to number of errors, F (1, 60) = .001, p = .97, partial eta squared = .00. There was no significant difference between the control and diagnosis threat groups on CPT II Omission Errors after adjusting for GPA, F (1, 57) =.07, p = .79, partial eta squared = .001. Similarly, there was no significant difference between groups on CPT II Commission Errors, F (1, 57) = 2.56, p = .12, partial eta squared = .04.

Mean Comparisons using Independent Samples *t*-tests

To ensure that failures to reject the null hypothesis were not due to a lack of statistical power or the potential that GPA was not a successful covariate, a series of *t*-tests was performed as a double check to analyze the first set of hypotheses (regarding neuropsychological measures).

When compared to controls (M = 24.89, SD = 1.78), participants' performance on the TMT A in the diagnosis threat group (M =24.11, SD = 7.27) was not significantly different, t(68)

= -431, p = .67, two-tailed, d = .10. Similarly, when compared to controls (M = 56.18, SD = 15.40), participants in the diagnosis threat group (M =61.90, SD = 16.52) performed slightly worse on TMT B; however, this difference was not significant, $t(68) = 1.50$, p = .14, two-tailed, d = .36.

No significant differences were found between controls (M = 77.92, SD = 11.21) and participants in the diagnosis threat group (M =75.62, SD = 8.13) on Digit Symbol—Coding, $t(68)$ = -.98, p = .33, two-tailed, d = 1.21. There was no significant difference between controls (M = 17.94, SD = 3.49) and participants in the diagnosis threat group (M =17.06, SD = 3.38) on Digit Span, $t(68) = -1.08$, p = .29, two-tailed, d = .26.

When compared to controls (M = 18.33, SD = 4.68), participants in the diagnosis threat group (M =16.00, SD = 5.04) performed significantly worse on Information, $t(68) = -2.01$, p <.05, two-tailed, d = .48. When compared to controls (M = 56.69, SD = 8.30), participants in the diagnosis threat group (M =52.94, SD = 7.11) performed significantly worse on CVLT Immediate Recall, $t(68) = -2.03$, p <.05, two-tailed, d = .49. However, there was no significant difference between controls (M = 12.80, SD = 2.48), and the diagnosis threat group (M =11.65, SD = 2.73) on CVLT Delayed Recall, $t(68) = -1.84$, p = .07, two-tailed, d = .44.

When compared to controls (M = 45.46, SD = 10.52), participants in the diagnosis threat group (M =51.28, SD = 11.43) performed significantly worse on CW Inhibition—Time to Complete, $t(68) = -2.22$, p <.05, two-tailed, d = .53. However, controls (M = 2.56, SD = 7.41), did not significantly differ from the diagnosis threat group (M =2.15, SD = 1.74) on the number of errors made in this task, $t(68) = -.31$, p = 76, two-tailed, d = .08.

When compared to controls (M = 2.32, SD = 4.41), participants in the diagnosis threat group (M =2.25, SD = 3.63) did not differ on CPT Omission Errors, $t(65) = .07$, p = .94, two-

tailed, d = .02. There was no significant difference between controls (M = 15.33, SD = 8.06), and the diagnosis threat group (M =14.77, SD = 7.56) on CPT Commission Errors, $t(65) = -2.91$, p = .77, two-tailed, d = .07.

Analyses of Self-Report Measures

Independent-samples *t*-tests were conducted to test the second set of hypotheses (self-report measures) for the control and diagnosis threat groups. When compared to controls (M = 34.19, SD = 7.48), participants in the diagnosis threat group (M = 34.41, SD = 7.50) were not found to be significantly different in their report of ADHD symptoms on the BAARS-IV Current, $t(68) = .12$, p = .90, two-tailed, d = .03. Similarly, when compared to controls (M = 43.86, SD = 10.77), participants in the diagnosis threat group (M = 45.41, SD = 11.27) were not found to be significantly different in their report of ADHD symptoms on the BAARS-IV Childhood, $t(68) = .59$, p = .56, two-tailed, d = .14. In sum, these results indicated that there were no significant differences between the control and diagnosis threat group on the frequency of occurrence of self-reported symptoms of ADHD, as measured by the BAARS-IV Total ADHD Count.

Analyses of Manipulation Check Questionnaire Items

Independent-samples *t*-tests were conducted test the third set of hypotheses (Manipulation Check Questionnaire) for the control and diagnosis threat groups. Results indicated that there were no significant differences between groups in self-reported effort, difficulty, pressure, confidence, or performance during testing. When compared to controls (M = 8.39, SD = .728), participants in the diagnosis threat group (M = 8.12, SD = .64) were not found to be significantly different in their self-rated report of effort, though this difference was marginally significant, t(68) = -1.65, p = .06, two-tailed, d = -.39.

When compared to controls (M = 5.81, SD = 1.64), participants in the diagnosis threat group (M = 6.00, SD = 1.26) were not found to be significantly different in their self-rated report of difficulty, t(68) = .56, p = .58, two-tailed, *d* = .13.

When compared to controls (M = 4.17, SD = 2.40), participants in the diagnosis threat group (M = 4.79, SD = 2.20) were not found to be significantly different in their self-rated report of pressure, t(68) = 1.14, p = .26, two-tailed, *d* = .27. Similarly, when compared to controls (M = 6.22, SD = 1.48), participants in the diagnosis threat group (M = 5.97, SD = 1.57) were not found to be significantly different in their self-rated report of confidence, t(68) = -.69, p = .49, two-tailed, *d* = -.16. Finally, when compared to controls (M = 5.94, SD = 1.19), participants in the diagnosis threat group (M = 6.06, SD = 1.28) were not found to be significantly different in their self-rated report of performance, t(68) = .39, p = .70, two-tailed, *d* = .10.

Discussion

The current study is among the first to examine the influence of diagnosis threat in adult individuals with ADHD. The purpose of this paper was to determine what effects diagnosis threat has on neuropsychological test performance and symptom report in adults who have been diagnosed with ADHD. Due to its potential relationship to the dependent variables in the first set of hypotheses, it was determined that GPA would be treated as a covariate in the analyses of neuropsychological measures. Therefore, in examining the first set of hypotheses, ANCOVAs were used to examine performance on neuropsychological measures. As hypothesized, participants who were exposed to diagnosis threat performed worse on tests of complex attention and executive functioning when compared to controls. Specifically, participants in the diagnosis threat group performed slower than controls on TMT B and the Color-Word Interference Test. Both of these tasks are commonly used to measure attention and processing speed, which are often found to be

impaired in those with ADHD. However, it appears that the addition of diagnosis threat negatively affects performance in each of these constructs. Previous research indicates that working memory is often found to be impaired in those with ADHD (Goodman, 2010). It has also been shown to act as a mediator between stereotype threat and performance on complex cognitive tests (Schmader & Johns, 2003). Although the TMT B and Color-Word Interference Test are not traditionally used to measure working memory, these tasks certainly demand utilization of this cognitive domain. Impairment of working memory would be expected to negatively affect performance on both the TMT B and Color-Word Interference Test, and it is likely that diagnosis threat acted as a contributing factor to this impairment.

These findings are supported by previous research examining diagnosis threat in mTBI populations (Ozen & Fernandes, 2011; Suhr & Gunstad, 2002). Specifically, participants assigned to a diagnosis threat condition performed significantly worse on the TMT B when compared to controls (Suhr & Gunstad, 2002). Additionally, trends in Stroop data suggested that that diagnosis threat may have also impaired attention span and slowed information processing speed in head injured participants (Ozen & Fernandes, 2011). The current study is first to show similar findings with these measures in an adult ADHD population. This demonstrates the potential for diagnosis threat to occur in populations other than mTBI and the need for continued investigation of this phenomenon in other disorders.

As a double check of adequate power and the success of GPA as a covariate, independent samples *t*-tests were used to examine performance on neuropsychological measures. Results indicated that group differences were found on measures of attention, memory, and intelligence. Similar to findings using ANCOVA, participants in the diagnosis threat group were slower to complete the Color-Word Interference Test when compared to controls. Additionally,

participants in the diagnosis threat group scored lower on the CVLT-II Immediate Recall than the control group. Again, it is possible that lower performance on the CVLT-II Immediate Recall was due to reduction of the diagnosis threat group's working memory capacity, as seen in examinations of stereotype threat (Schmader & Johns, 2003).

Finally, participants in the diagnosis threat group were found to perform worse on the Information subtest of the WAIS-III. At first glance, this finding may seem curious because this measure is often found to be resilient to impairment even in cases of neurological injury. However, it demonstrates the potential of diagnosis threat to impact even areas of cognitive function that are thought to be crystallized knowledge. This finding is consistent with previous diagnosis threat research in participants with mTBI (Suhr & Gunstad, 2002). Although this may be an unexpected finding, the fact that there are significant differences between controls and diagnosis threat participants on this measure provides more evidence for these differences being related to a non-neurological factor, such as diagnosis threat. This finding suggests that diagnosis threat may have its own unique way of affecting test scores.

The second set of hypotheses was not supported. There were no significant differences between groups with regard to their self-report of currently experienced ADHD symptoms on the BAARS-IV Current or recollection of childhood symptoms on the BAARS-IV Childhood measures. It is possible that the report of ADHD symptoms is not as susceptible to the impact of diagnosis threat as other measures examined in this study. Alternatively, it may be that the several manifestations of ADHD (i.e., inattentive, hyperactive, combined) may have made differences between groups unclear. In other words, some individuals in the diagnosis threat group may have reported a high frequency of symptoms on one subscale and a very low frequency of symptoms on another subscale. An examination of group differences on the

subscales of the BAARS-IV may be a better indicator of potential effects of diagnosis threat than the overall score.

The final set of hypotheses explored the MCQ. Results indicated that differences in self-rated reports of effort were approaching significance, in that the diagnosis threat group reported that they had put forth less effort when compared to controls. Results of subjective and objective effort has been variable in previous research, which may suggest the need to examine definitions of effort, as well as the way it is measured (Suhr & Gunstad, 2002). There were no differences in self-rated reports of difficulty, pressure, confidence, or performance during testing. This suggests that the diagnosis threat group did not report significant differences in their subjective experiences of the neuropsychological tests or their performance on these measures when compared to the control group. However, these findings become understandable in light of previous research regarding the absence of a link between poor test performance and the activation of preexisting or internalized anxiety (Steele & Aronson, 1995), which items on the MCQ likely tap into. In the current study, significant group differences were found primarily in test performance, and it appears that these differences were not likely due to several of the constructs measured by the MCQ.

The results of the current study demonstrate that performance on certain measures can be influenced by the awareness of one's diagnosis of ADHD. As researchers Suhr and Gunstad (2002) highlight, clinicians must remember that testing only allows one to assess behavior, not measure brain function. This statement purports the importance of considering the contribution of non-neurological factors to poor test performance. Given the absence of an objective diagnostic test for ADHD, it is important to consider what factors may contribute to poor test performance in this population. In particular, it is important to consider the role of non-

neurological factors. In the current study, individuals diagnosed with ADHD are not necessarily the targets of chronic stereotyping; however, the research suggests that these individuals may still be susceptible to exhibiting lowered performance when faced with a threatening stereotype (Aronson et al., 1999). Results of the current study support the idea that diagnosis threat may function as a type of stereotype threat in neurological populations.

It is possible that the degree to which one identifies with the disorder affects susceptibility to the construct of diagnosis threat. If an individual does not identify with the disorder, or is not concerned with its implications, diagnosis threat may not function the same way as someone who strongly identifies with ADHD and has concerns about its consequences. Future research may also consider the degree to which one identifies with his or her ADHD diagnosis as a potential factor in susceptibility to diagnosis threat.

Another potential area of examination is the role of age. It was noted through behavioral observations that some older, non-traditional students had developed more clear strategies in their approach to neuropsychological testing. Future research should consider the role of age or length of time with the ADHD diagnosis in relation to diagnosis threat. It is possible that age may act as potential protective factor to diagnosis threat, and this concept is yet to be explored.

The potential implications of an ADHD diagnosis are great. Research has shown that adults with ADHD are less likely to finish college, have two to three times higher rates of substance abuse disorders, and are three times more likely to be unemployed (Goodman, 2010). Considering this information, it is important that accuracy of diagnosis be ensured, especially considering the potential of diagnosis threat to skew the picture. In the same vein, it is apparent that there are certain incentives to being given an ADHD diagnosis, particularly with regards to obtaining stimulant medication. This is of particular concern in college-aged students, who may

seek to use stimulant medication for recreational purposes or as an aid in academic pursuits (McCabe, Knight, Teter, & Wechsler, 2005; Sollman et al., 2010). Again, this emphasizes the importance of accuracy in diagnosis.

Research has demonstrated that there are several barriers to diagnosing adult ADHD correctly (Weisler & Goodman, 2008). Results of the current study are directly relevant to the process of evaluation and consideration of adult ADHD. Specifically, these findings highlight the importance of considering the impact of non-neurological factors, such as diagnosis threat, on neuropsychological test performance. Furthermore, results may reinforce the value of using multiple informants and types of information in differential diagnosis of adult ADHD, such as using various types of assessment, implementing structured and unstructured observation and interviewing, as well as obtaining relevant historical data (i.e., educational records, etc.). Improved methods of evaluation may lead to more accurate diagnoses, which in turn might lead to overall improvements in the of quality of care for adults with ADHD. These improvements include consideration of how the diagnosis is relayed, as well as overall treatment and management of the disorder. It is important that clinicians and researchers continue to explore the impact of word choice, underlying messages, and delivery in regards to the way information is passed to clients.

Limitations

Due to the fact that the test battery was designed to mimic a potential ADHD assessment, there was a possibility that participants had been previously exposed to some or all of our testing battery. This may have resulted in a familiarity of the testing scenario, and/or some limited awareness of the nature of the study in the control group. One way this was addressed in the current study was to compare those controls that guessed as to why they were selected to those

who did not, there scores were not found to be significantly different.

Additionally, given the small sample size, the present study should be replicated with a larger sample. In addition, a community-based sample may also be advisable to determine whether results of the current study are generalizable to the adult ADHD population at large.

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Appendix A

NEUROPSYCHOLOGICAL LAB SCREENING FORM

INSTRUCTIONS*: If you are interested in being considered for studies in the neuropsychological lab, please complete the following screening questionnaire by filling in the blanks or circling your answers.*

Date_____ Age_____ Gender_____ Ethnicity_____ GPA _____

1. Were there any known difficulties with your birth? Yes No
   If YES, describe: _____

2. Do you have a vision problem that requires corrective lens wear (e.g., glasses)? Yes No

Education

3. Did you ever have to repeat any grades? Yes No

4. Were you ever placed in special education classes? Yes No

5. Are you currently receiving services from Disability Services for Students (DSS)? Yes No

   If YES, please indicate the reason you are receiving services: _____
   _____

6. What is the highest grade you have completed? (Please report years **completed.** For example, if you are a freshman you are in your 13th year of school, but you have completed 12 years of education. So, you would indicate 12) _____

Medical and Health History

7. Have you ever been diagnosed with any neurological condition? Yes No
   If yes, please list: _____

8. Have you ever had a blow to your head that caused you to become unconscious for longer than 30 minutes? Yes No

9. Are you currently experiencing significant problems with your mood (such as anxiety &/or depression) or any other psychiatric condition? Yes No
   If YES, please list: _____

10. Are you currently receiving treatment for your mood (such as anxiety or depression) or any other psychiatric condition? Yes No

11. Have you ever felt you should cut down on your drinking/drug use? Yes No

12. Have you ever been annoyed by people who criticize your drinking/drug use? Yes No

13. Have you felt bad or guilty about your drinking or drug use? Yes No

14. Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover? Yes No

15. Do you often drive under the influence of alcohol or drugs? Yes No

Head Injury History

16. Have you ever experienced a concussion or brain injury? Yes No

17. Were you knocked unconscious? Yes No

If YES, how long were you unconscious? (circle one)

1. Less than 1 minute
2. 1-30 minutes
3. More than 30 minutes

18. Do you remember the events before or after your head injury? Yes No

If NO, how long of a time period were you unable to remember?

1. A few seconds
2. Less than 5 minutes
3. Less than 30 minutes
4. 30 to 60 minutes
5. More than 60 minutes

Attention Deficit Hyperactivity Disorder (ADHD)/Attention Deficit Disorder (ADD) History

19. Have you ever been diagnosed with ADHD or ADD? Yes No

If YES, please answer the following questions.
If NO, you do not need to complete the rest of the questionnaire

20. At what age were you first diagnosed? _____

21. Who diagnosed you? (circle one)

1. Doctor
2. Psychologist/therapist
3. Psychiatrist
4. School counselor

5. Other, please provide job title: _____

22. Are you currently receiving treatment for your ADHD/ADD? Yes No

If YES, what type of treatment (circle all that apply)

1. Talk therapy/counseling
2. Medication for ADD/AHDHD
   Type:_____
   Dosage: _____
   Frequency: (i.e., number of times per day, week, etc.)_____
3. Other, please describe: _____

23. If taking medication for ADHD/ADD, please answer the following questions:

23a. When was the last time you took your medication (please estimate the hour and day)?

_____

23b. How effective is your ADHD/ADD medication in improving your attention (circle one)?

1	2	3	4	5	6	7
Not effective at all						Extremely effective

Appendix B

Drug and Alcohol Questionnaire

Directions: The following questions concern information about your involvement with drugs and alcohol. Drug abuse refers to (1) the use of prescribed or "over-the-counter" drugs in excess of the directions, and (2) any non-medical use of drugs. **Consider the past year** (12 months) and carefully read each statement. Please be sure to answer every question by circling YES or NO.

1. Have you used drugs other than those required for medical reasons?	YES	NO
2. Have you abused prescription drugs?	YES	NO
3. Do you abuse more than one drug at a time?	YES	NO
4. Can you get through the week without using drugs (other than those required for medical reasons)?	YES	NO
5. Are you always able to stop using drugs when you want to?	YES	NO
6. Do you abuse drugs on a continuous basis?	YES	NO
7. Do you try to limit your drug use to certain situations?	YES	NO
8. Have you had "blackouts" or "flashbacks" as a result of drug use?	YES	NO
9. Do you ever feel bad or guilty about your drug/alcohol abuse?	YES	NO
10. Does near relative or close friend ever worry or complain about your involvement with drugs/alcohol?	YES	NO
11. Do your friends or relatives know or suspect you abuse drugs?	YES	NO
12. Has drug/alcohol abuse ever created problems between you and a near relative or close friend?	YES	NO
13. Has any family member ever sought help for problems related to your drug/alcohol use?	YES	NO
14. Have you ever lost friends because of your use of drugs/alcohol?	YES	NO
15. Have you ever neglected your family or missed work because of your use of drugs/alcohol?	YES	NO
16. Have you ever been in trouble at work because of drug/alcohol abuse?	YES	NO
17. Have you ever lost a job because of drug/alcohol abuse?	YES	NO
18. Have you gotten into physical fights when under the influence of drugs/alcohol?	YES	NO

19. Have you ever been arrested, even for a few hours, because of unusual behavior while under the influence of drugs/alcohol?	YES	NO
20. Have you ever been arrested more than once for driving while under the influence of drugs/alcohol?	YES	NO
21. Have you engaged in illegal activities in order to obtain drug?	YES	NO
22. Have you ever been arrested for possession of illegal drugs?	YES	NO
23. Have you ever experienced withdrawal symptoms as a result of heavy drug intake?	YES	NO
24. Have you had medical problems as a result of your drug/alcohol use (e.g., memory loss, hepatitis, severe shaking, bleeding, liver trouble, etc.)?	YES	NO
25. Have you ever gone to anyone for help for a drug/alcohol problem?	YES	NO
26. Have you ever been in a hospital for medical problems related to your drug/alcohol use?	YES	NO
27. Have you ever been involved in a treatment program specifically related to drug use?	YES	NO
28. Have you been treated as a psychiatric inpatient or outpatient for problems related to drug/alcohol abuse?	YES	NO
29. Do you feel you are a normal drinker? (“normal”- drink as much or less than most other people)	YES	NO
30. Have you ever awakened the morning after some drinking the night before and found that you could not remember a part of the evening?	YES	NO
31. Can you stop drinking without difficulty after one or two drinks?	YES	NO
32. Have you ever attended a meeting of Alcoholics Anonymous (AA)?	YES	NO
33. Do you drink before noon fairly often?	YES	NO

Appendix C

ADHD/ADD Questionnaire

The American Psychological Association currently defines ADHD/ADD as “a persistent pattern of inattention and/or hyperactivity/impulsivity” (APA, 2000, p. 85).

How accurately does this describe you (circle one)?

1	2	3	4	5	6	7
Not accurately at all						Perfectly accurately

Comments:

Appendix D

MC Questionnaire
(Adapted from Suhr and Gunstad, 2002)

Please indicate why you were selected to participate in this study:

_____
_____

Please indicate what led you to your response listed above:

_____
_____

1. How hard did you try on the tests?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
Not at all Very hard

2. How difficult did you find these tests?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9
Not at all difficult Very difficult

3. How much pressure did you feel during testing?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

No pressure at all Very pressured

4. How confident are you in your performance?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

Not confident at all Very confident

5. How well did you do on the tests?

☐1 ☐2 ☐3 ☐4 ☐5 ☐6 ☐7 ☐8 ☐9

Very poorly Very well

Appendix E

Instructions for Controls

When you finish reading these instructions, sign at the bottom indicating that you have read them and understand your task. Then, place this signed sheet back into the envelope, seal it, place an X over the seal and wait for the examiner to return. You will be asked about these instructions later on.

When the experimenter returns to the room, s/he will ask you to complete a brief collection of common neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, problem solving skills, etc. Some of the tests are easy, some are more difficult. Please give your best effort. Questions about individual tests will be answered following the testing.

I have read these instructions and will do my best to follow them for the remainder of the experiment.

_____

(*Signature)*

Appendix F

Instructions for NEG

When you finish reading these instructions, sign at the bottom indicating that you have read them and understand your task. Then, place this signed sheet back into the envelope, seal it, place an X over the seal and wait for the examiner to return. You will be asked about these instructions later on.

You have been invited to participate in this study because of your responses to one of the questionnaires included in this study. Your responses indicated a diagnosis of ADHD/ADD. A growing number of neuropsychological studies find that many individuals with ADHD/ADD have difficulties on neuropsychological tests, particularly on tests of attention. This study examines the role that ADHD/ADD may play in areas of attention to better understand the nature of the disorder.

When the experimenter returns to the room, s/he will ask you to complete a brief collection of common neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, problem solving skills, etc. Some of the tests are easy, some are more difficult. Please give your best effort. Questions about individual tests will be answered following the testing.

I have read these instructions and will do my best to follow them for the remainder of the experiment.

_____

(*Signature)*

Appendix G

Debriefing Statement

Thank you for participating in this study. Throughout the course of this experiment, you may have had questions regarding the nature or purpose of this study. If you still have these questions, the experimenter will be glad to answer them for you at this time.

The purpose of this study was to investigate the influence of negative expectations on neuropsychological test performance. Specifically, this study was interested in examining whether or not drawing your attention to your previous diagnosis of ADHD/ADD influenced your performance on cognitive tasks. Previous research suggests that even individuals who do not have neuropsychological impairment may perform more poorly simply due to an awareness of their diagnosis (Suhr & Gunstad, 2002, 2005).

You will receive a credit for each half hour of participation in this study.

Your answers to these questions, as well as your performance on the testing measures, will be kept completely confidential.

Although a slight amount of discomfort is normal, if you experienced a significant amount of discomfort during the course of the experiment, please address your concerns to the experimenter at the present time. If you feel uncomfortable doing so, you may contact the faculty supervisor of the project, Dr. Stuart Hall, at 243-5667. If you experience significant discomfort and would like to explore counseling or mental health services, students can be seen at the Clinical Psychology Center, at 243-2367 or at Counseling and Psychological Services through the Curry Health Center, at 243-4711.

IMPORTANT:
We request that you not discuss the details of this experiment with anyone who may be a future participant in the study. Thank you for your cooperation.

Table 1

Demographic Comparisons

	Group		Overall Sample	*t*	df	*p*
	Diagnosis Threat (n = 30-34)	Control (n = 33-36)				
Age	21.47 (4.38)	21.33 (5.31)	21.4 (4.84)	.12	68	.907
Years Education	13.12 (1.34)	13.33 (1.66)	13.23 (1.51)	-.68	68	.499
GPA	2.67 (.66)	3.10 (.56)	2.90 (.64)	-2.76	61	.008

Note. Seven participants were missing GPAs due to first semester freshman status.

Table 2

Mean Comparisons of Guessing vs. Non-Guessing Controls on Neuropsychological Measures

	Group		*t*	df	*p*
	Guessers (*n* = 7)	Non-Guessers (*n* = 29)			
TMT A	28.05 (9.65)	24.12 (7.25)	1.21	34	.235
TMT B	62.05 (19.33)	54.76 (14.34)	1.13	34	.267
Digit Symbol—Coding	78.00 (11.49)	77.90 (11.35)	.02	34	.983
Digit Span	17.43 (3.41)	18.07 (3.56)	-.43	34	.669
Information	17.71 (4.72)	18.48 (4.75)	-.39	34	.703
CVLT-II Immediate Recall	53.57 (12.30)	57.45 (7.11)	-1.11	34	.273
CVLT-II Delayed Recall	11.86 (3.44)	13.04 (2.20)	-1.13	34	.268
CW Inhibition—Time to Complete	36.21 (16.82)	47.69 (7.16)	-1.77	34	.123
CW Inhibition—Errors	7.00 (16.77)	1.48 (1.48)	.87	34	.418
CPT II Omission Errors	1.43 (1.13)	2.45 (4.00)	-.66	34	.512
CPT II Commission Errors	20.00 (8.37)	14.21 (7.72)	1.76	34	.088

Comparisons of Guessing vs. Non-Guessing Controls on Self-Report Measures

	Group		*t*	df	*p*
	Guessers (*n* = 7)	Non-Guessers (*n* = 29)			
BAARS-IV Current Symptoms	34.86 (7.52)	34.03 (7.60)	.26	34	.798
BAARS-IV Childhood Symptoms	45.71 (8.86)	43.41 (11.27)	.50	34	.619

Comparisons of Guessing vs. Non-Guessing Controls on MCQ

	Group		*t*	df	*p*
	Guessers (*n* = 7)	Non-Guessers (*n* = 29)			
Effort	8.29 (1.11)	8.41 (.63)	-.41	34	.682
Difficulty	5.14 (2.27)	5.97 (1.45)	-1.20	34	.238
Pressure	4.71 (2.75)	4.03 (2.34)	.67	34	.508
Confidence	6.43 (1.62)	6.17 (1.47)	.41	34	.686
Performance	5.86 (1.07)	5.97 (1.24)	-.21	34	.833

Table 3

Means and Standard Deviations of Neuropsychological Measures for Control and Diagnosis Threat Group

	Group		Group	
Neuropsychological Measure	Diagnosis Threat (n = 30)	Control (n = 33)	Diagnosis Threat (n = 30)	Control (n = 33)
	Mean (SD)	Mean (SD)	Adj. Mean (SD)	Adj. Mean (SD)
TMT A	24.79 (7.28)	25.06 (7.94)	24.82 (1.45)	25.03 (1.38)
TMT B	62.99 (17.15)	55.53 (15.38)	63.83 (3.06)	54.76 (2.91)
Digit Symbol—Coding	75.53 (8.39)	78.45 (11.23)	75.25 (1.89)	78.71 (1.80)
Digit Span	17.20 (3.52)	17.88 (3.53)	17.53 (.65)	17.58 (.62)
Information	16.47 (4.86)	18.12 (4.74)	16.57 (.91)	18.02 (.86)
CVLT-II Immediate Recall	53.00 (7.17)	56.58 (8.49)	53.64 (1.46)	55.99 (1.39)
CVLT-II Delayed Recall	11.60 (2.82)	12.78 (2.43)	11.88 (.48)	12.51 (.47)
CW Inhibition—Time to Complete	52.52 (11.42)	45.95 (10.83)	52.46 (2.11)	46.01 (2.01)
CW Inhibition—Errors	2.17 (1.76)	2.76 (7.71)	2.50 (1.07)	2.45 (1.02)
CPT II Omission Errors	2.26 (4.43)	2.27 (3.79)	2.10 (.82)	2.41 (.74)
CPT II Commission Errors	14.48 (7.45)	15.58 (8.36)	13.25 (1.50)	16.59 (1.35)