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The Non-Standardization of Attention Deficit Hyperactive Disorder: A Call to Action

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THE NON-STANDARDIZATION OF ATTENTION DEFICIT HYPERACTIVE DISORDER: A CALL TO ACTION

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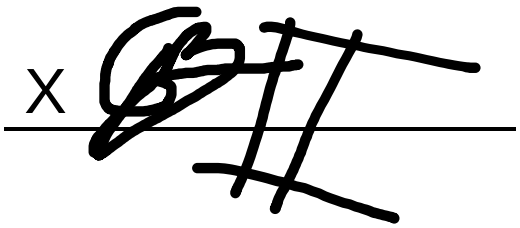
X 

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ABSTRACT

Attention Deficit Hyperactive Disorder (ADHD) is one of the most diagnosed disorders in adults and children, yet there is no standardized method to assess for ADHD. The similarity of symptoms shared across other disorders (comorbidity) makes the assessment of ADHD a very delicate process. This is not aided by the fact that the assessment of ADHD is not standardized. This allows individuals able to assess for ADHD to give a test or a combination of tests that they find fitting. This in turn brings into question the quality of testing and disagreement in diagnosing across fields. Lastly, ADHD-focused measures typically fail to address the overlap in symptoms with other disorders, which can help assist clinicians with differential diagnoses. The question then becomes, how does one attempt to standardize ADHD testing while providing testing that shows adequate clinical validity in both the diagnosis of ADHD and differential diagnosing? This paper aims to produce insight into the complications of ADHD diagnosis and suggest a solution to current testing, in the form of an assessment battery.

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Section I: History of Attention- Deficit-Hyperactive-Disorder (ADHD)

ADHD in Past Literature

When peering into the first mention of ADHD, it is a commonplace to accredit the first medical description of ADHD to the German physician Heinrich Hoffman. In 1844, Hoffmann authored the book *Struwwelpeter* for his son (Lange, 2010). In 1845, he published the work under the same name but titled *Cheerful Stories and Funny Pictures with 15 colored plates for children from 3 to 6 years* in English. Within this work is a story titled *Zappelphilip,* which translates to *Fidgety Phillip*. In this story, Hoffman illustrates a family dinner faced with conflict due to the fidgety behavior of the son, causing him to fall over his chair and take the contents on top of the table with him, indicative of the hyperactive portion of ADHD. As the story is introduced, the father states, "let me see if Phillip can be a gentleman; Let me see if he can sit still for once at the table" (Lange, 2020, p. 243). Phillip's fidgety behavior at the dinner table could be seen as the first indication of ADHD. His father's comment at the begging of this story shows that he had anticipated Phillip's behavior, thus indicating persistent behavior and disorder.

The current Diagnostic and Statistical Manual of Mental Disorders (5h ed. Text Revision; American Psychiatric Association, 2022) posits that, for an ADHD diagnosis, symptoms have “persisted for at least 6 months” (APA, 2022). Hoffman further describes symptoms of inattention and hyperactivity stating, “but Phillip did not listen to what his father was saying to him… but wriggled and giggled and then I declare, swung backward and forward and titled his chair” (Lange, 2010, p. 243). Phillips's actions are indicative of inattention, which is described within the DSM-5-TR as "Often

fail[ing] to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate)" (APA, 2022). Phillips's actions on his seat are also covered within the current DSM-5-TR, which states that clients with ADHD often fidget with or tap their hands or feet and squirm in their seats (APA, 2022). Phillip's final action of tipping his chair, taking the contents of the dinner table with him, and causing his parents to be angry with him, possibly hints at another DSM-5-TR criterion for ADHD. It states that ADHD and its symptoms tend to negatively impact those with ADHD directly on a social, academic, and occupational level.

Although Heinrich Hoffman's stories in 1844 are regarded as the first adequate referencing of ADHD, which has held up to the current time with its accuracy of the disorder, ADHD can be seen in other literature and art before the work of Hoffman. Two hundred thirty-one years before Hoffman's book, William Shakespeare alluded to an individual with severe inattention problems in his play King Henry VII, where he describes the character as having a malady of attention (Martinez-Badia & Martinez-Raga, 2015). Another alleged depiction of ADHD was in Johan Goethe's work *Faust*, published in 1832. He described a character of a principally hyperactive boy who has excessive motor activity, is impulsive, and pays little attention to his parents (Martinez-Badia & Martinez-Raga, 2015). Such literature shows that ADHD has been around for centuries and continues to increase in prevalence as time goes on.

Early History and 18th Century

The current conceptualization of ADHD has evolved through time, and its formation could be taken back to the Greeks. Hippocrates, the father of medicine, made

reports of a condition that could be conceptualized as ADHD. According to Martinez-Badia and Martinez-Raga (2015), around 493 BC, Hippocrates observed patients with "quickened responses to sensory experience, but also less tenaciousness because the soul moves on quickly to the next impression" (p. 382). He attributed these symptoms to bodily humor, but one can discern the similarities to the current symptomology of ADHD.

Moving into the later years of the 18th century, the earliest medical reports describing individuals with abnormal levels of inattention, distractibility, and hyperactivity come from the German physician Melchior Weikard and the Scottish physician Sir Alexander Crichton. Between 1773 and 1775, Dr. Weikard published a textbook titled *Der Philosophische Artz.* Within this text, he included a chapter on Attention Volubilis or Attention Deficit (Barkley & Peters 2012). He described individuals who "lack of attention as being easily distractible by anything, even by his or her own imagination, as well as lacking perseverance and persistence, overactive and impulsive generally characterized as unwary, careless, flighty and bacchanal" (Martinez-Badia & Martinez-Raga, 2015, p.382). Dr. Weikard went on to state that these behaviors were more common in younger than older individuals. Sir Still's description of symptoms is very close to the DSM-5-TR's ADHD symptomology.

In 1798, Sir Crichton published *An Inquiry into the nature and origin of mental derangement: Comprehending a concise system of the physiology and pathology of the human mind and a history of the passions and their effects*. He composed a chapter titled *On Attention and its Diseases* in the second volume. He described a disorder characterized by atypical inattention, distractibility, unusual impulsivity, restlessness,

and emotional reactivity (Barkley & Peters 2012). Most importantly, Sir Crichton added that people could be born with this condition and affected early in life. This addition spurred the notion that ADHD is a developmental disorder and set Sir Crichton apart from his predecessors. He also stated that the symptoms he observed affected individuals' education, suggesting the need for extra education assistance (Barkley & Peters 2012). Sir Crichton's report on ADHD follows our current construct of ADHD.

Sir George Frederic Still and The Goulstonian Lectures

Sir Still was a British pediatrician who was heavily involved in researching childhood diseases. In 1902, Still gave a series of lectures to the Royal College of Physicians of London titled "On some Abnormal Psychical Conditions in Children" (Lange 2010, p. 244). These lectures are formally known as the Goulstonian Lectures, considered the scientific starting point of the history of ADHD by most authors. Still went on to lecture on the moral control of children, stating that it is dependent on three physical factors, the cognitive relation to the environment, moral consciousness, and volition (Lange 2010). Within these factors, Still described a group of children that fit within the three factors but not to the level of being considered mentally retarded (such was the vocabulary at the time). Amongst these children, he listed children who suffered from a defect of moral control without intellectual impairment (Barkley & Peters 2012).

Still described 20 cases of children who fit the above description (Lange, 2010). Barkley and Peters (2012) observed, 15 cases were young boys and five girls, which Still did not perceive as an accident. This of course is consistent with the proportion of those affected with ADHD to this day, with males being diagnosed with ADHD at a

higher rate when compared to females. Most of the children in his cases went on to show symptoms before the age of 9. Although in the present day, the DSM requires symptom presentation prior to the age of 12, Sir Still was ahead of his time regarding the early onset of ADHD. Still went on to list the followings symptoms as those found in children who suffer from the defect of moral control without intellectual impairment: (a) passionateness; (b) spitefulness – cruelty; (c) jealousy; (d) lawlessness; (e) dishonesty; (f) wanton mischievousness – destructiveness; (g) shamelessness – immodesty; (h) sexual immorality; and (i) viciousness. The keynote of these qualities is self-gratification, the immediate gratification of self without regard either to the good of others or to the larger and more remote good of self (as cited in Lange, 2010, p. 245) Most of the symptoms listed above are not directly associated with the current concept of ADHD, but Still cemented essential concepts that are key to modern ADHD conceptualization. For example, describing passionateness as impulsivity regarding an immediate goal (Barkley 2006), delayed gratification, and reactions without regard to consequences are essential to the current impulsivity criteria, which is one of the two critical criteria for ADHD.

Still mentioned that a plethora of his cases showed an abnormal difficulty when sustaining attention. This was further confirmed by parents and teachers, with an exciting note being that the children's intellectual function was not affected (Lange 2010). One of the criteria for inattention type in the DSM-5-TR states that the individual with ADHD "Often has difficulty sustaining attention in tasks or play activities [e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading] (APA, 2022). Furthermore, the current conceptualization of ADHD

understands that most individuals with ADHD tend not to have intellectual dysfunction, although some do. Still did not refer to his observations as ADHD, nor did his listed symptoms fully mirror the current criteria of ADHD with the DSM-5-TR. His remarks were paramount. Still combined and attributed his research on ADHD with other disorders, but his research is unquestionably the furthest anyone had gone to describe ADHD, as well as the closest they have been to our current understanding of ADHD at the time. It can be said without a doubt that Sir George Still created the launchpad for the research and understanding of ADHD.

Franz Kramer, Hans Pollnow and Hyperkinetic Disease

In 1932, German physicians Franz Kramer and Hans Pollnow detailed their account of their work on the disease they titled Hyperkinetic Disease of Infancy (Lange 2010) or Hyperkinetic Disease in Children (Neumärker 2005), depending on the translation. Colloquially, it was titled Hyperkinetic Syndrome. Although others had studied hyperkinetic disease, research mainly centered around the lasting effects of encephalitis lethargica. A condition that spread across the globe between 1915-1926 (Lange 2010). Kramer and Pollnow were the first to distinguish their description of Hyperkinetic Syndrome from the lasting effects of encephalitis lethargica, named postencephalitic disorder, citing “marked motor restlessness” as their primary symptom (Lange 2010). Furthermore, when observing their patients (ages 3 to 7), they failed to notice bodily symptoms, sleep disturbances, and nocturnal agitations, thus finding no epidemiological connection to encephalitis lethargica (Neumärker 2005).

Kramer and Pollnow cited motor activity that appeared to be of urgency as the hallmark of their disease, reporting that it caused the children to be unable to stay still

for periods, climb on furniture, move furniture, being destructive in play, and difficult to settle (Lange 2010). This description of their disease is similar to the DSM-5TR's description of ADHD and its hyperactivity and impulsivity criteria. Kramer and Pollnow described the aimless nature of the children's play, their tendency to quickly switch activities due to their distractibility and inability to concentrate on a difficult task, thus leading to learning deficits (Lange 2010 & Neumärker 2005). These descriptions are akin to current symptoms within the inattention criteria of ADHD, such as difficulties sustaining attention, failing to give close attention to details, and often avoiding, disliking, and being reluctant to engage in a task that requires sustained mental effort (APA 2022).

Kramer and Pollnow went on to give lectures where they reported further findings on their patient's unresponsiveness to instruction, causing educational difficulties for others and being disobedient (Neumärker 2005). Lastly, they stated that children with Hyperkinetic Syndrome could persevere with activities regardless of their difficulty and if it interested them (Neumärker 2005). These symptoms are directly related to the current symptomologies of ADHD under both the inattentive and hyperactivity criteria. The age of extinction is a critical distinction between Kramer and Pollnow's criteria for Hyperkinetic Syndrome and the current conceptualization of ADHD. Kramer and Pollnow reported the extinction of Kinetic Syndrome past age eight, while ADHD is currently determined to be a lifetime disorder (Lange 2010). Even with extinction, it is worth noting that Kramer and Pollnow reported residual effects being carried into adulthood (Neumärker 2005).

Kramer and Pollnow's research on Kinetic Syndrome began with their curiosity about the lasting effects of encephalitis lethargica. This journey led them to distinguish their syndrome from postencephalitic disorder and build upon the work of Sir Still, providing a definitive symptom outline and naming it. Their work set a clear blueprint for others to further elaborate on their work, leading to our current conceptualization of ADHD. Through refining with minimal deviation from their observations.

Setting the Stage for the Diagnostic and Statistical Manual of Mental Disorders (DSM)

By the 1960's it was understood that minimal brain damage could lead to behavior disorders (Lange, 2010). A flaw of this approach was that people within the scientific community began to associate any person and child that presented with abnormal behavior having minimal brain damage (Birch 1964, cited by Watson Jr, n.d). This became of particular interest regarding Hyperkinetic Syndrome, given that children presented with it without a history of brain damage, which was confirmed by the studies conducted by Laufer, Denhoff, and Solomons (1957). Their results suggested functional disturbance rather than brain damage. Given such research, revisions were to be made, prompting the Oxford International Study Group of Child Neurology to push for a change from minimal brain damage as the cause of the hyperkinetic syndrome and disorders of similar origin to minimal brain dysfunction in 1963 (Connors, 2000).

Once more, in 1963, the National Institute of Neurological Diseases and Blindness held another conference where they theorized about the terminology and identification of minimal brain dysfunction. Per Lange 2010, the meeting yielded the following definition:

> The term minimal brain dysfunction refers to children of near average, average, or above average general intelligence with particular learning or behavioral disabilities ranging from mild to severe, which are associated with deviations in the function of the central nervous system. These deviations may manifest themselves in various combinations of impairment in perception, conceptualization, language, memory, and control of attention, impulse, or motor function. (pg. 251)

The focus on attentional control, impulse, and motor control set the stage for the three main symptoms of ADHD. Inattention, impulsivity, and hyperactivity were codified within the definition of minimal brain dysfunction. Furthermore, the distinction that minimal brain damage (MBD) not affecting one's intelligence still plays a vital role in assessing ADHD today. These critical distinctions for Hyperkinetic Syndrome set the stage for the DSM and the rapid rise of ADHD's presence ad status within it.

ADHD and the Diagnostic and Statistical Manual of Mental Disorders (DSM)

MBD was not meant to be the final decision on categorizing disorders such as Hyperkinetic Syndrome, but it stayed as so until the 1980s. MBD's decline began in the 1960s when critics emerged. Neurodevelopmental abnormalities were found to be non-specific, thus causing more confusion than alleviating the distinctiveness of MDB. This would start the replacement of MDB with labels such as hyperactivity, learning disability, dyslexia, or language disorders (Birch 1964, cited by Watson Jr, n.d).

Moving forward, efforts made to define the disorder were based on objective evaluations and the study of children rather than focusing on the brain. Hyperactivity became the focus due to its straightforwardness and previous research by Kramer and

Pollnow. This birthed the concept of hyperkinetic impulse disorder (Laufer et al. 1957). According to Lange (2010), hyperactivity became recognized as a "behavioral syndrome that could arise from organic pathology but could also occur in its absence. Even so, it would continue to be viewed as the result of some bio-logical difficulty, rather than due solely to environmental causes" (pg. 251). The year 1968 saw hyperactivity and a definition of it incorporated into the diagnostic nomenclature, specifically within the Diagnostic and Statistical Manual of Mental Disorders II (DSM-II). It was labeled Hyperkinetic Reaction of Childhood. "The disorder is characterized by overactivity, restlessness, distractibility, and short attention span, especially in young children; the behavior usually diminishes by adolescence" (American Psychiatric Association, 1968, pg. 50).

In 1970, a shift from hyperactivity towards attention deficit in affected children was made (Lange 2010). Scientists began to argue that when it came to the Hyperkinetic Reaction of Children, "deficits in sustained attention and impulse control were more significant features of the disorder than hyperactivity" (Lange 2010, pg. 252). Virginia Douglas championed this argument. Douglas (1972) wrote an influential paper that fostered further research. Then a change in the conceptualization of the Hyperkinetic Reaction of Children. In 1980, the DSM-III and by extension the APA renamed Hyperkinetic Reaction of Children to Attention Deficit Disorder (ADD), along with the modifiers, with or without hyperactivity (APA, 1980). These modifiers signaled the DSM-III's assertion that hyperactivity was not essential for the diagnosis of ADD, exemplifying the shift initiated by Virginia Douglas. This distinction also separated the DSM-III from the International Classification of Diseases (ICD-9) curated

by the World Health Organization which continued to focus on hyperactivity as a primary indicator of the disorder (Lange 2010).

Apart from departing from hyperactivity as the primary indicator of ADD, the DSM-III curated three separate symptom criteria (Lange, 2010). Inattention, impulsivity, and hyperactivity further adding specificity to the disorder (APA, 1980). Lastly, the DSM-III introduced an explicit numerical cutoff score for symptoms, guidelines for age onset and symptom duration, and exclusion of other childhood psychiatric conditions (Lange 2010). Such focus moved the disorder from a synopsis that inhabited two lines to a disorder with its conceptualization. This new status would see ADHD face research popularity and refined.

As the 80s went on, discussions over the symptomology and the creation of subtypes of ADD regarding hyperactivity were disregarded. It was unclear if the attention deficit subtype within ADD without hyperactivity was "qualitatively similar to that of the subtype with hyperactivity, or if the two types had to be considered as two separate psychiatric disorders" (Lange 2010, pg. 252). As a means to improve the criteria, especially with the focus on empirical validation, a revision of the DSM-III was produced as the Diagnostic and Statical Manual of Mental Disorders Revision III-R (DSM III-R), published in 1987. The DSM III-R (APA, 1987) removed the concept of two subtypes and renamed Attention Deficit-Hyperactivity Disorder (ADHD). Inattention, impulsivity, and hyperactivity were combined into one list of symptoms with a cutoff score derived from a field trial (Lange, 2010). The subtype of ADD without hyperactivity was removed and labeled undifferentiated ADD (Lange, 2010).

The late 1980's to the 1990s, and its lead-up to DSM-IV in 1994, was a monumental moment for ADHD. Studies further investigate the existence of subtypes within ADD, finding that children with ADD "without hyperactivity" differed from those with ADD "with hyperactivity." It was found that these children were more daydreamy, hypoactive, lethargic, hampered in academic achievement, and less aggressive and less rejected by their peers (Lange, 2010). Moreover, the opinion was that a deficit of attention among individuals with ADD was a lack of motivation and a shortfall in reinforcement for individuals. Such an opinion is still around today. Furthermore, research found a genetic component to ADHD, further separating its conceptualization away from brain damage.

Although it is now common knowledge that ADHD is a chronic and persistent disorder that is transferred into adulthood in many cases (Lange,210), it was not recognized as so till the 2000s. Before the publication of the DSM-IV, a field trial was conducted where three subtypes of ADHD were identified. The categorization of the DSM-II-R was subdivided into three sub-types, predominantly inattentive type, predominantly hyperactive-impulsive type, and a combined type with both sections (Lange, 2010). This categorization reintroduced the ability to strictly diagnose a purely inattentive form of the disorder. The APA further solidified that ADHD is a chronic disorder that persists to adulthood by providing examples of workplace difficulties associated with the symptoms of ADHD (Lange, 2010).

The DSM-TR (text revision) was published in 2000 and corrected errors identified in the DSM-IV; thus, most of the changes were confined to descriptive text (Lange 2010). The DSM IV-TR saw no changes to ADHD, keeping it close to the

criteria used by the ICD-10 with few differences. These differences center around the number of measures in each "domain required for diagnosis, the importance of inattention and the handling of comorbidity" (Lange 2010, pg. 253). The ICD-10 also held a stricter cross-situational pervasiveness, requiring all criteria requirements to be present at home, at school, or in other situations. The DSM-5 was released in 2013 with no changes to the criteria and symptomology of ADHD. However, further examples were added to the criterion items to facilitate application across ages, and stricter requirements were made regarding cross-situational presentations, following the steps of the ICD (APA, 2013).

The age criterion for ADHD symptoms was increased from age 7 to age 12, a comorbid diagnosis with Autism was allowed, and the symptom threshold cutoff for adults was capped at five compared to the six required for younger individuals (APA, 2013). The latter change was made to reflect the evidence of clinically significant ADHD impairment. Lastly, ADHD was moved to the neurodevelopmental disorders chapter within the DSM-5 to reflect the fact that ADHD is correlated with brain development. In 2022, the DSM 5-TR was released with no changes to ADHD. Please see the DSM 5-TR for a complete criterion listing ADHD.

Section II: Comorbid Disorders with ADHD

The diagnosis of attention deficit disorder (ADHD) has a risk factor of being comorbid with other disorders. Alzaben et al. (2018) stated that in 2011, the prevalence of lifetime ADHD diagnosis among children from the age of 4-17 was 11 percent. That 11% does not consider adults who are diagnosed with ADHD. Barkley (2015) found that 67-80% of clinic-referred children and 80% or more of clinic-referred adults with ADHD had a comorbid disorder. The rates mentioned above have most definitely increased and will continue to grow, making the research and development of measures to effectively assist in differential diagnosis to be essential. In this section, the focus shall be placed on disorders considered significant comorbidities for ADHD. Given the focus of this dissertation, the disorders focused on are depression, anxiety, tic disorders and obsessive-compulsive disorder (OCD), intellectual disability (ID) and autism spectrum disorders (ASD), conduct disorder (CD), and oppositional defiant disorder (ODD).

Oppositional Defiant Disorder and Conduct Disorder

Many studies have been conducted regarding the comorbid of ODD, CD, and ADHD. According to Barkley (2015), 45 to 84 percent of children and adolescents with ADHD will proceed to meet the diagnostic criteria for either ODD and CD alone or combined. Eksikligi (2021) conducted a study with 105 adolescents with ADHD and found that the most common comorbid mental disorder in his sample was ODD, with 30-40 percent of students with ADHD presenting with it, while 30-50 percent of them presenting with CD. Within a Multimodal Treatment Study of ADHD, it was found that 40 percent of the children with ADHD met the criteria for ODD, while 14.3 percent met the criteria for CD (as cited in Barkley 2015). Studies such as the ones mentioned state

that amongst those with ADHD, 15-56 percent of children and 44-50 percent of adolescents will be diagnosed with CD.

There are many explanations and hypotheses as to why ADHD has a substantial comorbidity with CD and ODD. Some, like Barkley (2015), argue that it could be mainly due to a function of the difficulties with dysregulation in ADHD that can cause a progression to ODD. It is also theorized that children with ADHD and ODD/CD have hereditary genes from parents with greater psychopathology rates than children with ADHD alone (Barkley 2015). These rates of mental illness being comorbid with ADHD is also seen within other mental illness such as anxiety and depression.

The combination of ADHD and ODD/CD has seen a lot of different outcomes within studies. For example, children with ADHD and comorbid CD were far more likely than those with solely ADHD to have reading and learning disabilities (as cited in Barkley, 2015). Children with ADHD and CD also had lower reading scores than children with CD alone. The interaction with ADHD, CD, and ODD is paramount due to the possible long-term implications of the disorders interacting with each other. Such implications are heightened symptomology presentation within academic settings leading to academic difficulties and possibly criminal behavior related to CD and ODD. Furthermore, ADHD and ODD/CD symptoms overlap at certain junctures. Regarding CD and ADHD, the critical difference between the two is that the hyperactive nature of ADHD may be disruptive but does not aim to violate societal norms. Still, both disorders cause functional difficulties within academic, occupational, and societal environments. As for ODD and ADHD, people with ODD could resist work or school tasks that require self-application due to being expected to conform to

the demands of others, which can be characterized by defiance and negativity (APA, 2022). Given its similarity to ADHD, this symptom will have to be differentiated from an aversion to mentally demanding tasks for individuals with ADHD due to inattentive difficulties, forgetfulness, and impulsivity. This is further complicated by the fact that children can be diagnosed with a combination of ODD, ADHD, and CD. Please see the DSM 5-TR for a complete criterion listing for ODD and CD.

Depression

In this review, the term depression shall encompass the DSM-5 TR criteria for major depressive disorder (MDD). Per the DSM-5, youths and adults alike can be diagnosed with MDD. In short, for depression, "the abnormal mood must be persistent and associated with four other criteria (loss of interest, weight loss, sleep disturbance, agitation/retardation, fatigue, low self-esteem, diminished concentration, suicidal ideation/attempts)." (Barkley, 2015, pg. 151). Concentration difficulties are relevant in both ADHD and MDD. When a patient is suspected of having ADHD, the concentration problems related to depression must surpass those referable to as ADHD. This leaves the need for differential diagnosis between the two, given that up to one-third of children with ADHD may meet the criteria for depression, while one-fourth to half of the children with depression may have ADHD (as cited in Barkley, 2015).

Xia (2015) conducted a study to compare rater reliability between parents, children, and teachers regarding ADHD. Within the sample of 135 children with ADHD, 17.8% had a comorbid disorder of depression, while 14.8% had a comorbidity of anxiety, ADHD, and depression. Eksikligi (2021) stated that the prevalence of major depression in children with ADHD was 6-30%, while Van Ameringen (2010) found that

the most common comorbid disorder associated with ADHD was MDD. The comorbidity rate was 53.8%. Compared to youth with ADHD alone, youth with both ADHD and depression showed greater impairments in social functioning, higher rates of reoccurrence of depression, higher rates of family conflict, and more negative life events (Barkley, 2015). Per the DSM-5TR, regarding differential diagnosis, individuals with depressive disorders can present with the inability to concentrate, but their difficulties with concentration are only prominent during a depressive episode. Although such a distinction is available, it is once again left to the discretion of the clinician to be able to parse out the inattentive symptoms and their prevalence. It is worth noting that individuals with depression can still attend work, class, and social situations while depressed and face the effects of inattention, thus hampering their functionality and seeming like ADHD, making differential diagnosis challenging. Please see the DSM 5-TR for a complete criterion listing for Depression.

Anxiety Disorder

Prevalence of anxiety disorder estimates in children with ADHD range from 25-50% compared to the majority of 6-20% in the general population (Barkley, 2015; Van-Ameringen, 2010). Given this, the chance of having anxiety is 2.1-4.3 (OR) greater in children with ADHD relative to the general population, making anxiety another highly comorbid disorder for ADHD. This is also seen with children with anxiety, as do adults with panic disorder (Barkley, 2105). Adults with ADHD also show high rates of anxiety disorders compared to the average population, including greater deficits in self-regulation of emotion and self-origination/problem-solving (Jarett, 2016).

When individuals with ADHD and anxiety disorders were compared to those with anxiety alone, there was no difference in subtype or severity of anxiety, meaning that ADHD has no moderating effect on anxiety disorders (Barkley, 2105). Although ADHD has no moderating effect on anxiety, it is still unclear how anxiety affects the cognitive and behavioral aspects of ADHD. According to Jarett (2016), anxiety symptoms appear to be associated with college students' self-reported executive functioning deficits not only with ADHD but beyond it. Barkley (2015) stated that when tested on continuous performance tests (CPTs), the comorbid ADHD and anxiety group showed decreased impulsivity and dyscontrol errors relative to the ADHD group. Such a finding indicates that individuals with ADHD and anxiety are less impulsive than those with ADHD.

Per the DSM-5TR, ADHD shares symptoms of inattention with anxiety disorders. To help with differential diagnosis, it should be noted that the inattention experienced by individuals with ADHD is due to preferential engagement with stimuli they are interested in. This is different from the ruminating and worry saw within individuals with anxiety. Restlessness might be seen in anxiety disorders and can be easily mistaken for hyperactivity, but with ADHD, it is not rooted in worry (APA, 2022). Please see the DSM 5-TR for a complete criterion listing for Anxiety.

Tic Disorders and Obsessive-Compulsive Disorders

It is understood that there is a genetic link between tic disorder and OCD due to individuals with OCD having relatives with both disorders in one form and another. Roughly, "13-26% of patients with OCD have tic disorders while up to 50% of patients with complete Tourette syndrome have OCD" (Barkley, 2015, pg. 153). These figures

become interesting when further broken down, and it is seen that the onset of a tic disorder is between the ages of 3 and 5 years, with peak prevalence at 9-12 years (APA, 2022). Within these ages, only 20% of them go on to experience tics in adulthood, but 50-60% of children with tic disorders have ADHD, while 10% of children with ADHD have tic disorders (Barkley, 2015). Although highly comorbid with ADHD, their symptomology and co-exitance are independent, with ADHD not increasing tic severity and tic severity not affecting ADHD.

The intriguing relationship between tic disorder and ADHD continues with the relationship between OCD and ADHD. Although individuals with a primary diagnosis of ADHD do not tend to meet the criteria for OCD, 51% of children and 36% of adolescents with OCD meet the criteria for ADHD (Barkley, 2015). Barkley (2015) found that children with ADHD did not differ in the prevalence of hoarding obsessions, ordering, contamination and aggressiveness compared to those with OCD. Children with OCD and ADHD showed higher rates of poor social functioning compared to those with only OCD, a higher chance of developing a tic disorder, but lower rates of depression (Barkley, 2015). Please see the DSM 5-TR for a complete criterion listing for OCD.

Intellectual Disability

Intellectual disability (ID) occurs jointly with ADHD at a prevalence rate of 18-40% compared to 7-10% in the general population (Barkley, 2015). Various studies examining the prevalence of ADHD within those with ID concluded that the increased rate seen throughout time could not simply be associated with rater bias or other psychiatric conditions (as cited in. Barkley, 2015), which means that there is an

undeniable comorbidity between the two disorders. This was further emphasized by Neece et al. (2011), finding that ADHD and ID were the highest comorbidities within their sample of 142 adolescents with ADHD. To further complicate the comorbidity, there has been evidence that children with ADHD and ID are at risk for tics and social withdrawal at a rate higher than those of typically developing children, as cited in Barkley, 2015).

It is easy to dismiss ADHD symptoms within children with ID due to the symptomology of ID, especially when individuals with ID are placed in an academic environment above their educational aptitude. When individuals with ID are placed in such environments, they face inattention, academic difficulties, behavior indicative of disinterest in the current task, and hyperactive behaviors. Although typical of individuals with ID within an environment above their educational aptitude, these behaviors are also symptoms of ADHD. According to the DSM 5-TR (APA, 2022), to assist with differential diagnosis, it states that "a diagnosis of ADHD in intellectual development disorder requires that inattention and hyperactivity be excessive for mental age" (pg. 75).

Regarding differential diagnosis, the symptomology of a specific learning disorder alone is presented within the subject matter or area associated with the disorder. It is worth noting that the same problem of symptomology overlaps with a specific learning disorder, which can also be comorbid with ADHD. Individuals with a specific learning disorder may exhibit frustration, lack of interest, or limited neurocognitive ability when challenged by a particular area of content that they find difficult. They may exhibit symptoms of frustration, lack of interest, or limited

neurocognitive ability (APA, 2022). These symptoms can be indicative of ADHD as well, making differential diagnosis difficult if not completed effectively.

Given how easy it is to conflate ID, specific learning disorders, and ADHD, the diagnosis of ADHD needs work and standardization. Depending on the assessor, there may be a lack of experience to notice the comorbidity or diagnose them differently. Furthermore, they may not conduct enough assessments to highlight ID or a specific learning disorder. An IQ and other ADHD measures such as the CARS, a neurocognitive like the BROWN, a continuous performance task, and an achievement test may be needed to capture it effectively. Most assessors may not assign all the assessments mentioned, especially an IQ test, which is key to capturing ID and a specific learning disorder. Due to the non-standardization of ADHD testing, most insurance companies allow for three hours' worth of billing. This in turn forces some assessors to remove IQ testing from testing. On the other hand, some assessors do not believe that IQ testing is not important in capturing ADHD. Barkley (2015) further emphasizes this point by stating, "ADHD should not be left untreated in the child with ID; clinicians and families should never dismiss the symptoms of ADHD as “normal” for a child with ID because of a reduced mental age” (pg. 156). Please see the DSM 5-TR for a complete criterion listing for ID.

Autism Spectrum Disorders

Autism spectrum disorder is now a single category that consists of autistic disorder, Asperger's syndrome, and pervasive developmental disorder. This combination has also removed AD as an exclusionary criterion for diagnosing ADHD. The review of prevalence studies shows that 30-80% of individuals with ASD meet the

criteria for ADHD, while those with ADHD have ASD traits above the levels found in the general population (Barkley, 2015). This is of significant interest because ADHD and ASD were considered entirely separate from each other but are now seen as comorbid and share the same clinical and etiological factors. Reviews have shown that ADHD and ASD both have early onset, with ADHD having an earlier onset, high heritability, and comorbidity with learning, language problems, and shared genes (Barkley, 2015).

A study of 644 participants between the ages of 6-17 found that participants with elevated AD symptoms fell into two classes. Those with predominantly "ADHD symptoms with significant ASD problems (ADHD + ASD, 9.2%) and those with more prominent ASD symptoms with problematic ADHD symptoms (ASD + ADHD, 9.0%)" (Barkley, 2015, pg. 156). It is worth noting that the individuals within the study did not meet the criteria for ADHD or ASD but rather showed symptomology indicative of both ASD and ADHD. The study found that those with solely ADHD traits were impaired only in motor inhibition and working memory tasks. In contrast, those with ADHD/ASD were impaired in motor inhibition, working memory, and facial emotion recognition.

According to the DSM 5-TR (APA, 2022), to assist with differential diagnosis, individuals with ADHD and those with ASD exhibit similar symptoms, such as inattention, social dysfunction, and behavior that are difficult to manage. In terms of social dysfunction and peer rejection that is seen in individuals with ADHD, it "must be distinguished from the social disengagement, isolation, and indifference to facial and tonal communication cues seen in individuals with autism spectrum disorder" (APA,

2022, pg. 75). Furthermore, individuals with ASD may display tantrums due to the inability to tolerate a change from an expected outcome. Still, individuals with ADHD may misbehave or have a tantrum due to a significant transition or poor self-control. Please see the DSM 5-TR for a complete listing of the criterion for ASD.

Section III: ADHD Assessment

Assessment Difficulties

Despite the extensive research on ADHD and existing guidelines on the condition, there are still uncertainties concerning the clinical and empirical utility of the different ADHD assessment methods. An overarching assessment requires multiple informants, various methods, co-occurring symptoms, functional impairment, and cross-environmental effects, all of which are difficult to trust for one reason or another. Self-reports are biased with little validity safeguards; observations allow for rater bias and the only objective measure available. Continuous Performance Tests (CPTs) have faced their fair share of criticism. Given that there is no standardized manner to assess for ADHD, these methods can be given at the assessor's discretion leading to a lack of standardization of ADHD assessment.

Furthermore, all of the measures available are questioned on clinical utility. According to Tallberg et al. (2019), clinical utility alludes to the assessment method providing valuable information to the assessor or practitioner. In turn, it improves clinical work, is cost-effective, gives specific information not provided by another method, and successfully measures what it is asked to measure. As this section continues, the clinical utility of the various ADHD assessments shall be called to question.

As stated above, an integral aspect of ADHD assessment is self-reports and observational reports. These require the individual with ADHD, as well as their parents, significant others, friends, teachers, and assessor, to rate a person functioning across environments. At times, this might include an interview with those who know the individual with ADHD symptoms best by the assessor and a review of the client's

history. Depending on the assessor, an Intelligence Quotient (IQ) test shall be administered to rule out intellectual disabilities or learning disabilities that can present as ADHD-like symptoms and be comorbid with ADHD. Furthermore, a personality inventory may be given to gain an overall understanding of the client's presentation due to the overlapping symptomology between ADHD and various mental disorders such as anxiety and depression. Once more, there are no guidelines suggesting that IQ and personality tests should be given, thus leaving the assessment methods up to the clinician, which can be problematic.

What Does Optimal Assessing Look Like

When evaluating for ADHD, there are various goals that an assessor should optimally keep in mind. A significant goal of ADHD assessment is not simply assessing for ADHD but also ruling out other psychiatric disorders and differentiating between the overlap of the symptomology of ADHD and other disorders. This, in turn, requires extensive clinical knowledge (Barkley, 2015), which can be of concern depending on the assessor. Moreover, the assessments used should be normed within the country, age group, and ethnic background the client stems from.

The assessment process should include a clinical interview, looking into the clients' past ADHD presentations, difficulty within various environments, and current difficulties. A client's academic functioning, study habits, and sleeping habits should also be questioned. Past and present academic underachievement can be related to a multitude of reasons including ADHD and other disorders, IQ, or poor study habits. The inquiry of a client's sleep pattern is paramount due to the lack of sleep affecting cognitive processing, thus looking like ADHD.

Another purpose of the evaluation is to delineate the types of interventions needed to serve the client best to assess their psychological deficits (Barkley, 2015). This is important due to ADHD causing academic, adaptive, and social impairments. Many studies have found that those with ADHD are more likely to experience learning difficulties leading to lower GPAs, social isolation, challenges at work, and future financial difficulties (Fasmer et al., 2016 & Vincentie et al., 2014). Given ADHD's chronic nature, assessment to formulate treatment for current symptoms to negate future effects is critical.

Given ADHD's rate of comorbidity, assessment should aim to determine comorbid symptomology. Furthermore, when assessing for ADHD, IQ, and personality measures should be administered. Their inclusion not only helps with differential diagnosis and comorbidity, but they also assist with treatment by pointing out specific areas of concern. Areas like IQ deficits can lean towards learning disabilities rather than ADHD, and other psychiatric problems or show specific areas where ADHD is at its most impairing such as processing speed, and decision-making. Moreover, such results shall allow the clinician to explore treatments best suited to the individual client and the specific environment their ADHD affects them the most or throughout multiple environments.

Continuous Performance Tests (CPT)

CPTs are a group of computerized tests that measure impulsivity, attentiveness, and vigilance through the analysis of hits, hit reaction time (HRT), HRT SD, omissions, commissions, reaction time variability (RTV), and reaction time (RT). Hits are defined as correct target notification, HRT is defined as the mean response time (in

milliseconds) for all accurate target hits over the trial, and omissions are defined as the number of targets an individual did not respond to (Vincenie et al. 2014). Commissions are defined as the number of times an individual responded to a nontarget; HRT SD is a measure of response speed consistency during the entire administration. CPTs also analyze detectability (d) and measure the respondent's ability to differentiate nontargets for targets. Most CPTs also look at an individual's response patterns, seeing if they are balanced, liberal, or conservative.

The Conners Continuous Performance Task (Conners CPT) is one of the most popular and used CPT. For this section, the discussion of CPTs moving forward shall be focused on the Conners CPT. Specifically the Conners CPT-II and 3 due to the limited research on the third version of the CPT. When completing the Conners CPT-II and 3:

> Participants were shown successive letters on a computer screen and were required to press the space bar or click the mouse button when any letter except "X" appeared. Stimuli were presented in six blocks, with three sub-blocks, each containing 20 trials (i.e., letter presentations). Interstimulus intervals varied between 1, 2, and 4 s, while the display time was held constant at 250 ms. During the CPT-II, there were 360 trials (324 targets and 36 nontargets). The CPT-II takes 14 min to complete (Vincentie et al., 2014, pg. 204).

When it comes to ADHD diagnosis, CPTs are considered to be the most effective and objective assessment tool. Even with such high regard and empirical investigation, the effectiveness of CPTs in detecting ADHD and differentiating it from other disorders has been debated.

Simoes et al. (2021) used two CPTs to test their ability to detect ADHD between controls and individuals with ADHD. They found that CPTs were effectively able to detect ADHD within the experimental group while accurately not diagnosing ADHD in those within the control group. On the other hand, Tallberg (2019) found that the CPT-II was successful at objectively assessing attention and impulsivity. Still, when data was computed for diagnostic decision-making, the CPT was poor when used as a standalone test. Furthermore, it was concluded that the CPT-II lacked clinical utility but was very useful when combined with other assessments to clarify ADHD diagnosis when uncertain.

Vincentie et al. (2014) conducted a longitudinal study assessing ADHD in preschoolers, followed up with the same participant, and retested them using the CPT at age 11. They found inattentive symptoms were predicted by omission errors and slower HRT, while inattention and hyperactivity predicted more significant standard error in HRT. Overall, their results indicated that within their sample, the CPT-II was the most effective test to discriminate groups of children with ADHD symptoms from a healthy population. However, it was not definitive in differential diagnosis and covering the full spectrum of ADHD symptomology. Fasmer et al. (2016) tested the CPT-II's ability to detect ADHD and differentiate it from Anxiety and mood disorders in adults. It was found that ADHD patients committed more omissions and commission errors than regular patients. Moreover, it was concluded that the CPT-II was helpful in differentiating ADHD clients from clients with mood disorders and anxiety.

Regarding the CPT-3, Baggio et al. (2020) found that when adults with ADHD were tested using the CPT-3, it failed to adequately identify ADHD, suggesting a lack

of specificity with a high rate of false negatives. The CPT effectively detected hyperactive symptoms through increased omissions and commissions. The CPT also found it difficult to differentiate between hyperactive and inattentive presentations. Baggio et al. (2020) concluded that the CPT-3 lacked clinical utility. These findings were also replicated by Stern & Shura (2019), who investigated the CPT-3's ability to evaluate ADHD among veterans. They concluded that the CPT was consistently unable to differentiate between inattentive, hyperactive, and combined presentations.

CPTs are considered the only empirically supported objective measure for assessing ADHD. Yet, study after study agree that although CPTs may be helpful with the elucidation of uncertain ADHD presentations and detect some inattentive and hyperactive symptoms, the CPT does not meet clinical utility. Furthermore, the CPT is ineffective at differential diagnosis, leaving the diagnosis of ADHD to the expertise and discretion of the assessor. Scimeca et al. (2021) explain that some of the shortcomings of the CPT-3 are that it was designed to be highly sensitive to attentive difficulties. Thus, "adults with ADHD may obtain scores ranging from low to highly elevated on CPT-3 indices due to the range of severity of attentional impairment in ADHD" (p. 2356). This, in turn, makes it difficult to differentiate between invalid and valid performance on the CPT by individuals with ADHD. The CPT also has a task duration of 14 minutes, a short period to represent overall patient performance. Furthermore, the heterogeneity of ADHD is not fully captured within the CPT, such as task planning.

Baggio et al. (2020) offer a different explanation for the CPT's lack of clinical utility. They believe that the CPT lacks ecological validity, meaning that it does not adequately simulate everyday difficulties experienced by individuals with ADHD, such

as external distractions. Simoes et al. (2021) created a CPT assessment that included external auditory stimuli to meet the real-life environmental distractors that individuals with ADHD face. Results indicated that the combined CPT with hearing and visual cues yielded an accurate diagnostic rate of 76.3%. Using auditory assessment only, it reached a 70% diagnostic assessment rate, while the visual data yielded an accuracy of 66.2%. These results indicate that the CPT alone, which is visually cued, is not the best at accurately diagnosing ADHD. Lastly, the CPT is an attention task rather than a task specifically attuned to ADHD. Thus, exacerbating the issue of ADHD testing, there is no unique measure for ADHD, but rather an amalgam of measures placed together to ascertain results that are then compiled into a diagnosis by the assessor's clinical judgment.

Conners ADHD Rating Scale/ Adult ADHD Rating Scale

The Conners ADHD Rating Scale (CARS) and Conners Adult ADHD Rating Scale (CAARS) are a set of self-report and observer rating scales designed to assess symptoms and behaviors related to ADHD in children and adults (Grogan et al., 2017). They are broken down into different evaluation forms, each having a long and short form. These are self-report and observer forms that can be completed by the assessor or individuals within the client's life that observe them within different environments, such as academic, occupational, and home environments. Having multiple observers within various environments rating an individual suspected of having ADHD helps meet the criteria of ADHD symptoms being observed within multiple environments. All of the CARS/CAARS symptomology ratings are based on the DSM. The Conners ADHD forms also have screener forms.

Given the overlap of symptomology between ADHD and anxiety, Grogan et al. (2017) decided to test the CAARS ability to identify ADHD. This was tested with a sample of individuals with either ADHD, anxiety, or a combined presentation of ADHD and anxiety. They found that the CAARS had limited sensitivity and specificity and could not diagnose ADHD differentially. Although data showed that the CAARS inattention/memory problems and CAARS DSM inattentive symptom scores differed between the three groups, the difference was insignificant. The same outcome was experienced when all three groups were compared on hyperactivity, restlessness, and impulsivity.

Behavior Assessment System for Children

The Behavior Assessment System for Children-Third Edition (BASC-3) measures a wide range of adaptive, behavioral, and emotional problems in children and adolescents. The BASC-3 evaluates the behavior and self-perceptions of children and young adults with three rating scales: teacher rating scales (TRS), parent rating scales (PRS), and a self-report of personality (SRP). The BASC-3 TRS is a measure designed to identify a variety of Emotional and Behavioral Problems in children and adolescents. The measure assesses the following areas: Externalizing Problems, Internalizing Problems, School Problems, Behavioral Symptoms, and Adaptive Skills.

The BASC-3 PRS and BASC-3 SRP also identify a variety of Emotional and Behavioral Problems in children and adolescents. The PRS does so by assessing the following areas: Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. While the SRP does so by asking the adolescent to answer a

variety of questions about themselves and results in composite scales in the following areas: School Problems, Internalizing Problems, Inattention/Hyperactivity, Emotional Symptoms Index, and Personal Adjustment. The BASC is one of the most widely used broadband assessments for ADHD diagnosis due to encompassing behaviors through multiple environments: school, home, and the patient's social and personal life. Having the patient assessed and observed through multiple environments accomplishes a key criterion for ADHD which is the prevalence of ADHD symptoms within multiple environments.

Given the popular use of the BASC-3 for ADHD diagnosis, Zou et al. (2017) set out to illustrate the accuracy and efficiency of using an evidence-based assessment strategy for the diagnosis of ADHD by integrating the scores obtained on the BASC-3 TRS and PRS. Three hundred and thirty-nine students were rated by teachers and parents and results were compiled for clinical utility and percent agreement amongst raters. In simpler terms, the frequency at which teachers and parents correctly rated the same student as having or not having ADHD-like symptoms. They found that behavioral scales of executive functioning and functional communication improved the utility of the BASC-3 in ADHD diagnosis when compared to results without behavioral scales of executive functioning and functional communication.

Their results provided a probability of .80 or higher as the diagnostic criterion, teachers, and parents positively diagnosed 70% and 94% of the ADHD cases respectively (Zou et al., 2017). Such results show that the BASC-3 is a good tool to use when diagnosing ADHD but not a tool that should be solely relied on for the diagnosis of ADHD due to the necessary manipulation of scales needed to produce such

probabilities Lastly, regarding rater reliability, Zou et al. (2017) found that teachers and parents demonstrated high agreement in diagnosis results on the BASC-3. Such results speak to the BASC-3's reliability across raters and environments.

Brown Executive Function/Attention Scales

The Brown Executive Function/Attention Scales (Brown EF/A) are a set of rating scales designed to evaluate executive functions related to ADHD. The Brown EF/A is a follow-up to the Brown Attention-Deficit Disorder Scales and Brown Attention-Deficit Disorder Scales for Children. The Brown EF/A Scales has eight separate forms: self-report (ages 8-12, 13-18, 19 and older), parent (ages 3-7, 8-12, 13-18), and teacher (ages 3-7, 8-12). The goals of the Brown EF/A are to screen for and diagnose ADHD along with executive function deficits (Brown et al., 2019). The Brown EF/A derives its scores from the following scales: Activation, Focus, Effort, Emotion, Memory, and Action. The scales are described as follows:

> Activation is described as "organizing, prioritizing, and activating to work"; Focus as "focusing, sustaining, and shifting attention to tasks"; Effort as "regulating alertness, sustaining effort, and adjusting processing speed"; Emotion as "managing frustration and modulating emotions"; Memory as "utilizing working memory and accessing recall"; and Action as "monitoring and self-regulating action" (Brown et al., 2019, p. 2).

Although the Brown EF/A has demonstrated capabilities of assessing for ADHD, the Brown EF/A lacks validity scales thus causing each report to be interpreted with caution. Furthermore, due to its sole focus on ADHD, there are no differential diagnostic aids. Given the scales of focus of the Brown EF/A, the scales can be flagged

by ADHD or depression, anxiety, a learning disability, and other disorders, leaving the Brown EF/A a tool that can mislead an assessor if a host of other assessments are not given along with the brown to aide in ADHD diagnosing.

Weschler Adult Intelligence Scale & Weschler Intelligence Scale

The Weschler Adult Intelligence Scale Fourth Edition (WAIS-IV) provides a Full-Scale IQ in addition to 4 composite scores: Verbal Comprehension Index (VCI), the Perceptual Reasoning Index (PRI), the Working Memory Index (WMI), and the Processing Speed Index (PSI). These scores measure the abilities to operate verbally and nonverbally, solve problems and reason, utilize short-term memory, and process information quickly and fluently. Just as the former, The Wechsler Intelligence Scale for Children - Fifth Edition (WISC-V), is an individually administered test of overall cognitive functioning for children. The measure provides an overall estimate of cognitive skills as well as composite indices in 5 areas: Verbal Comprehension (VCI), Visual Spatial (VSI), Fluid Reasoning (FRI), Working Memory (WMI), and Processing Speed (PSI). The WISC-V includes VSI and FRI which are not included in the WAIS-IV. The FRI measures an individual's ability to identify relationships among visual objects, while VSI measures an individual's ability to assess visual details and identify visual-spatial relationships or patterns.

Lieb et al (2021) examined the neuropsychological profile of patients with ADHD based on the WAIS-IV, specifically looking at the WMI and PSI. WMI and PSI were chosen due to short-term memory and the ability to process information quickly and fluently being deficits regularly associated with ADHD. The author's analysis revealed that although some individuals with ADHD demonstrated impairment in

attention and speed tasks, most of the sample performed at or above the normal range, compared to same-age peers (Leib et al., 2021). The authors argue that the reason for their finding is that individuals with ADHD may perform normally on tests of focus and manipulation and processing speed, but still complain about difficulties concentrating and slow processing speed due to context. When assessments are given, they are given in quiet and distraction-free environments, which do not portray real-world settings. This argument was highlighted by Baggio et al. (2020), concerning continuous performance tasks, failing to account for auditory stimuli and distractions. Leib et al (2021) go on to argue that although the WAIS-IV may not be able to appropriately test for ADHD, it can be used to inform clinicians about potential difficulties and for differential diagnoses regarding ADHD and other learning disorders that are IQ related.

The same conclusions were made by Theling and Peterman (2016), regarding their study on the neuropsychological profiles of Adults with ADHD on the WAIS-IV. Their results found that individuals with ADHD experienced significant impairment patterns on the WAIS-IV when compared to controls. These impairments were most prevalent in WMI, followed by PSI and PRI. Such outcomes were expected due to ADHD affecting such processing areas. Given their findings, Theling and Peterman (2016), argue that ADHD screeners tend to miss additional cognitive deficits which can be ascertained through the WAIS-IV. They conclude that the WAIS-IV is sensitive to neuropsychological impairment present in ADHD and reinforces the use of full psychological batteries which include IQ. By doing this, "clinicians can gather information from a variety of cognitive functions that tap different functional abilities and to draw parallels to self-reports" (Theiling & Peterman, 2016, p. 922). In

conclusion, if an IQ test can be given, be it the WISC, WAIS, or others like the KBIT-2, it should be given due to the need for differential diagnosis of specific learning disorders and intellectual disabilities. Furthermore, IQ testing can help identify specific problem areas and influence treatment planning.

Minnesota Multiphasic Personality Inventory

As of the current time of writing, the Minnesota Multiphasic Personality Inventory (MMPI) contains three current versions. The Minnesota Multiphasic Personality Inventory-Adolescent-Restructured-From (MMPI-ARF), the Minnesota Multiphasic Personality Inventory-2-Restructured-From (MPPI-2RF), and the Minnesota Multiphasic Personality Inventory- 3 (MMPI-3), which is the latest iteration of the assessment. The MMPIs are self-report measures of personality and psychopathology that are used to determine the presence (or absence) of psychiatric symptoms within a manner that classifies it a broadband measure. The MMPIs conduct assessments on multiple scales ranging from somatization, anxiety, depression, and mania to substance use and one's social disposition. The MMPIs contain various indicators that determine how an individual approaches the test; specifically, whether they responded consistently and whether they attempted to over or under-report symptoms and problems. Such indicators function as a validity measure of the self-reports, working to inform clinicians if the results are valid for interpretation or not.

Kim, Lee & Lee (2021) aimed to determine if the MMPI-2RF can possibly predict ADHD symptoms in adults if coupled with machine learning techniques. Machine learning is a computational strategy that automatically determines methods and parameters that are best, to arrive at an optimal solution. When applied to the

Korean version of MMPI-2RF which was administered to 5736 college students, results showed that ADHD in adults was predicted with 91.2-93.6% accuracy. Such accuracy shows promise, but the accuracy was reached once machine learning was provided with results from an ADHD screen tool (ADHD Self-report Scale). Given this, the authors were quick to note that the screening tool and the MMPI-2RF alone did not produce enough specificity regarding the ADHD diagnosis until combined.

Kim, Lee & Lee (2021), also noted that machine learning provides the disadvantage of not being able to describe the relationship between input and output, thus making it difficult to determine the complex influence of selected characteristics in classification models. Furthermore, Kim, Lee & Lee (2021) acknowledge that a key difficulty in diagnosing ADHD is that there are often multiple comorbidities and coexisting pathologies. These symptoms of ADHD may in turn be mistaken for other disorders. I would further state that the reverse as well may be true, in that those exact symptoms may be mistaken for ADHD rather than another disorder. Kim, Lee & Lee (2021), concluded that "using a common screening tool, the MMPI-2-RF, risk factors related to poor concentration, a symptom of ADHD in adults, may be predicted using ML algorithms" (p.6). Their conclusion reiterates that even with machine learning, there are multiple assessments and considerations needed to accurately diagnose ADHD, most of which comes down to the ability of machine learning or a clinician to complete differential diagnosis with experience.

Personality Assessment Inventory

The Personality Assessment Inventory (PAI) is a multidimensional inventory made to identify characteristics of personality and psychopathology in adults. It is a

344-item self-report questionnaire organized into 22 non-overlapping scales focusing on validity, clinical, treatment, and interpersonal scales. The PAI serves the same function as the MMPI. Saleh et al (2018), sought to find measures that best identify ADHD and within the group, was the PAI. They tested 230 participants within the University of Vanderbilt counseling center during the years 2013-2015. Individuals who received a diagnosis of ADHD and were administered the PAI showed lower scores on the scales of anxiety, anxiety-related disorders, schizophrenia, borderline personality disorder, and paranoia (Saleh et al., 2018). It is worth noting that such scale differences were small across the domains. The authors went on to note that even with such differences, the PAI itself was not adequate to diagnose ADHD.

Lancaster and Liljequist (2018) also sought to indicate if the PAI would be a useful indicator for ADHD across scales. To accomplish their goals, they completed a hierarchical logistic regression analysis of the following scales: Positive Impression (PIM), Treatment Rejection (RXR), Somatization (SOM-S), Anxiety-Cognitive (ANX-C), Anxiety Related Disorder-Traumatic Stress (ARD-T), Mania-Activity Level (MAN-A), Mania-Grandiosity (MAN-G), Schizophrenia-Thought Disorder (SCZ-T), Borderline Features-Self-Harm (BOR-S), and Antisocial Features (ANT) for individuals seeking ADHD diagnosis. The 10 scales were specifically chosen due to their incorporation of symptomology that are commonly seen within individuals with ADHD. For example, the MAN-A subscale contains items that focus on rapid speech, taking on too many commitments, buying things on impulse, and finding a need to be active. The SCZ-T subscale addresses symptoms of confusion, scrambled thoughts, rapid shifting on topics/activities, and difficulties concentrating. While the ANT-S

subscale contains items that identify thrill-seeking and risk-taking (Lancaster and Liljequist, 2018).

Their model of 10 scales provided an overall ADHD classification rate of 75%, but the hit rate was low. Approximately 21% of individuals with ADHD went unrecognized (Lancaster and Liljequist, 2018). Such results brought Lancaster and Liljequist (2018) to the same conclusion as Saleh et al. (2018). The PAI should not be used for ADHD diagnosis, but rather used as a tool to further alert clinicians of the possibilities of ADHD, and a follow-up with additional testing and interviewing can be completed. Furthermore, a battery of testing is recommended with the PAI or MMPI to assist in differential diagnosis due to comorbidity and shared symptomologies between ADHD and other disorders.

Section Conclusion

This section focused on the current assessments available for ADHD, with a focus on the ones most used. Each assessment was researched and their clinical utility regarding the identification of ADHD and its ability to differentially diagnose ADHD from disorders with similar symptomology was assessed. Most assessments showed clinical validity in one aspect and not in another, while some arguments were made that some assessments are poor in both facets by themselves. Such findings are what spurred the subject of this dissertation. It is common to find that most people diagnosed with ADHD or are seeking ADHD diagnosis are administered one to a few of the assessments listed above depending on the professional providing services.

Such discrepancies in testing across occupations provide unique challenges for ADHD diagnosis. It provides a non-standardization of testing which brings into

question the validity of the ADHD diagnosis or the lack of ADHD diagnosis. As one can imagine, given the challenges faced by those with ADHD, a lack of proper diagnosis can lead to a lack of treatment and further difficulties in life. Conversely depending on the measures given an individual who may believe to be struggling with ADHD, can be wrongly diagnosed with ADHD, when in truth, they are suffering from another disorder with symptomology similar to ADHD in certain respects such as depression, anxiety, or a learning disorder. Such misdiagnosing leads to a lack of appropriate treatment and continued struggle by the patient. The question then becomes, how does one attempt to standardize ADHD testing and provide testing that shows adequate clinical validity in both the diagnosis of ADHD and differential diagnosing?

Standardization of testing is a multi-step process that is beyond the scope of this dissertation, but the goal is to shed light on the need for standardizing. Regarding which measures are best for the diagnosing of ADHD and differential diagnosing, this section is the answer. Each measure listed within this section, alone either fails to appropriately diagnose ADHD or provide differential diagnosing. When they are combined, they provide an assessment battery that is successful at both diagnosing ADHD and differential diagnosing. A battery must include a continuous performance task (CPT) to objectively measure impulsivity, attentiveness, and vigilance. A battery should also include an ADHD report measure such as the BASC and CARS/CAARS to offer the assessor a self-report of the patient's current struggles, as well as observational reports from various environments which are key to ADHD diagnoses. The BASC also sheds light on other disorders that a patient may be struggling with. A cognitive test like the Brown EF/A which offers another view of executive function helps to further

corroborate the BASC and CAARS/CARS. An IQ test is needed to differential diagnose learning disorders as well as clue an assessor as to the main cognitive deficits faced by a patient. Lastly, a Broadband such as the MMPI or PAI is needed to assist in differential diagnosing of other mental disorders that may be mimicking the symptomology of ADHD.

Such a battery should allow for the successful testing of ADHD. It is acknowledged that even such a battery requires the assessor to be capable of compiling all the results ascertained into a cohesive diagnosis. It is implored that assessors have such skills. This battery of course is yet to be researched in depth and measures like the CPT can be improved to further simulate real-world ADHD studies. Such research is on the way, till then, a battery like the one in this section is one of the best means to comprehensively assess for ADHD with the confidence of differential diagnosis.

Section IV: Case Studies

This section shall preview two cases of ADHD assessment. Each case study included an ADHD battery in a manner that was argued for in Section III. These case studies will serve as an example and educational tool for the importance of an assessment battery in ADHD testing in relation to clinical validity and differential diagnosis. Personal information has been altered to ensure the de-identification and safety of the clients. The first case study illustrates ADHD diagnosis, and the second illustrates the non-diagnosis of ADHD with the same assessment battery.

Case Study I

Background Information

Dupe is a 23-year-old female who is currently in her first year of graduate school. She was referred by her primary physician for an attention deficit hyperactivity disorder (ADHD) evaluation. Dupe reported struggling with motivation and sustained attention when completing tasks related to her academics. She also reported finding herself interrupting people or speaking over them. Dupe reported a current lack of study structure. When she does attempt to study, she is easily distracted by external stimuli. She reports finding herself folding laundry, watching a show, or completing multiple tasks at once, instead of focusing on the previous task she had started. Dupe presenting problems have caused her some distress, and she reports experiencing anxiety and depression. Her symptoms of anxiety are general, focusing on the catastrophizing of events, along with panic attacks. She reported symptoms of depression such as low self-esteem, worthlessness, and self-deprecation, related to feelings of not having a functioning family system and a passion in life. As the assessment procedures were

completed, Dupe presented with a history of trauma, prompting further investigation into her possible history of posttraumatic stress disorder (PTSD), as well as her current presentations of PTSD symptoms such as sleep disturbances due to intrusive distressing memories related to her trauma, psychological distress at the exposure to internal or external cues that resemble her past trauma, and problems with concentration, among other PTSD symptoms.

Observations from Clinical Interview with Dupe

Dupe displayed normal affect and was oriented to person, place, time, and situation. Dupe showed no cognitive impairments, had a logical thought process and denied any current homicidal and suicidal ideations. Dupe reported experiencing limited positive emotions, stating that she only experiences happiness with her fiancé and dog. She also went on to report facing fleeting feelings of anger at times due to not having a nuclear family that is functional and together. The clinician went on to observe that Dupe holds a very negative perception of herself, failing to give herself credit for accomplishments, as well as speaking of herself in a self-deprecating manner. Dupe is unemployed, debating her educational path, and lacks proper self-care. Although Dupe showed no signs of memory difficulties on the clinical level, she did struggle to recall information from her past.

Psychological Testing Overview

Dupe was provided with the Kaufman Brief Intelligence Test (KBIT-2) to assess her IQ. Her IQ Composite standard score was 94, which falls in the average range of intellectual ability, noting that her attention difficulties do not stem from an intellectual disability or a specific learning disability. Dupe was provided with the Brown EF/A to assess her executive function. Her Total Composite score, which represents an overall indication of executive functioning, was 92 which is in the Markedly Atypical range, suggesting it is a very significant problem regarding her executive functioning. Dupe was also provided with the CAARS self-report and observational scales. These reports contain scales concerned with inattentiveness and hyperactivity/impulsivity. These reports allow for the gathering of ADHD symptoms within three different environments, which is key for the diagnosis of ADHD. Dupe completed one self-report, while two observational reports were given to her partner and mother. Dupe's self-report indicated that she was reporting significantly above-average behaviors that are indicative of ADHD. Dupe's mother and partner both returned observations that suggest that Dupe does not appear to exhibit symptoms that are indicative of ADHD.

Dupe Completed a Continuous Performance Test, the CPT-3, which is a computer-administered, performance-oriented, measure of attention-related problems associated with psychological or neurological problems (e.g., ADHD, depression, anxiety, etc.) in individuals aged 8 years and older. Dupe's scores on the CPT-3 indicated a moderate likelihood of having a disorder characterized by attention deficits, such as ADHD. Her scores also strongly suggest that she may have problems with

impulsivity. Dupe was also provided the MMPI-3 to rule out disorders that are comorbid with ADHD or share common symptomology with ADHD.

The MMPI was also administered to clue the clinician into the cognitive concerns faced by Dupe. Per the MMPI, Dupe reported neurological complaints and a pattern of cognitive difficulties including memory problems, difficulties with attention, and concentration. Her scores also indicated significant emotional distress and perceiving others as being overtly critical of her. Her scores indicated symptoms of impulsivity, elevated mood, as well as self-doubt, feeling inferior, and indecisive. She reported an above-average level of stress, excessive worries centered on misfortune as well as a preoccupation with disappointments, along with multiple anxiety-related experiences, and multiple fears that significantly restrict her typical activity. She also reports experiencing an elevated level of negative emotionality, including insecurities, intrusive ideation, a lack of positive emotional experiences, and pessimism.

Throughout testing, Dupe endorsed various disorders. To help pinpoint a diagnosis, she was provided The Structured Clinical Interview for the DSM-5 (SCID-5-CV) and the Trauma Symptom Inventory Second Edition (TSI-2). Per the SCID-5-CV, Dupe endorsed generalized anxiety disorder, posttraumatic stress disorder (PTSD), and ADHD. The TSI-2 is a self-report measure of acute and chronic trauma-related symptoms and behaviors that have occurred in the past six months. Three of Dupe's TSI-2 factors were either within the problematic scale or within the clinically elevated range, suggesting that she endorses symptoms of PTSD. To see detailed information on the assessments provided to Dupe and their scores, see Appendix A.

Diagnostic Considerations

Dupe's scores on the ADHD battery were compiled along with her clinical interview and observations. Although Dupe endorsed ADHD-type symptoms on the CPT, SCID-5-CV, and neurological symptoms akin to ADHD on the MMPI, a diagnosis of ADHD was not given due to the clear presence of other disorders that share symptomology with ADHD. Dupe failed to show ADHD symptoms in three different environments per the CAARS and clinical interview. Dupe also endorsed generalized anxiety and PTSD across multiple assessments, reporting past and current symptoms. PTSD and Generalized Anxiety have symptoms that mimic ADHD due to their effects on an individual's executive function. These are symptoms such as difficulty concentrating, restlessness, and hypervigilance which can be confused for impulsivity. PTSD and General Anxiety also produce sleep disturbance, which can further disrupt executive functioning, producing ADHD-type symptoms. Given this, Dupe was diagnosed with:

- F41.1 Generalized Anxiety Disorder, with Panic Attacks
- F43.10 Posttraumatic Stress Disorder.

Case Study II

Background Information

Asake is a 19-year-old, African American female. She is self-referred for assessment services to determine the presence of Attention-Deficit Hyperactive Disorder (ADHD). She reported difficulty paying attention in classes, difficulty staying engaged in conversations, and concerns about schoolwork completion. She has tried various study practices; creating a routine, regimented study time, picking intentional study spaces, etc., yet she reports she is still finding it difficult to pay attention and keep up with her class work. Additionally, she reported that she frequently "daydreams" while she is trying to work on homework and must redirect herself back to her homework. She is seeking support through acquiring accommodations for tests, homework, etc. Additionally, she endorsed interest in further therapy for help with her attention issues.

Observations from Clinical Interview with Asake

Asake dressed appropriately, and appeared well-groomed, and had good hygiene. She was attentive and cooperative with all questions. She displayed normal affect and was oriented to person, place, time, and situation. Asake showed no cognitive impairments, had a logical thought process, and denied any current or historical homicidal and suicidal ideations. She was not found to show any deficits in insight, abstraction, or similarities when completing aspects of the mental status exam.

Psychological Testing Overview

Asake was provided with the Kaufman Brief Intelligence Test (KBIT-2) to assess her IQ. Her IQ Composite standard score was 83, which falls in the below-average range of intellectual ability, noting that her attention difficulties could stem from an intellectual disability or a specific learning disability. Asake was provided with the Behavior Rating Invention of Executive Function for Adults (Brief-A) to assess her executive function. Her Global Executive Composite score, which represents an overall indication of executive functioning, was 72 which is in the Elevated range of cognitive dysfunction, suggesting she is experiencing executive functioning problems.

Asake Completed a Continuous Performance Test, the CPT-3, which is a computer-administered, performance-oriented, measure of attention-related problems associated with psychological or neurological problems (e.g., ADHD, depression, anxiety, etc.) in individuals aged 8 years and older. Asake's scores on the CPT-3 did not indicate a likelihood of having a disorder characterized by attention deficits such as ADHD. Although there is no pervasive pattern of atypical T-scores, Asake's response pattern indicates a possible issue with one specific dimension of attention: inattentiveness. Her scores also suggest that she may have minor problems with visual inattentiveness.

The MMPI was also administered to clue the clinician into the cognitive concerns faced by Asake. Per the MMPI She had two elevated scales: impulsivity and self-importance. Individuals with scores similar to Asake often report difficulty with behavioral control and planning. Individuals who score similarly in self-importance

tend to be confident in who they are and have special talents or abilities. Her elevations on these two scales are consistent with the information she provided during the clinical interview suggesting she is confident and her overall presentation which suggests she is easily distracted.

Diagnostic Considerations:

Asake's scores on the ADHD battery were compiled along with her clinical interview and observations. Asake saw elevations in inattentiveness across testing measures as well as her clinical interview and clinical observations. Furthermore, no other disorders were shown to be present or comorbid. Asake was diagnosed with:

- (F90.0) Attention-Deficit/Hyperactivity Disorder, Predominately inattentive presentation, Mild.

Section V: Discussion and Future Directions

ADHD is currently diagnosed at a rate that places it within the list of the most frequent diagnosis one can come across. So much so that Alzaben et al. (2018) stated that in 2011, the prevalence of lifetime ADHD diagnosis among children from the age of 4-17 was 11%. That 11% does not consider adults who are diagnosed with ADHD. The rates mentioned above have increased and will continue to grow. This growth will impact those who suffer from ADHD, pharmacology, and the money to be made from it, the education system, workplace settings, and society at large. Given this, one would presume that ADHD is well-researched and that the assessment and diagnosis of it have been standardized. Sadly, only the former is true.

As it stands, ADHD diagnosis is not standardized. Some assessments aid in its diagnosis but there are no clear guidelines as to which assessments to administer to ascertain a diagnosis. Leaving various professionals across fields who can assess for ADHD to subjectively choose what assessments to administer as well as the breadth and depth of their assessment. This in turn causes a disagreement of diagnosis between professionals, with some feeling as though other professionals do not administer enough assessments to confidentiality diagnose ADHD, while some believe that the assessments used do not adequately assess for ADHD. Such discrepancies between professionals bring into question the validity of the diagnosis given, which can be problematic if individuals are being misdiagnosed with ADHD or not being adequately diagnosed.

My interest in the standardization of ADHD was engendered due to receiving many referrals for ADHD, finding that most of my referrals were previously diagnosed

with ADHD but seeking reassessment. When assessed, the patients were always surprised by the extent of our testing, stating that their previous testing only included a self-report. As it stands, a single measure or sole self-report is not adequate for proper ADHD diagnosing as shown by the case studies in Section IV. This is due to multiple reasons.

First, is the criterion for ADHD diagnosis. A history of several inattentive or hyperactive-impulsive symptoms needs to be present before age 12. To ascertain such information, a clinical interview with the patient or the patient's guardian is needed. Another key criterion is the presence of ADHD symptoms across two or more settings, which can be difficult to ascertain from a single self-report. The optimal practice is to acquire reports from individuals who interact with the clients in different environments or through the conducting of observations. Clinical interviews were conducted with both Asake and Dupe. Regarding corroborations from multiple environments, Dupe was presented with the CAAR's which helped further guide the clinician toward the appropriate diagnosis.

Second, ADHD is comorbid with other disorders. Per the DSM-5TR, ADHD is comorbid with "oppositional defiant disorder, autism spectrum disorder, personality and substance use disorders, anxiety disorders, major depressive disorder, obsessive-compulsive disorder, and intermittent explosive disorder" (APA, 2022, p.75). For adults, antisocial and other personality disorders may co-occur with ADHD. These comorbidities were also reviewed in Section II in detail. Such a vast number of comorbidities requires the assessment for ADHD to be capable of identifying these comorbidities when present. Being able to effectively identify them allows for the better

treatment of the conditions, as well as being able to identify the extent to which ADHD is the source of the patient's current distress, focusing treatment. Such information cannot be gathered from one self-report or two measures, but rather from an assessment battery.

Third, due to ADHD's comorbidity rates and shared symptomology across other disorders, differential diagnosis is key when assessing for ADHD. Per the DSM-5-TR, disorders to consider for differential diagnosis are:

1. Oppositional defiant disorder, intermittent explosive disorder
2. Other neurodevelopmental learning disorders
3. Specific learning disorder
4. Intellectual developmental disability
5. autism spectrum disorder
6. Reactive attachment disorder
7. Anxiety disorders
8. Posttraumatic stress disorder
9. Depressive disorders
10. Bipolar disorder
11. Disruptive mood disorder
12. Substance use disorders
13. personality disorders
14. Psychotic disorders
15. Medication-induced symptoms of ADHD
16. Neurocognitive disorders.

The list itself speaks as to why differential diagnosis should be of importance for ADHD assessment. Having to differentially diagnose 16+ disorders away from ADHD is a daunting task, but one that can be done with the right set of assessments and clinical experience. The battery of assessments argued for includes an IQ, broadband measures, a clinical interview, cognitive assessments, and a continuous performance task. These measures coupled with a clinician's experience come together to inform further testing if needed. This is seen throughout Dupe's case study. Through the battery, the assessor was able to clue into Dupe's depressive-like symptoms and anxiety-like symptoms which can come across as ADHD. Through further testing, and implementing a TSI, it was found that Dupe suffers from PTSD and anxiety. ADHD assessment without the consideration of measures that focus on differential diagnosis or are capable of differential diagnosis is simply not a clinically valid assessment.

ADHD assessment is a complex task that should be completed with care and precision. Given its comorbidities, differential diagnosis, and projected increase in the human population, it should be standardized. Currently, there is no battery officially designed for mass use. This is of concern because a combination of assessments that target differential diagnosis, continuous performance, environmental presentations, cognitive and executive difficulties, IQ, and ADHD criteria is the optimal way to assess for ADHD. It is hoped that the battery and arguments provided in this paper guide future clinicians and individuals who can assess for ADHD to complete optimal testing. It is also hoped that it sparks future research and standardization.

Future research should also consider the use of virtual reality (VR) as a continuous performance task (CPT). As argued in section III, although current CPTs are

key to ADHD diagnosis, they lack ecological validity. Ecological validity measures the degree to which a test produces similar results as those found in the real world. Given that CPTs tend to be tested in quiet rooms and focus on task tracking on a computer, it lacks other environmental distractions faced by individuals with ADHD in their daily lives. Negut et al. (2017) compared a clinical VR titled Classroom-CPT against a traditional CPT on 33 children diagnosed with ADHD and 42 typically developing (TD) children. Classroom-CPT is a neuropsychological test embedded in a virtual reality classroom, made to immerse the participant within a classroom scenario. It assesses the attention deficits of those with ADHD while providing mixed auditory distractors, such as someone walking into the classroom with accompanying noise from the hallway. Auditory distractors such as a bus engine, knocking on the door, footsteps, and the school bell ringing. It also includes visual distractors such as a paper airplane being thrown and a teacher looking at her watch (Negut et al., 2017).

Once participants are within the immersive classroom, they are tasked to respond to targets that appear on a blackboard. Targets consist of letters from the alphabet displayed at a fast pace, with the participant instructed to press the left mouse button when the letter “K” appears after the letter “A” (Negut et al., 2017). There were two conditions within the VR variable. One where auditory distractors were used along with the task, and another without distractors. The VR testing consists of 374 stimuli and 54 total targets of the "AK" sequence. Participants who completed the traditional CPT did so on a Lenovo T400 laptop. Those using the traditional CPT were also placed in two conditions, with distractors, and without distractors (Negut et al., 2017).

Results showed that the VR testing was able to discriminate between children with ADHD and TD children at a clinically valid rate. Finding that "the children with ADHD performed worse on correct responses, had more errors of commission and errors of omission, and demonstrated slower reaction times compared to the TD children" (Negut et al., 2017, p. 703). Furthermore, it was found that VR testing did not increase task difficulty. Results indicated a significant main effect for test modality, auditory distractors, and overall performance. The addition of auditory distractors within the VR modality showed the ability to distract participants, making them more prone to missing correct targets, thus increasing the number of errors of omissions (Negut et al., 2017). The same was true for total correct responses, as in participants missing correct sequences.

When the effects of auditory distractors on the traditional CPT were compared to the condition with no distractors, no significant differences were found, except for the total number of correct responses regarding children with ADHD (Negut et al., 2017). Overall, in both VC and traditional CPT, children with ADHD were affected by auditory at a higher rate than TD children. Overall, the results that were found by Negut et al. (2017) align with other studies, showing that VR testing is a clinically valid testing modality, and when coupled with auditory distractors in the virtual environment, ecological validity, and task complexity increase.

Although only auditory distractors were included in testing, the VR software contained visual and mixed distractors. It is fair to hypothesize that a larger effect on performance may be expected when visual, auditory, and mixed districts are used in coalescence. Furthermore, given that ADHD testing holds considerable implications for

a client's life, performance validity measures should be considered. The current battery contains assessments such as the MMPI, PAI, Brief-A, and CAARS that have some performance validity scales, an ADHD battery needs further developments or inclusion of assessments that ensure that individuals seeking ADHD assessment are not feigning symptoms to be diagnosed with ADHD. Lastly, as mentioned throughout this work, ADHD affects an individual's executive function. The neuropsychological explanations of the etiology of ADHD should be further explored in hopes of better understanding the underpinnings of ADHD and to help further distinguish ADHD symptomology from other disorders.

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APPENDICES

Appendix A: Dupe's Testing

Regarding the following testing information, personal information pertaining to the client in question has either been altered, omitted, or de-identified to ensure the client's safety and privacy.

IQ: Kaufman Brief Intelligence Test, Second Edition (KBIT-2)

Dupe was administered the KBIT-2, a brief measure of cognitive and intellectual functioning that provides an overall IQ Composite standard score. The KBIT-2 was administered to aid in the differential diagnosis of ADHD and learning disorders and to clue the clinician into possible deficits faced by Dupe, which can be observed and ascertained from her scores.

Dupe obtained an IQ Composite Standard Score of 94 (90% Confidence, 87 to 101), which falls in the Average range of intellectual ability and places her in the 34th percentile. Dupe's Verbal Standard Score of 93 (90% Confidence, 86 to 101), falls in the Average range. This score is at the 32nd percentile. Dupe's Nonverbal Standard Score of 96 (90% Confidence, 87 to 105) falls in the Average range, which is at the 39th percentile.

Cognitive: Brown EF/A

Dupe was administered the Brown Executive Function/Attention Scale, which contains a set of rating scales designed to evaluate executive functions related to attention ADHD. Dupe's Total Composite score, which represents an overall indication

of executive functioning, was T=92 which is in the Markedly Atypical range, suggesting it is a very significant problem. Other scales in the Markedly Atypical range include Activation (T=88), which assesses organization, prioritizing, and activating to work; Focus (T=87) which assesses focusing, sustaining, and shifting attention; Effort (T=91), which assesses regulating alertness, sustaining effort, and adjusting processing speed; Emotion (T=72) which measure's her ability to manage frustration and modulating emotions; Memory (T=96) which assesses her ability to utilize working memory and accessing recall; and Action (T= 92), which assesses monitoring and self-regulating action.

Self-Report and Observational Rating Scales: CAARS

Dupe was provided with the CAARS- Screening- Short Version self-report and the CAARS- observer scale- long version. Dupe provided her own responses on the screener and her mother and partner provided responses to the observer forms. The more scales on the CAARS that show significant elevations, the more likely that a moderate to severe problem with ADHD exists.

Dupe's responses on the self-report version of the CAARS yielded a Very Much Above Average (T=89) level of difficulty with Inattentive Symptoms compared to typical responses in the general population. She finds it difficult to manage several things at once, loses things she needs, and has trouble getting started on tasks. She has a Very Much Above Average (T=79) level of concerns with Hyperactivity/Impulsive Symptoms compared to average responses in the general population. Her ADHD Symptoms Total was within the Very Much Above Average range (T=90) and her

overall ADHD Index was within the Very Much Above Average Range (T=67). Given that all the scales on the CAARS self-report were elevated above a T-Score of 65, the results indicate that Dupe is reporting significantly above-average behaviors that are indicative of ADHD.

Dupe's partner completed one of the observer scales. He placed Dupe's Inattention/Memory Problems within the Average Range (T=54) as well as her Hyperactivity/Restlessness (T=48), Impulsivity/Emotional liability (T=53), Problems with Self-Concept (T=48) and DSM-IV Inattentive Symptoms (T=52). Dupe's DSM-IV Hyperactive-impulsive Symptoms (T=58) were rated within the Slightly Above Average Range, as well as her DSM-IV ADHD Symptoms Total (T=56), and her ADHD Index (T=67). Given that only one of the scales on the CAARS observer report was elevated above a T-Score of 65, the results indicate that Dupe's partner's informed observations of Dupe do not appear to suggest that she is exhibiting symptoms that are indicative of ADHD.

Dupe's mother completed the other observer report. Dupe's Inattention/Memory Problems were rated within the Slightly Below Average range (T=43) and rated within the Below Average Range regarding her Hyperactivity/Restlessness (T=38). Furthermore, her mother's responses placed her in the Slightly Below Average for the following subscales: Impulsivity/Emotional Liability (T=43), Problems with Self-Concept (T=43), DSM-IV Inattentive Symptoms (T=41), DSM-IV Hyperactive-Impulsive Symptoms (T=40), and the ADHD Index (T=42). Lastly, her mother's responses place Dupe's DSM-IV ADHD Symptoms Total within the Below Average

Range (T=39). Given that none of the scales on the CAARS self-report were elevated above a T-Score of 65, the results indicate that her mother fails to report any scores that are indicative of ADHD.

Continuous Performance Test:

Continuous performance tests are crucial in ADHD diagnosis considering that individuals with ADHD find it difficult to maintain attention, complete tasks efficiently, and are impulsive. The Continuous Performance Task - 3rd Edition (CPT-3), is a computer-administered, performance-oriented, measure of attention-related problems associated with psychological or neurological problems (e.g., ADHD, depression, anxiety, etc.) in individuals aged 8 years and older. The test compares an individual's standardized scores on 10 variables with the normative sample to provide measures of validity, response style, and four dimensions of attention: Inattentiveness, Impulsivity, Sustained Attention, and Vigilance.

Dupe's responses indicated a balanced (neither impulsive nor slow) style of responding that is sensitive to both speed and accuracy (T=41). Overall, Dupe had a total of three atypical scores which is associated with a moderate likelihood of having a disorder characterized by attention deficits, such as ADHD. Dupe's T-score is 67 (90% CI = 62-72), which is ranked at the 98th percentile. This result means that her ability to discriminate non-targets from targets was poor when compared to the normative group. Her T-score on Commissions is 71 (90% CI = 66-76), which is ranked at the 98th percentile means that she responded to a higher percentage of non-targets when

compared to the normative group. Dupe's scores on these measures indicate that she may have problems with inattentiveness.

Dupe's T-score within the impulsivity dimension is 37 (90% CI = 36-38) which is ranked at the 10th percentile and falls in the Atypically Fast range. This result means that her response speed was much faster than the normative group's speed. A faster-than-normal HRT is often related to impulsivity. Her T-score on Commissions is 71 (90% CI = 66-76), which is ranked at the 98th percentile, and falls in the Very Elevated range. This result means that she responded to a much higher percentage of non-targets when compared to the normative group. Dupe's scores on these measures scores on these measures strongly suggest that she may have problems with impulsivity.

MMPI-3

An MMPI-3 was administered to Dupe to rule out disorders that are comorbid with ADHD or share common symptomology with ADHD. The MMPI was also administered as a means to clue the clinician into the cognitive concerns faced by Dupe. Per the MMPI, Dupe reported neurological complaints and a pattern of cognitive difficulties including memory problems, difficulties with attention, and concentration. Her scores also indicated significant emotional distress and perceiving others as being overtly critical of her.

Her scores indicated symptoms of impulsivity, elevated mood, as well as self-doubt, feeling inferior, and indecisive. She reported an above-average level of stress, excessive worries centered on misfortune as well as a preoccupation with disappointments, along with multiple anxiety-related experiences, and multiple fears

that significantly restrict her typical activity. Overall. Dupe is socially introverted. She reports experiencing an elevated level of negative emotionality, including insecurities, intrusive ideation, a lack of positive emotional experiences, and pessimism.

The Structured Clinical Interview for DSM-5, Clinician Version (SCID-5-CV)

Dupe was administered the SCID-5-CV to further aid with differential diagnosis due to the wide range of symptomology she presented with. Regarding the anxiety disorders module, Dupe reported facing panic attacks and its related symptomology, the most recent one happening a month prior to this administration of the SCID-5-CV. She also reported symptoms of social and generalized anxiety, stating that she has had a fear of crowds and social situations, doing her best to avoid them. This in turn has affected her ability to keep certain occupations and attend courses. Regarding general anxiety, she reported worrying about everything and finding it very difficult to stop her worrying, which is exacerbated by social situations. Dupe went on to report symptoms of fatigue, difficulty concentrating, irritability, muscle tension, and sleep disturbances due to her anxiety.

Dupe went on to endorse posttraumatic stress disorder (PTSD) and its associated symptoms, reporting an extensive lifetime trauma history. She reported experiencing two life-threatening scenarios, one at age 4 and another at 11. She reported being abused when younger, and witnessing domestic violence when she was 10 and 13. She reported finding her mother overdosed. Dupe's PTSD is untreated and faces sleep

disturbances, nightmares related to her trauma, being irritable, hypervigilant, and concentration problems.

Dupe was also administered the ADHD module. She reported being easily distracted, having difficulty sustaining attention, difficulty meeting deadlines, making mistakes due to difficulty with attention to detail, and struggling to complete tasks. She also reported difficulty completing activities she does not find interesting. She went on to report that she began noticing her ADHD between the ages of 8 and 13 years old.

Trauma Symptom Inventory Second Edition (TSI-2):

Given Dupe's extensive trauma history, she was administered the TSI-2 to further explore her trauma and to aid with differential diagnosis. The TSI-2 is a self-report measure of acute and chronic trauma-related symptoms and behaviors that have occurred in the past six months. The Self-Disturbance factor broadly measures disturbed or altered perceptions of self and others, and the degree to which the respondent finds it challenging to interact with the external world. Dupe's T-score of 64 on the Self-Disturbance factor falls into the problematic range placing her at the 90th percentile.

The Posttraumatic Stress factor broadly measures respondents' reports of flashbacks, nightmares, intrusive or triggered memories, cognitive or behavioral avoidance of reminders of previous traumatic events, sympathetic hyperarousal, and various dissociative symptoms. Dupe obtained a T-score of 67 on the Posttraumatic Stress factor falls into the clinically elevated range. Her score places her at the 93rd percentile.

The Externalization factor broadly measures proneness to exhibit problematic, self-destructive, or aggressive behaviors when dealing with overwhelming internal states and/or substantially diminished or underdeveloped affect regulation capacities. Dupe's T-score of 51 on the Externalization factor does not fall into the problematic range and places her at the 63rd percentile.

The Somatization factor broadly measures general preoccupation with bodily concerns, either for psychological reasons or as a result of preoccupation with actual physical disease, dysfunction, or pain. Dupe's T-score of 65 falls into the clinically elevated range and places her at the 92nd percentile. Three of Dupe's TSI-2 factors were either within the problematic scale or within the clinically elevated range, suggesting that she endorses symptoms of PTSD.

Appendix B: Asake's Testing

Regarding the following testing information, personal information pertaining to the client in question has either been altered, omitted, or de-identified to ensure the client's safety and privacy.

IQ: Kaufman Brief Intelligence Test, Second Edition (KBIT-2)

Asake was administered the KBIT-2, a brief measure of cognitive and intellectual functioning that provides an overall IQ Composite standard score. The KBIT-2 was administered to aid in the differential diagnosis of ADHD and learning disorders and to clue the clinician into possible deficits faced by Asake, which can be observed and ascertained from her scores. Asake was generally attentive and put forth adequate effort throughout this administration of the tests. There were times during the Riddles subtests where she appeared to be distracted and she would occasionally request that items be repeated. Due to this occasional inattention, it is believed that although her scores on this measure appear to be valid, they likely under-represent her cognitive and intellectual abilities at the time of the evaluation.

Asake obtained an IQ Composite standard score of 83 (90% Confidence, 77 to 91), which falls in the Below Average range and places her in the 13th percentile. Asake's Verbal standard score of 92 (90% Confidence, 85 to 100), falls in the Average range which is at the 30th percentile. This score may be under-represented due to her observed distraction during the Riddles subtest, which loads onto the Verbal composite

score. Asake's Nonverbal standard score of 78 (90% Confidence, 70 to 88), falls in the Below Average range, which is at the 7th percentile.

Cognitive: Behavior Rating Inventory of Executive Function for Adults (Brief-A)

The Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A) is a standardized self-report rating scale and screening tool for possible executive dysfunction. The BRIEF-A provides three validity measures that assess for response bias (Negativity, Infrequency, and Inconsistency), an overall functioning scale (Global Executive Composite; GEC), as well as two more specific summary index scales: Behavior Regulation Index (BRI) and Metacognition Index (MI).

Asake's GEC (T=72, 96th percentile) score falls in the Elevated range of executive dysfunction and suggests that she is currently reporting symptoms that suggest that she is experiencing executive functioning problems.

Asake's BRI (T=66, 92nd percentile) score falls in the Elevated range of executive dysfunction. She endorsed elevated scores on the Inhibit (T=77, 99th percentile) and Self Monitor (T=76, 99th percentile) scales. This suggests that she has difficulty sitting still, controlling her behavioral responses, and feeling restless most of the time.

Asake's MI (T=73, 97th percentile) score falls in the Elevated range of executive dysfunction. Asake endorsed elevated scores on the Initiate (T=73, 98th percentile), Working Memory (T=89, >99th percentile), Plan/Organize (T=70, 98th percentile), and

Task Monitor (T=77, >99th percentile) scales and suggests that she is currently reporting difficulty with starting required tasks, remembering her responsibilities, staying on task while working, keeping track of what she is doing while she works, and keeping track of her successes and failures on tasks.

Continuous Performance Test:

Asake exhibited a **liberal** style of responding that emphasizes speed over accuracy (T-score = 38). Relative to the normative sample, Asake made more commission errors. Overall, because there is only one atypical T-score, the results do not suggest that Asake has a disorder characterized by attention deficits, such as ADHD. Although there is no pervasive pattern of atypical T-scores, Asake's response pattern indicates a possible issue with one specific dimension of attention: inattentiveness.

The Inattention dimension is made up of Detectability, Omission and Commission Errors, Hit Reaction Rate (HRT), Hit Reaction Time Standard Deviation (HRTSD), and Variability. Commissions are made when responses are given to non-targets. Asake's T-score is 62 and falls in the Elevated range. This result means that she responded to a higher percentage of non-targets when compared to the normative group. This was the only elevated scale on the assessment and was likely due to her liberal response style, which emphasized speed in responding over accuracy. Asake's scores on these measures suggest that she may have minor problems with visual inattentiveness.

MMPI-3

An MMPI-3 was administered to Asake to rule out disorders that are comorbid with ADHD or share common symptomology with ADHD. The MMPI was also administered as a means to clue the clinician into the cognitive concerns faced by Asake. She had two elevated scales: impulsivity and self-importance. Individuals with scores similar to Asake often report difficulty with behavioral control and planning. Individuals who score similarly in self-importance tend to be confident in who they are and have special talents or abilities. Her elevations on these two scales are consistent with the information she provided during the clinical interview suggesting she is confident and her overall presentation which suggests she is easily distracted.