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The Behavior Assessment System for Children Third Edition (BASC-3)'s Classification Accuracy for Attention-Deficit/ Hyperactivity Disorder (ADHD) in Young Adults

Angela LaFaye Lucas
Stephen F Austin State University, rittenbeal@jacks.sfasu.edu

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By

ANGELA LAFAYE LUCAS, M.S.

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THE BEHAVIOR ASSESSMENT SYSTEM FOR CHILDREN THIRD EDITION (BASC-3)'s CLASSIFICATION ACCURACY FOR ATTENTION-DEFICIT/HYPERACTIVITY DISORDER (ADHD) IN YOUNG ADULTS

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ANGELA LAFAYE LUCAS, M.S.

APPROVED:

Luis Aguerrevere, Ph.D., Dissertation Chair

Nina Ellis-Harness, Ph.D., Committee Member

Frankie Clark, Ph.D., Committee Member

Sarah Savoy, Ph.D., Committee Member

Sheryll Jerez, Ph.D.
Interim Dean of Research and Graduate Studies

ABSTRACT

Attention-Deficit/Hyperactivity Disorder (ADHD) was established as a condition initially considered to be outgrown; however, research later demonstrated that about one-half to two-thirds of children with ADHD had persistent symptoms into adolescence and adulthood (Resnick, 2005). It was estimated that the percentage of college-aged students with ADHD ranged somewhere between 2 and 8% (DuPaul et al., 2009). Assessing for an ADHD diagnosis determination in college student-aged individuals was a challenge that required strategies not typically used when assessing for other disorders or within different age ranges (Lovett & Davis, 2017). There was a lack of consistent strategies amongst clinicians on how to best evaluate adult ADHD. It was specifically reported that clinicians expressed diminished confidence in their ability to determine accurate diagnostic judgments for adult ADHD cases (Schneider et al., 2019). The purpose of this study was to determine the classification accuracy of the *Behavior Assessment System for Children* (Third Ed.; BASC-3) Inattention/Hyperactivity composite *t*-score in predicting the diagnosis of Attention-Deficit/Hyperactivity Disorder among college students who completed a psychological assessment through the Stephen F. Austin State University School Psychology Assessment Center. It was hypothesized that the BASC-3 would be a strong predictor of the final ADHD diagnosis due to high levels of specificity and sensitivity. An exploratory analysis was conducted for misclassified (i.e., false positive or false negative) individuals to determine other effective predictors of the final diagnosis.

Finally, for individuals that did not receive an exclusive ADHD diagnosis, common comorbidities and differential diagnoses were determined.

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Finally, I would like to dedicate this to my dear Eleanor LaFaye and other future children. Even before you were born, you were my inspiration. You make me a more courageous, wiser and joyous person. I love you beyond words.

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CHAPTER I: Introduction

In 2013, the Diagnostic Statistical Manual-5th edition (DSM-5) defined Attention-Deficit/Hyperactivity Disorder (ADHD) as a neurodevelopmental disorder that presents chronic and pervasive symptoms of inattention and hyperactivity (American Psychiatric Association, 2013). This source also indicated that individuals diagnosed with ADHD frequently struggled with social relationships. Mikami (2010) suggested that individuals with ADHD struggled to create mutual relationships founded on reciprocal understanding and emotional supportiveness. Similarly, Pfiffner et al. (2000) showed that individuals with ADHD appeared as aggressive, argumentative, or disruptive due to a lower level of self-control. These behavioral manifestations were predominately observed in the form of hyperactivity in early childhood years.

The DSM-5 estimated that a significant number of children diagnosed with ADHD remained relatively impaired into adulthood. According to DSM-5, ADHD has been impacting approximately 2.5% of the adult population. Avenevoli et al. (2013) and Polanczyk et al. (2007) found that ADHD was among the most prevalent of the neurodevelopmental disorders, with an estimated prevalence rate of 5.29% in school-aged children within the world population. These same sources found that ADHD prevalence rates decreased slightly throughout adolescent years to 3-5% (Polanczyk et al., 2007), and remained prevalent in adults at an approximate population rate of 3.4% (Fayyad et al., 2007). DuPaul et al., (2001) and Schwanz et al., (2007) found that ADHD symptoms

were commonly experienced by college students and both inattention and hyperactivity difficulties were correlated with decreased academic college outcomes. In these studies, ADHD rating scales were completed by over 1,200 college students in the United States, Italy, and New Zealand. Results indicated that 2.9%-8.1% of male students and 0%-3.9% of female students met the ADHD diagnostic criteria (DuPaul et al. 2001). In a later study, DuPaul et al., (2009) found that approximately 25% of the college students who received disability services were diagnosed with ADHD.

Schwanz et al. (2007) suggested that the inattention and hyperactive symptoms associated with ADHD in college students correlated with poor academic performance. Similarly, Prevatt and Young (2014), determined that college students with ADHD received lower grades when compared to their non-ADHD peers, were more likely to withdraw from classes, had worse study habits, and experienced difficulty completing tests and assignments on time. DuPaul et al., (2001) also reported that college students with ADHD received lower grade point averages, practiced fewer study skill strategies, did not advance within their program at the same rate as non-ADHD peers, and remained in their academic program for less time.

In addition to the symptoms associated with ADHD, individuals diagnosed with this condition identified comorbid conditions that brought additional socio-emotional difficulties. Biederman et al. (2006) found that the most common comorbid conditions associated with ADHD were oppositional defiant disorder, mood and anxiety disorders, and substance abuse disorders. Seo et al. (2022) reported that out of a group of adults

with ADHD, about 79% of them had at least one comorbidity, with depressive disorders ranked as the most prevalent. As such, the need for services that supported mental health within the university setting increased (Kitzrow, 2003). Ahn et al. (2014) stressed the need for psychometrically strong assessment tools that provided college-aged students with reliable psychological services.

To date, ADHD determination has been based on assessment procedures that measured symptomatology pervasiveness and associated impairments (Adesman, 2001). Typical assessment strategies have included: a review of patient history and previous psychological examinations, clinical interviews, and observations, performance testing, and completion of standardized rating forms (Lovett & Harrison, 2021). Despite this multifaceted approach, it has been difficult for clinicians to provide an ADHD diagnosis in college student populations (Eckert et al., 2000). Critical clinical considerations in relation to diagnosing ADHD have included (a) the onset of the symptoms; (b) confirmation of client symptoms within the childhood years and (c) comorbid or causal conditions (i.e., depression, anxiety; Lovett & Harrison, 2021) as well as d) determination of psychometrically strong testing procedures (Nakash & Algeria, 2013).

The *Behavior Assessment System for Children*- 3rd Edition (BASC-3) has been a commonly used broadband assessment strategy that assessed several different psychological symptomologies (Reynolds & Kamphaus, 2015). The BASC-3 *Self-Report of Personality-College* (BASC-3 SRP COL) was designed as a self-reporting assessment to measure behaviors and symptoms in the context of typical college situations. The

assessment includes four composite scores: Internalizing Problems, Inattention/Hyperactivity, Emotional Symptoms Index, and Personal Adjustment. Within the Inattention/Hyperactivity composite score, the BASC-3 SRP COL measures a person's level of Attention Problems and Hyperactivity (Reynolds & Kamphaus, 2015).

The proposed study determined the classification accuracy of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score in predicting the final clinical-based diagnosis of ADHD in a college-aged population. Additionally, the study examined clinical cases in which the BASC-3 SRP COL Inattention/Hyperactivity composite score was not a good indicator of an ADHD diagnosis and identified which, if any, separate assessment variables were more effective or accurate as a diagnostic identifier. The data was derived from completed assessment reports found within a university-based clinic in the East Texas area. The reports included were from college-aged students who completed the BASC-3 SRP COL and who had Clinically Significant or At-Risk *t*-scores on the Inattention/Hyperactive composite score.

Four outcomes were analyzed: (a) the number of individuals who met elevated scores on the Inattention/Hyperactivity composite scores and who received an ADHD diagnosis; (b) the number of individuals who did not meet elevated scores on the Inattention/Hyperactivity composite scores and who did not receive an ADHD diagnosis; (c) the number of individuals who did not meet elevated scores on the BASC-3 SRP COL but who received an ADHD diagnosis; and (d) cases where an individual had elevated levels on the BASC-3 SRP COL but did not receive an ADHD diagnosis due to

alternative assessments measurements and additional information.

The results of this study potentially helped clinicians understand alternative scores on the BASC-3 SRP COL or other psychological assessments that generate information more accurate in determining an ADHD diagnosis. The information gained from these findings also provided additional helpful information to clinicians in determining possible sources of misdiagnosis and misclassifications of college-aged individuals. Overall, it is expected that future clinicians will have a stronger understanding of the classification accuracy of the BASC-3 SRP COL scores in determining an ADHD diagnosis for college students and will gain insight into alternative assessment measurements and client information that may accurately predict ADHD in this population.

CHAPTER II: Literature Review

ADHD

The DSM-5 (American Psychiatric Association, 2013) defined ADHD as a chronic, pervasive neurodevelopmental disorder that had a typical onset within early childhood years. The DSM-5 described three different ADHD diagnostic subtypes: (a) predominately inattentive; (b) predominately hyperactive/impulsive; (c) or a combined category for those individuals who persistently displayed behaviors of both inattentiveness as well as hyperactivity/impulsiveness (American Psychiatric Association, 2013). Avenevoli et al. (2013) and Polanczyk et al. (2007) found ADHD was among the most prevalent neurodevelopmental disorders, with an estimated global population rate of 5.29% in school-aged children. These same sources determined ADHD rates decreased slightly throughout adolescent years to 3-5%, and additional research determined ADHD remained prevalent in adults at an approximate population rate of 3.4% (Fayyad et al., 2007). DuPaul et al., (2001) and Schwanz et al., (2007) concluded ADHD symptoms were commonly experienced by college students, and both inattention and hyperactivity difficulties were correlated with decreased academic college outcomes. In one particular study, ADHD rating scales were completed by over 1,200 college students in the United States, Italy, and New Zealand. Results indicated that 2.9%-8.1% of male students and 0%-3.9% of female students met the ADHD diagnostic criteria (DuPaul et al. 2001). In a later study, DuPaul et al., (2009) found that approximately 25% of the college students

who received disability services were diagnosed with ADHD.

Adult ADHD

Recently, Dobrosavljevic et al. (2020) conducted a meta-analysis study to determine the prevalence of older adult ADHD. The category of participants was narrowed to individuals aged 50 years and above. From the 32 datasets collected and analyzed, it was determined that adult ADHD prevalence in individuals aged 50 years or more was about 2%. These findings suggested the prevalence of an ADHD diagnosis decreased in older populations when compared to pediatric populations. It was further concluded that selected ADHD symptoms persisted far into adulthood, although symptoms presented differently than in childhood. The DSM-5 recognized that while children experienced difficulties with schoolwork and creating relationships, adults often struggled with effective work habits and maintained relationships (American Psychiatric Association, 2013).

Schaefer et al. (2017) expressed that because certain ADHD symptoms, particularly inattention, were shown to be caused by other possible disorders, ADHD should not be the only diagnostic consideration simply because an adult displayed ADHD-like symptoms. Moreover, it was suggested, that clinicians often missed differential diagnoses, contributing to wrongly diagnosed adults with ADHD. It was also noted that some adults deliberately sought out an ADHD diagnosis to gain access to medication or to obtain disability accommodations. Cook et al. (2021) indicated that the stimulant medication frequently prescribed to treat ADHD was commonly used for

recreational and performance enhancement means. The study determined that prescribed medication was frequently sold, traded, or gifted to individuals without a prescription. Interestingly, Schaefer et al., (2017) found a majority of college freshmen reported not being able to complete their medication regimen as prescribed due to substantial peer pressure to share prescribed medication. Hanson et al. (2010) found hundreds of thousands of electronic messages about the ADHD drug Adderall on various social media platforms with the highest frequency of these messages peaking around final exam periods. In addition to the prescription of stimulant drugs, Gordon et al., (2015) and Harrison, (2017) found that a diagnosis of ADHD often provided college students with beneficial accommodations such as additional exam time, flexible work schedules, and financial payments through welfare programs. Despite the need to take precautionary measures against malingering, it was observed that clinicians rarely seemed to formally evaluate performance or symptom validity within the assessment process (Nelson & Lovett, 2019; Suhr & Berry, 2017).

Lovett and Harrison (2021) found that increased access to educational resources about ADHD led to increased self-identification and sensitivity to normal experiences of inattention or memory lapses. Typical daily struggles were attributed to a possible ADHD diagnosis. Within the assessment process, honest, but inaccurate reported elevated levels of ADHD symptoms were more likely. As a result, ADHD within adult populations showed to be easily over diagnosed.

Common Comorbidities

Seo et al. (2022) conducted a study that determined over 78% of participants who were identified as having ADHD also had at least one comorbidity. The results of the study reported that concentration deficits were commonly found in individuals with diagnoses other than ADHD such as Major Depressive Disorder (MDD). Moreover, the study found that the following conditions were identified as the most common comorbidities: depressive disorder (45.76%), anxiety disorder (23.80%), bipolar disorder (15.44%), sleep disorder (13.43%), schizophrenia spectrum disorder and other psychotic disorders (7.34%).

Biederman et al. (2006) determined ADHD characteristics and symptoms consisted not only of chronic inattentive behaviors, impulsivity, and/or hyperactivity but difficulties with mood or adjustment-related disorders. The research also indicated that individuals with ADHD often exhibited high comorbidity with oppositional defiant disorder (ODD), conduct disorder, mood and anxiety disorders, and cigarette and substance use disorders. This conclusion was determined from a 10-year study of ADHD youth who were initially assessed to determine baseline levels of symptoms and then reassessed a decade later at a mean age of 22. A group of individuals who did not meet ADHD criteria was used as a comparison group. By the time the children with ADHD were reassessed as young adults, they were at a higher risk for antisocial, addictive, mood, and anxiety disorders when compared to the control group.

Connor et al., (2003) determined that children with comorbid ADHD and anxiety

disorders had more intensive levels of symptoms associated with anxiety. Additionally, there was an earlier onset of anxiety symptoms in individuals with comorbid ADHD and anxiety disorders (Katzman et al., 2017). In a study conducted by Bowen et al. (2008), the clinical characteristics of children with comorbid anxiety disorders and ADHD were assessed. Participants included 714 children divided into four different groups: (a) previous anxiety diagnosis but no ADHD diagnosis; (b) no previous anxiety diagnosis but ADHD diagnosis; (c) neither a diagnosis of anxiety disorder nor ADHD, referred to as the control group; (d) and both a previous diagnosis of an anxiety disorder and ADHD referred to as the comorbid group. Results indicated that of the children with a previous anxiety disorder (n = 68), 14 additionally qualified for a diagnosis of ADHD (20.6%). Of those with ADHD (n =29), 14 participants met the criteria for an anxiety disorder (48.3%). The data also showed that the comorbid group of children reported more total symptoms of the anxiety measurement scale as well as higher scores on the subscales that measured different conditions. Specifically, the comorbid group of children reported higher scores on the panic, social phobia, and school phobia subscales when compared to the ADHD control group. Social impairment scores measured across the four different groups of children determined that higher social impairment levels were found in the comorbid group when compared with the ADHD-only or the anxiety-only groups. These findings aligned with previous research findings that suggested the presence of psychiatric comorbidity increased the risk for interpersonal deficits, difficulties with peer interactions, and self-esteem problems (Biederman et al., 1993).

Arnett (2007) reported limited research on the rates and patterns of ADHD comorbidity in individuals within the emerging adulthood age range of 18 to 25 years of age. Data by Barkley et al. (2008) suggested that 80%-84% of adults with ADHD experienced at least one additional condition, and 53%-60% experienced two or more comorbid conditions. Anastopoulos et al. (2018) analyzed the rates and patterns of psychiatric diagnoses comorbid with ADHD within a large group of first-year college students both with and without a previous ADHD diagnosis. The participant pool consisted of 443 participants aged between 18-22 years who were recruited from nine different colleges. A multi-method assessment approach was used, in addition to an expert panel that reviewed participant information. Eligibility requirements for the ADHD group included participants who met the DSM-5 criteria. Assessment methods used within the study included a background information sheet, self-report ADHD rating scale, parent rating scale, structured interviews, depression scales, and anxiety scales. Results of the study indicated significantly higher rates of comorbid conditions in college students with well-defined ADHD. It was reported that 55% of those participants exhibited at least one additional comorbid condition and 31.8% displayed two or more conditions. Within the comparison group, 11.2% of the individuals presented one additional comorbid condition and 4% had two or more conditions. The differences in comorbid conditions between the ADHD and the control group were largely attributed to increased conditions of depression and anxiety within the group of students with ADHD. Specifically, MDD and Generalized Anxiety Disorder (GAD) were among the most

prevalent comorbid conditions. Within the ADHD group, varied comorbid condition rates due to ADHD presentation type as well as participant gender were observed, but not when ethical/racial diversity variables were considered. These findings aligned with previous research that concluded within the college population, anxiety and depressive comorbid conditions were more prevalent within the student population who meet the diagnostic criteria for ADHD than those who were not diagnosed with ADHD (Biederman et al., 2006).

Social Strains

The ADHD assessment processes within the college student population were analyzed due to the increased risks that were commonly associated with social circumstances within that developmental life stage (Anastopoulos & King, 2015). Results from Barkley et al. (2008) suggested that students new to college transitioned to an environment that demanded more social attentiveness and presented more frequent self-regulation tasks. It was further discussed that college students who struggled with self-regulation skills often reported ADHD symptomatology. McMahon (2012) determined that college students with ADHD had more difficulty mastering the developmental skills required within the college setting.

Meaux et al. (2009) suggested that college students had several social stressors that reduced self-monitoring behaviors (e.g., lack of parental monitoring, increased peer pressure, new social environment, and independent study habits). Data from Mikami (2010) suggested individuals with ADHD often experienced an assortment of social

relationship issues that stemmed from overly intrusive behavioral tendencies. Pfiffner et al. (2000) found that individuals with ADHD exhibited a lack of self-control and aggressive, argumentative, or disruptive behavioral tendencies. It was discussed by Anastopoulos et al. (2018) that a college environment often cultivated a lack of self-management skills that caused many students with ADHD to not seek out provided support services and resources, which lead to negative social and educational consequences. Weyandt et al. (2013) determined college students diagnosed with ADHD were at a greater risk for significantly lower grade point averages (GPAs), longer required degree timespans, and a higher likelihood of college dropout.

A study by Advokat et al. (2010) analyzed the impact ADHD medications had on the study habits and academic achievement of ADHD diagnosed undergraduates. A total of 92 participants with a self-reported ADHD diagnosis and a current prescription were compared to a control of 143 students. Despite taking medications prescribed for ADHD, the group of students with an ADHD diagnosis reported that while the drug helped, they felt continued skill deficits in planning, completing assignments, and distraction avoidance. In reality, the study habits of ADHD did not differ much from those of the control group; however, the GPA and American College Test (ACT) scores of the ADHD group were significantly lower. Furthermore, the data showed that students with ADHD withdrew from class much more significantly than the control students. This data suggested that even with medications, students with ADHD continued to struggle at a level that left them at risk of negative academic outcomes.

A study by Barkley et al. (2008) determined college students with ADHD were at an increased risk for lower levels of social adjustment and social skills. Additionally, the study found students with ADHD were at increased levels of engagement in risky sexual behavior or substance abuse. Rooney et al. (2011) examined tobacco, alcohol, illicit drug use, and associated impairments within a college student population. A total of 91 college students were included and of those, 53 were determined to meet ADHD criteria. The results of the study suggested that the increment in age was frequently associated with greater use of the variable substances. Additionally, individuals with ADHD reported higher rates of dangerous alcohol use and higher levels of impairments due to marijuana and non-marijuana illicit drug use. This data suggested that students with ADHD were at elevated risk for problematic substance use. These findings supported the American Psychiatric Association (2013) information that suggested behavioral, emotional, and psychological conditions commonly experienced by college students with ADHD led to functional impairments across several settings. Although Purper-Ouakil et al. (2011) expressed that certain characteristics were shown to be typical of individuals with ADHD, the heterogenetic nature of the condition caused considerable inter- and intraindividual variability.

Theoretical Perspectives of ADHD

Executive Functioning

One theoretical stance on ADHD was the condition characterization of cognitive impairments in inhibitory control and executive functioning. Executive functions (EFs)

were indicated to be a set of mental processes involved when a person concentrated. These processes were reported to have been involved when an individual paid close attention to detail or during moments when instinct or intuition was insufficient (Burgess & Simons, 2005; Espy, 2004). EFs were determined to be at the helm of controlled thoughts and behaviors directed toward goal accomplishments (Anderson, 2002; Zelazo & Carlson, 2012). Previous research established EFs were a set of capabilities that modulated behavior and cognitive activities. These skills included inhibition, working memory, and cognitive flexibility (Anderson, 2002; Baddeley, 1996). Inhibition was referred to as a person's ability to engage in self-control through behavioral inhibition, interference control, or selective attention. Working memory was determined to be the ability to manipulate information recently learned. Cognitive flexibility was established as mental set shifting and was determined to be intertwined with the cognitive mechanisms relied upon in creative tasks. From these three foundational EF skills, higher-order abilities such as reasoning, problem-solving, and planning were achieved (Collins & Koechlin, 2012; Lunt et al., 2012).

Durston et al. (2011), proposed that behavioral control deficits led to the theory of ADHD as a disorder of the prefrontal cortex and the associated neural connections. Data from Rubia (2013) suggested that individuals with ADHD presented deficits in higher-level EF processing skills. These findings determined some individuals with ADHD struggled with goal-directed behaviors due to abnormal mediation of the fronto-striato-parietal and fronto-cerebellar networks. Ye et al. (2020) observed the fronto-striato-

parietal network supported tasks such as sequenced information within a person's working memory. It was concluded the fronto-cerebellar was involved in time-sensitive decisions as well as established temporal expectations (Durston et al., 2011). Fox et al. (2005) discussed that when an individual was presented with a demand that required higher levels of processing speed, the frontal cortices, parietal cortices, occipital cortices, and cerebellum were activated in what was determined as the task-positive network. It was suggested that deficits or abnormalities in any of these neurobiological circuits resulted in behavioral presentations associated with ADHD. For example, dysfunctions of the prefrontal cortex impacted control systems, or deficits in the circuits relaying information to the prefrontal cortex, which reduced the signaling necessary for control (Casey et al., 2007; Nigg & Casey, 2005). As a result, there were consistent deficits observed in tasks such as time discrimination, estimation tasks (Noreika et al., 2013; Rubia et al., 2009) as well as motivation control and reward related decision-making activities (Noreika et al., 2013; Plichta & Scheres, 2014; Willcutt et al., 2008).

These cognitive deficits were predominantly and consistently observed more often in pediatric populations rather than in adolescent or adult populations (Groen et al., 2013; Pievsky & McGrath, 2018). However, within the population of those diagnosed with ADHD, there was significant heterogeneity in presented skill impairments. Some individuals showed difficulties in all of the cognitive skill areas, other individuals only showed deficits in a few cognitive domains while still, others showed no impairments at all. It was hypothesized by previous researchers that these differences were due in part

because of a multitude of possible pathophysiological networking (Nigg et al., 2005; Sonuga-Barke, 2003; Sonuga-Barke et al., 2010).

Neurological Models for ADHD

The model known as the dual pathway model of ADHD demonstrated the neurocognitive mechanisms involved in the condition. A connection between the inattention and executive functioning deficits found within individuals with ADHD and prefrontal-striatal circuit impairments was observed. Additionally, the model explained that symptoms consistently observed in cases of ADHD hyperactivity were linked to the frontal-limbic system, which was concluded to be involved in the reward response and motivation system of the brain. (Sonuga-Barke, 2003; Sonuga-Barke, 2005). A separate model suggested that poor behavioral adjustments to environmental cues often associated with ADHD originated from insufficient signaling of the prefrontal cortex. This deficient signaling was due to subcortical and posterior systems. In other words, the observed maladaptive behaviors were determined to be the result of the brain's inability to detect discrepancies between current and expected context. Additionally, this model suggested that maladaptive behaviors were due to inefficient top-down control and not necessarily insufficient signaling (Casey et al., 2007; Nigg & Casey, 2005).

Neurological characteristics consistently observed between ADHD patients and their siblings were termed *brain endophenotypes* and were thought to be potential risk factors for ADHD. The activation pattern of the ventral prefrontal cortex, as well as reduced levels of striatal activity, were determined as potential brain endophenotypes

(Durston et al., 2006; Durston et al., 2008). Purper-Ouakil et al. (2011) identified numerous abnormalities associated with the Central Nervous System in individuals with ADHD; however, there remained a lack of information connecting genetic, neural, and cognitive/behavioral symptoms.

Neuroimaging researchers analyzed potential familial patterns of brain structure and function to determine commonalities between ADHD cases. Initial functional magnetic resonance imagining (fMRI) studies analyzed ADHD patients and detected lower inferior fronto-striatal activation when compared to age-matched healthy controls during motor inhibition tasks (Rubia et al., 1999; Vaidya et al., 1998). Despite this knowledge, there was little insight into the neuro-functional differentiation of the various ADHD subtypes. A study by Solanto et al. (2007) determined that children with ADHD inattentive type had larger activation in the middle frontal, temporal, and parietal regions. In addition, it was determined that those children who were predominately hyperactive/impulsive or the combined ADHD subgroup activated the bilateral medial occipital lobe to a greater extent than the children diagnosed as inattentive subtype only. Cross-sectional fMRI research studies showed that adults with persistent ADHD symptoms from childhood presented similar brain activation discrepancies as children with ADHD (Cubillo & Rubia, 2010; Cubillo et al., 2012). Research evidence by Rubia (2018) suggested that basal ganglia deficits were more prominent in ADHD children while frontocortical dysfunctions seemed to persist or become more pronounced in adult individuals with ADHD.

The Mechanisms of ADHD

General Brain Functionality for Attention and Focus

Because one of the two major subcategories of ADHD was directly linked to inattention (American Psychiatric Association, 2013), research established an understanding of *attention* from a definitional perception as well as highlighted the underlying mechanisms involved in attentional skills. Lindsay (2020) reported the concept of attention was difficult to conceptually define due to its multidimensional and multipurpose nature. Attention was defined as the "control of limited computational resources" (Lindsay, 2020, p. 1). Astle and Scerif (2009) defined attention as a person's ability to focus on certain stimuli while choosing to ignore others. Lindsay (2020) further described that attention was a person's overall level of alertness or ability to selectively engage with surrounding stimuli. However, the researcher noted that the amount of energy available to designate towards a task, as well as the control of resources used for attention, individually varied. It was further reported that a capacity to efficiently alter and intentionally route focus was beneficial.

Research studies on attention were traced back to at least the mid-19th century and consisted of knowledge primarily grounded in behavioral studies until neuroimaging techniques brought new information in the 1990s (Yantis, 2008). The concept of attention had multiple terms closely linked to it such as vigilance, or the ability to sustain attention (Lindsay, 2020). Fortenbaugh et al. (2017) discussed vigilance as the maintenance required to complete certain tasks that typically lasted over longer periods such as several

hours or even days. It was determined that any tasks which demanded more time for completion required the presence and preservation of attention for task completion. A separate attention skill was defined by Kröse and Julesz (1989) as *attentional shifting*, or the ability to change focus between stimuli as quickly as possible. Luo and Maunsell, (2019) reported that certain tasks required the implementation of attention-shifting skills that permitted multi-task behaviors and awareness of new stimuli or sequence responses at particular times. Examples of attention were noted to be simple tasks, such as an altered glance, or complex processes necessary to complete multistep or complex goals. Within the applications of attentional maintenance and attentional shifting skills, attention-related concepts were differentiated across timescales, goals, and stimuli.

Origin of the Attention Selection Process

Conclusions about the point of origin for the attention selection process were controversial. It was suggested by some researchers that the selection process originated within the cortical area and was specifically connected with higher processing within the prefrontal and parietal cortices of the brain. From there the selection process branched off into other areas associated with information processing (Bisley & Goldberg, 2010; Moore et al., 2003). However, Krauzlis et al. (2014) suggested that the attention selection process was initiated within the basal ganglia.

Rueda et al. (2004) determined that within each of the different types of attention, the act of pulling focus comprised three steps: alerting, orienting, and executive attention. The *alerting phase* was characterized by the goal of achieving and maintaining activation

of the cognitive systems in response to sensory stimuli. The *orienting network* was observed to select specific information and support the ability to maintain focus. Finally, the *executive control* network received and processed conflictual information. Lindsay (2020) noted that the primary role of the central controller was to prioritize tasks.

Miller and Buschman (2014) explained that to efficiently engage in tasks, a person depended on knowledge gained from previous experiences or contexts. It was further explained that the pairing of sensory stimuli with established knowledge coordinated the multiple systems necessary for efficient task selection. Behavior execution was determined to then be the duty of the executive control network. The executive control network was typically associated with the prefrontal cortex area of the brain. Lindsay (2020) noted the prefrontal regions were associated with top-down visual attention tasks. Furthermore, attention was understood as the output of the executive control system. Selecting the focus of attention and then communicating that information to the appropriate systems was found to be a central function of the executive control system.

Transference System for Attention

Ahissar and Hochstein (2000) described the *reverse hierarchy theory* as the transference system for attention. The reverse hierarchy theory posited that signals received from the input were transferred from higher areas to lower signals, and then continued down the hierarchy to lower signal levels. As such, Lindsay (2020) noted that as attention transcended from each level, the instructions for how attention needed to be

mitigated were then transformed and processed for the next targeted area of the attentional network. It was also reported that throughout the process of attentional processing, several other systems engaged with the executive control system. These other systems included early sensory processing and working memory. The executive control system was reported to be connected conjointly with working memory from previous knowledge that helped guide attentional goals. Moreover, working memory was determined as the loci for sustained activity within the prefrontal lobe.

Visual Attention

Lockhofen and Mulert (2021) referred to the cognitive methods that enabled a person to selectively process incoming information as *visual attention*. The capacities of the visual perception system were determined to be limited, and therefore the ability to focus on specific stimuli required the prioritization of attentional energy expenditures. Beck and Kastner (2005) indicated that visual attention in its most basic form was broken down into voluntary and involuntary. It was determined a person chose to focus their attention on a particular thing or have their attention unintentionally diverted towards something due to stimulus responses. These different forms of attention were observed to be engaged depending on the causation for attention. The involuntary attention process was suggested to be a bottom-up, stimulus driven process that was dependent upon the physical salience of the environment. The authors reported that objects contrastingly variant to the environment due to specific colors or motions allowed for the object to compete more effectively than surrounding stimuli. Luo and Maunsell (2019) discussed

that something as simple as a light coming on or movement through a doorway engaged a person in an attentional shift. Involuntary attention, also known as *nonselective attention*, was determined to be connected to levels of effort or arousal necessary for producing and sustaining performance at a variety of tasks.

Luo and Maunsell (2019) referred to the second type of visual attention as voluntary, or as *selective attention*. This form of attention was suggested to be a top-down system guided by the internal and behavioral goals of the individual. An example was observed when a person chose to focus their attention on a specific stimulus to achieve a certain task, located an object, or examined a significant stimulus feature. Yantis (2008) indicated additional variables that impacted a person's attention capabilities included the unexpectedness surrounding a stimulus as well as a person's previous experiences.

Carrasco and McElree (2001) stated that voluntary attention contrasted with involuntary attention in that it was a selective process. The researcher also reported that biologically, visual attention selection practices were important to analyze due to the limits of a person's ability to process stimulating information. In other words, it was determined that there was only so much that an individual's eyes saw and transmitted into visual information input for the brain to process. Additionally, the ability of a person to give attention to something was determined to be limited by the fixed available energy from the brain due to the high-energy cost of the neuronal activity required for cortical computation. Researchers determined that a brain only had a limited ability to process

incoming information (Lennie, 2003). A concept known as the *biased-competition hypothesis* suggested that stimuli within the visual field engaged neuron groups that then participated in competitive interactions at the intracortical level. Desimone and Duncan (1995) determined that the competition was dominated by neurons involved in encoding information to that specific stimulus. In addition, the researchers determined some neurons involved in encoding information to the visual stimuli became more activated while other neurons became suppressed.

Physical Movements Associated with Attention

Luo and Maunsell (2019) subdivided attention based on the physical movements of the individual. The two forms of attention associated with physical movements were classified as *covert* and *overt attention*. Overt attention was reported to be observable movements and covert attention involved unobservable body shifts. Examples of overt movements included eye movements toward a certain location. Kowler (2011) determined overt attention eye movements were sequential in nature. A provided instance of covert attention was a person paying attention to areas in their peripheral views without physically directing their gaze toward the stimuli. Covert attention allowed individuals to monitor surroundings while information was provided for subsequent eye movements. A unique aspect of covert attention discovered was that it was a skill that can be deployed to multiple locations simultaneously (Luo & Maunsell, 2019).

Involuntary vs. Voluntary Neural Systems

Corbetta and Shulman (2002) reviewed the different anatomical and functional

differences between the involuntary and voluntary systems associated with attention. The researchers proposed within the voluntary, or top-down system, a dorsal frontoparietal system. The involuntary system was suggested to be controlled by a ventral frontoparietal system and helped to process unexpected stimuli as well as attentional shifts. Vossel et al. (2014) determined that within the dorsal network of the voluntary system, the intraparietal sulcus (IPS) and the frontal eye fields (FEF) were located in each hemisphere. The network comprised of the IPS and the FEF was organized bilaterally and Posner et al. (1980) concluded the network was activated when attention shifted. Vossel et al. (2014) further reported that within the ventral network linked to the involuntary attention system, the temporoparietal junction (TPJ) and the ventral frontal cortex (VFC) responded when unexpected stimuli arose outside the focus of spatial attention.

Working Memory Impacts Attention

Established connectedness observed between executive control, working memory, and attention highlighted that material within working memory impacted attention. The influence of working memory proved true even within experimental situations when it was not beneficial for an individual during task completion (Soto et al., 2008). A previous research study by Soto et al. (2006) determined that if a subject was asked to maintain a particular object within their working memory while also simultaneously performing a visual search for a different object, the stored object within the working memory negatively interfered with the search. Results indicated that working memory impacted the executive control of attention. However, additional research showed that

while all objects in working memory influenced attention, the executive controller chose which items in working memory had priority (Oliver et al., 2011).

Improving Attention Skills

Kelley and Yantis (2010) researched the capability to willfully change attention or sustain attention. The results of the study concluded individuals increased their ability to suppress irrelevant information. The research suggested that individuals had greater generality of this skill depending on previous skill training. This suggested that with time and skill building, an individual could increase their ability to improve focus. Through the use of neural imaging techniques, it was determined that the changes observed with learning did not occur within the sensory pathways, but in the areas closely linked with attentional control. This suggested that skill building of the attentional control aspects of the brain increased the capability of learning overall.

Causations of ADHD

Purper-Ouakil et al. (2011) concluded that the variability observed in ADHD symptoms was related to the numerous proposed causal pathways as well as the complexity of the factors involved in symptom expression. Previous research by Faraone et al. (1994) attempted to determine the causations of the disorder. The findings identified variables from a diversity of sources. Genetically, it was determined that close family relatives of individuals with ADHD had a higher chance of also having the disorder. Continued research by Faraone et al. (2004) examined ADHD symptoms in twin studies to determine the role that genetic and environmental variables played in the wide variety

of symptom phenotypes. The results of this research showed that genetic influences majorly contributed to ADHD symptom variance. It was estimated that genetics played a role in 76% of pediatric ADHD variability and about 30% of adult symptom changeability. Nikolas and Burt (2010) found variability in how significantly genetics impacted inattentive versus hyperactive ADHD symptoms after interactions of gene alleles across and within loci were examined. It was concluded that there was a stronger genetic influence on predominant inattention cases versus hyperactivity.

Purper-Ouakil et al. (2011) found several environmental factors linked as risk factors for ADHD. Talge et al. (2007) reported some of these variables occurred before birth *in utero* and included factors such as maternal stress. Other proposed variables included exposure to toxins such as tobacco and alcohol (Ribas-Fitó et al., 2006), birth complications (Pineda et al., 2007) as well as low birth weight and prematurity (Bhutta et al., 2002; Strang-Karlsson et al., 2008). An external factor that increased the likelihood of a child developing ADHD symptoms was exposure to industrial toxins, such as lead. A research study by Nicolescu et al. (2010), suggested that increased levels of lead correlated with a higher likelihood of elevated scores for parent and teacher rating assessments in relation to a child's hyperactivity, impulsivity, and overall ADHD scores. An early traumatic experience during early childhood years (i.e., 24–48-month-old children) was found to increase the likelihood of ADHD, by a factor of three (Briggs-Gowan et al. 2010).

Neurological Causations of ADHD

Considering neurological factors, the DSM-5 explained that children with ADHD displayed slower-wave electroencephalograms when compared to a norm population (American Psychiatric Association, 2013). Physiologically, the frontal and parietal cortexes, the basal ganglia, the hippocampus, the corpus callosum, and the cerebellum regions of the brain were all found to be affected by ADHD (Giedd & Rapoport, 2010). Castellanos et al. (2002) examined the brain on macrostructural levels and found smaller volumes in all areas of the brain for children and adolescents who had ADHD. A longitudinal study by Makris et al. (2009) determined that there was a significant developmental delay of cortical thickness in participants with ADHD when compared to a control group. The greatest difference between the control group and those individuals with ADHD was found to be in the maturation of the middle prefrontal cortex. In addition to insufficient gray matter structures, Chen et al. (2016) found impairments within white matter tracts in ADHD cases predominately in the fronto-striato-cerebellar as well as the fronto-posterior and interhemispheric tracts. Amico et al. (2011) suggested most volume differences observed in younger ADHD individuals tended to normalize through the transition into adulthood.

Diagnostic Criteria

The most current version of the DSM established that a childhood onset of ADHD symptoms was required for an adult to be diagnosed. It was determined that of the listed common symptoms associated with ADHD, a child must have displayed six or more from

each of the different subtypes for a diagnosis. For older patients, adolescents and adults must have presented at least five associated symptoms. The identified symptoms must have persisted for at least six months and experienced to a degree that was abnormal for the person's developmental stage. In addition, the displayed symptoms must have caused impairment directly to the person's social, academic, and/or occupational activities (American Psychiatric Association, 2013).

Typical comprehensive psychological assessment processes for ADHD diagnosis were conducted in such a manner as to compare the client's presented behaviors against the symptoms listed in established literature such as the DSM-5 (Epstein & Loren, 2013). A study by Matte et al. (2015) sought to determine the reliability and validity of the DSM-5 in ADHD determination within adult populations. This study was proposed due to the 2013 ADHD changes in the DSM-5 from the DSM-IV. Research on the development of the DSM-5 indicated that ADHD was not among the disorders assessed in field trials within adult populations (Batstra & Frances, 2012). The major changes of the DSM-5 included the addition of four new impulsivity symptoms and a reduction in the number of symptoms required for assigning an ADHD diagnosis. The study included 133 adult subjects, 68 of which were ADHD cases, while the others were non-ADHD participants used as the experimental control group. The results of the research suggested that the new symptoms added for impulsivity did not improve ADHD diagnosis within adult populations enough to overcome the potential negative effects of the altered criteria. However, the reduction of presented symptoms provided a more effective cutoff point for

identifying adults who were impaired (Matte et al., 2015).

Research by Kitzrow (2003) analyzed the use of mental health services within university settings and determined that the severity of psychological problems experienced by college students before attending college grew in severity and frequency within the higher education setting. As such, the need for provided mental health services within the college university setting increased over previous decades and persisted as a necessity. These findings aligned with data by Ahn et al. (2014) which discussed the necessity for psychometrically sound assessment tools within college-aged student assessment services.

Establishing a valid approach to assessments was important for accurate diagnosis determinations. It was communicated that the accuracy of the diagnosis needed to be ensured despite client uniqueness. Thus, the goal of psychological testing was determined by researchers such as Adesman (2001) as a process to establish diagnostic homogeneity so that etiological and prognostic consistency could be achieved. It was also indicated that a clear diagnosis was important for the determination of disability services, special education eligibility, or accommodations. Additionally, diagnoses served as a guide to treatment goals, progress monitoring, and case outcome.

Assessment Strategies for ADHD Determinization

Important components of a comprehensive clinical assessment process for an ADHD diagnosis were determined to include a thorough review of patient history, clinical interviews, observations, and information about previous physical examinations

(Adesman, 2001). Eckert et al. (2000) suggested that the assessment process was most useful when it was conducted in a multifaceted approach that included observation, interviews, valid and reliable self-report instruments, and informant reports from other respondents. Adesman (2001) also concluded that when applicable, data from reviewed school/work records were also important to gain information regarding previous behavior patterns, academic performance, and school attendance. Additionally, information gathered from sources such as parents, teachers, or other family members helped obtain significant diagnostic data.

When considering which assessment strategy to use in ADHD diagnosis determination, there were several considerations. One strategy proposed by the American Psychological Association (APA) assessment guidelines was the initial step of data collection from referral forms (APA Task Force on Psychological Assessment and Evaluation Guidelines, 2020). According to the guidelines, psychological assessments were frequently supplemented with information taken from referral questions. Psychologists tried to gather client competency, needs, and purpose for assessments through referral responses. Additional data collected through the referral questions included the characteristics of the client. Collectively, referral responses guided the types of psychometric data collected and influenced which supplemental socioemotional measures were considered. The APA assessment guidelines cautioned the clinician that without knowledge of the referral information, a complete comprehension of the evaluation need and purpose could not be attained. Furthermore, the guidelines suggested

that without this understanding, the examinee's characteristics, chosen instrument appropriateness, assessment context, interpretation, and results application were more likely to be limited and/or inaccurate. As such, the APA guidelines claimed that psychologists needed to consider the reason for testing as well as how the anticipated assessments connected to the referral question.

Assessment Validity and Reliability of Measures

Andrade (2018) discussed there were several important factors to consider when determining appropriate assessment strategies. The researcher suggested that these considerations included assessment reliability and validity. The concepts of reliability and validity were important factors when assessment strategies such as rating scales and screening tools were used. Reliability was established as the consistency with which an assessment was able to obtain results. For example, if an assessment measuring depression was administered to the same patient within a short period, a measure of reliability measured the similarity of the two scores. Pelham et al. (2005) explained assessment reliability considerations included internal consistency, test-retest reliability, and interrater reliability. Internal consistency was determined to be the relation between each of the items within the scale. Test-retest reliability was reported as the temporal stability and interrater reliability was indicated to be the consistency between different raters' scores. Gronlund (1965) argued that reliability did not look at the assessment as a whole, but instead analyzed the specific results obtained within an evaluation. Gronlund (1965) stated:

> any particular instrument may have a number of different reliabilities, depending on the group involved and the situation in which it is used. Thus, it is more appropriate to speak of the reliability of ‘the test scores/ or of ‘the measurement/ than of ‘the test/ or ‘the instrument. (p. 80)

Researchers determined assessment validity evaluated concurrent, predictive, convergent, and discriminant validity (Pelham et al., 2005). Validity was determined to be an evaluation of whether an assessment accurately measured the intended data. For example, the validity values reflected if an assessment designed to detect depression symptoms did so with high sensitivity and specificity (Andrade, 2018). Concurrent validity was established as the relationship between the chosen assessment and similar measurement tools. Predictive validity measured whether the assessment tool was able to accurately discriminate different data sets. Convergent and discriminant validity were referred to as the comparison of the assessment tool to others in the sense of correlation with measures intended to assess the same data and no correlation with measures intended to assess different goals. For validity measurement to be implemented and understood, target data had to be established (Campbell & Fiske, 1959). For example, assessments for ADHD included target behaviors such as attention, impulsivity, hyperactivity, social relationship difficulties, academic achievement, and child-parent relationships (Reynolds & Kamphaus, 1998).

In previous research, Nowinski et al. (2007) suggested that one assessment used to assess psychological conditions within college-aged populations was the Behavior

Assessment System for Children-2 Self-Report of Personality, College Version (BASC-2-SRP-CV; Reynolds & Kamphaus, 2004). The BASC-2 SRP-CV was designed to be a multidimensional measure of behavior and personality that assessed both adaptive and maladaptive characteristics of college students (Reynolds & Kamphaus, 1992). The study by Nowinski et al. (2007) determined the convergent and discriminant validity scores of the BASC-2 SRP-CV scales. This was achieved when the BASC-2 SRP-CV scores were compared to similar assessment scores from alternative psychometric scales. The comparison assessments used were the Personality Assessment Inventory (PAI; Morey, 1991) and the Adult Self-Report (ASR; Achenbach et al., 2003). The study was distinctive due to it being the first independent evaluation of test-retest reliability and construct validity of the BASC-2 SRP-CV with clinical and nonclinical (NC) groups of college students. The results of the study showed the selected BASC-2 SRP-CV scales were related to conceptually similar scales on the PAI and ASR. However, the researchers suggested that significant correlations were observed within conceptually dissimilar scales, which indicated a lack of specificity in the self-report measures included in the study. As such, it was discussed by the researchers that the results of the study highlighted the diminished ability of such measures to distinguish among some domains of psychopathology.

The importance of reliability within psychological assessments was reported by Reynolds (1989) in the quote “reliability may be the single most influential of psychometric concepts because of its relationship to all other psychometric

characteristics. It is the foundation of validity, and classical psychometric theory is known as reliability theory" (p. 211).

He also reportedly expressed the need for assessments to reflect the diversity observed within a population by stating "all neuropsychological measures must be evaluated for effects related to culture, ethnicity, gender, and other nominal variables as findings in this area do not generalize well across tests or necessarily across nominal groupings" (p. 206).

ADHD Assessment Components

Clinician-Client Rapport

Previous studies determined patients who entered a new provider-client relationship experienced feelings of heightened stress. In patient care, the initial interactions of a patient-provider encounter were found to be vitally important for trust and rapport. Research suggested that relationships anchored in trust and rapport supported better healthcare experiences as well as alleviated feelings of anxiousness and distress (Dean & Street, 2014; Thorne et al., 2005). Additionally, it was determined that strong initial relationships helped enhance a patient's involvement in decision-making about their care (Shepherd et al., 2008).

Dang et al. (2017) designed a research study around the idea that the first patient interaction impacted treatment-relevant outcomes. The purpose of the research study was to supplement the lack of information on what new patients sought in their initial treatment visit as well as how the concerns of new patients differed from those of

established patients. It was noted by the study that patient-centered care was a critical component of a positive patient care experience. A study that examined patient-centered communication strategies determined that trust and rapport were essential to creating positive patient-provider relationships (Epstein & Street, 2007). As such, the intake interview a psychologist conducted with a client was critical to the overall effectiveness and success of the psychological assessment process.

Interview Data

There were three main types of interview strategies that clinicians implemented to collect client information: unstructured, semi-structured, and structured interviews (Mueller & Segal, 2015). In addition to the information provided by the client, the clinicians also gathered data through direct observation of social interaction skills, language skills, and communication skills during any of the three types of interviews (Sattler, 2008). An unstructured interview was presented as a free-flowing conversation that had no set parameters for selected topics of conversation emphasis. Research suggested that when clinicians used unstructured interviews only, there was an increased risk of hasty diagnoses or reduced diagnosis options, and therefore comorbid conditions were missed. It was further suggested by Mueller and Segal (2015) that trainee clinicians or masters or doctoral (MA/Ph.D.) level students in practicum settings who conducted unstructured clinical interviews gathered information about only a few common mental disorders with which they were most familiar. The researchers also explained that structured interviews differed significantly from unstructured interviews in that there was

a standardized list of questions as well as a set order of follow-up questions that were used by the interviewer. The exact phrases of probes, identical follow-up questions, and a systemized approach for rating client responses were all techniques implemented within structured interviews. When all of these characteristics were implemented with fidelity, clinicians did not deviate despite the individual case or expected diagnosis.

Established by APA, the semi-structured interview, also referred to as patterned interviewing, was a type of interview that focused on certain specific areas such as work history, education, and living conditions which also allowed the interviewer a chance to deviate from the conversation into other interest areas. The need for these diversions allowed the interviewer to ask clarifying questions or cultivate information channels that needed elaboration (APA, 2022). For example, the interviewer had the flexibility to amend or augment the provided questions with individualized probes to more accurately gather data regarding diagnostic information (Mueller & Segal, 2015)

In cases that involved a potential ADHD diagnosis, personal history gathered in either the referral forms or intake interviews provided the clinician with information about the client's habits, daily schedule, and patterns of typical behavior that potentially supported conditions such as ADHD. For example, the use of prescription, over-the-counter, and illicit drugs was information that was important in determining ADHD (Adesman, 2001). The goals of the interview were to gain information about developmental patterns, present behavior severity, emotional problems, presented functional skill levels, personal strengths, and determination of symptom onset. In

conjunction with data gathered from the client themselves, information collected from other family members provided important additional data regarding the sociodynamics of relationships (Srinath et al., 2019).

Research indicated that substance abuse of marijuana, cocaine, ecstasy, and caffeine elicited symptoms of poor attention or impulsivity. The effects of these substances on the hippocampus and prefrontal cortex areas of the brain produced behaviors that appeared to be similar to ADHD symptoms (Gouzoulis-Mayfrank, 2000; Hanson et al., 2010). Additionally, information gathered during these interviews suggested that even if the client was not abusing these substances at the time of the research, they could have been exposed to these substances prenatally. One research study examined how prenatal cocaine exposure impacted brain structures as well as neurobehavioral presentations. The researchers compared cocaine-exposed children with an unexposed control group. Images of brain activity were evaluated with MRI imaging techniques. The researchers looked not only for structural differences between the groups, but levels of N-acetyl compounds (NA), total creatine (Cr), chlorine-containing compounds, myoinositol, and glumate + glutamine. These variables were analyzed within the frontal matter and striatum areas of the brain. Children within the group of prenatal cocaine exposure in utero showed higher levels of Cr within the frontal white matter. The results of the findings suggested that prenatal exposure to cocaine resulted in a long-term impact on the metabolic function of the frontal regions of the brain which in turn affected impulse control, sustained attention, and goal-directed behavior (Smith et al., 2001).

Information gathered about an individual using certain medications, such as anticholinergics, alerted clinicians of compounds that potentially contributed to attentional deficits in certain patient populations (Bhatia, 2016). Additionally, intake forms inquired about vision and hearing problems as well as most current evaluations. This was particularly important in determining whether the observed skill deficits existed due to sensory issues or other psychological conditions like ADHD (Adesman, 2001).

Diagnostic Interview

A separate type of interview, which was helpful as clinicians determined specific diagnostic criteria, was indicated as a diagnostic interview. The APA dictionary defined diagnostic interviews as a strategy that a clinician engaged in to investigate a client's presenting problems, explore current situations, and gather background data. The goal of the diagnostic interview was to formulate a diagnosis and prognosis (APA, 2022). During the diagnostic interview, the clinician focused the questions on specific diagnostic criteria while simultaneously relying on the client's explicit endorsement of each diagnostic criterion. The diagnostic criterion followed the requirements and standards taken directly from the DSM-5 for each corresponding diagnosis. The clinician took the DSM-5 diagnostic criteria and formulated structured questions. A review of research demonstrated that clinicians have relied on the diagnostic interview process since the 1970s. This approach was considered the gold standard to increase diagnostic reliability and minimize clinical judgment that resulted in inaccurate diagnoses. Diagnostic assessment procedures were needed to produce reliable data across different cases and to

confirm the results were valid and clinically meaningful (Drill et al., 2015).

Rating Scales

In addition to the qualitative information gathered through referral forms, intake interviews, and diagnostic interviews, clinicians also quantified a client's symptoms by having the client complete rating scales, neurological assessments, or screener questionnaires. Self-reporting rating scales of ADHD have been used to diagnose and measure treatment outcomes since the 1960s (Conners, 1969; Goyette et al., 1978; Quay & Peterson, 1983). Assessments of symptom ratings were frequently relied upon during diagnostic processes due to the low financial cost of the questionnaires as well as the efficient aspects of gathering information about specific symptomology (Volpe et al., 2011).

Despite the wide use of rating scales in ADHD determination, in cases that involved adult clients, the validity and accuracy of self-reported information were called into question due to the client having to recall childhood symptom severity (Shaffer, 1994). A more recent research study measured the concordance of reported DSM-IV ADHD symptoms self-reported by adult participants and the reported symptoms provided by a separate informant. The sample size of the study included 281 students with reported academic difficulties. Of the participant sample, 34% of the individuals had previously received a clinical diagnosis of ADHD. The results demonstrated that there was a Moderate concordance found between the self-informant ratings as well as the childhood symptoms. It was determined that in regards to childhood and current symptom severity,

patients with ADHD disagreed more with the informant information than did the non-ADHD participants. The results also suggested that adults with and without ADHD tended to underreport inattention problems compared with the informant group. Additionally, it was determined that individuals with ADHD and informants both reported hyperactivity/impulsive symptomology in childhood equally well (Zucker et al., 2002).

The World Health Organization published the Adult ADHD Self-Report Scale v1.1 (ASRS v1.1) and it was determined to be the most widely used screening tool for ADHD cases that involved adults. The ASRS v1.1 consisted of six questions covering inattentive and hyperactive-impulsive symptoms. There was a predetermined threshold of four or more reported symptoms that determined probable ADHD. The reported scores were based on the number of questions that met the criteria of an endorsed answer of sometimes/often/very often for questions one through three. In addition, the participant endorsed often or very often for questions four through six. Validation measurements indicated that the ASRS v1.1 had a sensitivity of 69.7% and specificity of 99.5% for the detection of ADHD (Kessler et al., 2005).

A meta-analysis by Marshall et al. (2021) reviewed previous research that looked at the sensitivity and specificity of several ADHD rating scales and found seven studies that reported the diagnostic accuracy of ADHD scales in differentiating adults with ADHD from adults with psychiatric disorders. The results of the study found that the Brown Attention-Deficit Disorder Scales (Brown, 1996) had a sensitivity of 92%, but a

specificity of only 33% in differentiating adults with ADHD (and some comorbid disorders) from adults with anxiety and depression disorders (Solanto et al., 2004). The Barkley Adult ADHD Rating Scale – Fourth Edition (BAARS-IV) self-report inattention summary score had a sensitivity of 76% and specificity of 71% in differentiating those with ADHD and depression. Dunlop et al. (2018) noted the ASRS v1.1 had a sensitivity of 60% and specificity of 69% in distinguishing patients diagnosed with major depression and ADHD versus patients with only a major depression diagnosis. Luty et al. (2009) found the Conners' Adult ADHD Rating Scales (CAARS) had a sensitivity of 97% and specificity of 83%. Results suggested, with the possible exception of the CAARS, self-report ADHD behavior rating scales alone did not have good diagnostic accuracy.

Neurological Assessment Strategies

In addition to other assessment strategies, it was recommended for ADHD evaluations that a neurologic examination be conducted to rule out central nervous system faults or any progressive neurologic conditions. A neurologic assessment needed to include a screener for motor coordination, visual-perceptual skills, language skills, and cognitive functioning. Subtle neurological abnormalities were not found to necessarily be diagnostic for ADHD. Neurological deficits were found in populations with learning disabilities, psychoses, and autism as well as in individuals with developmental disorders (Adesman, 2001).

The Wisconsin Card Sorting Test (WCST) was the most commonly implemented neurological assessment used in the determination of ADHD (Rabin et al., 2016).

Developed by Grant and Berg (1948), the WCST was used to assess abstraction and a person's capacity to shift cognitive strategies in response to changing stimuli. As such, the WCST was used to measure EF levels (Strauss et al., 2006). Within the WCST, the individual was presented with four stimuli cards of different shapes and colors. The individual also received response cards that were categorized by color, shape, and number. The participant was then presented with the task of matching each of the response cards to one of the stimulus cards. Feedback was then provided to the participant on correctness. This activity required the individual to build cognitive structures as well as levels of abstraction. Once the participant established the cognitive set, they needed to maintain consistency in their responses. Overall, the task provided clinicians with information about participants' EF by measuring abstract reasoning and cognitive shifting strategies as the participant responded to alternating task contingencies (Kopp et al., 2019). The WCST was implemented within clinical practices to study not only abstract reasoning within adult populations but also to measure brain dysfunctions that affected the frontal lobe regions (Lezak, 1983).

Screener Questionnaires: The BASC-3 System

Screener questionnaires were implemented by psychologists as a tool to help guide decision-making processes on symptom areas that needed further query or assessment. The Behavior Assessment System for Children (BASC) was formulated as a screener and designed to be a multidimensional, multimethod means of evaluating client behavior and self-ratings. The BASC was considered multidimensional because it

measured characteristics associated with clinical and adaptive behaviors (Flanagan, 1995). Research determined that the Behavior Assessment System for Children Self Report of Personality (BASC-SRP) was commonly used within assessment settings due to its highly comprehensive nature (Mahan & Matson, 2011).

The BASC was created in 1992 but then evolved to the third edition (BASC-3) which included several different components. The established BASC-3 system included nine components: the Behavioral and Emotional Screening System (BESS), Teacher Rating Scales (TRS), Parent Rating Scales (PRS), Self-Report of Personality (SRP), Structured Development History (SDH), Student Observation System (SOS), Behavior Interpretation Guide, Flex Monitor, Parenting Relationship Questionnaire (PRQ), and the Behavioral and Emotional Skill Building Guide. When used collectively, the results from the different parts of the BASC-3 informed diagnoses found within the DSM-5. Some of the major benefits of the BASC-3 system included its strong scientific rigor as well as its ability to detect threats to response validity (Reynolds & Kamphaus, 2015).

The BASC–3 Structured Developmental History (BACS-3 SDH) was designed to gather information about the client's social, psychological, developmental, educational, and medical information. The BASC-3 SDH was intended to gather information that could be used in the diagnostic determination as well as treatment options. It was created to be conducted as a structured interview or as a questionnaire (Reynolds & Kamphaus, 2015). The SDH was formatted as a 12-page survey and was estimated to take approximately 30 minutes to complete depending on the amount of information the client

recalled. The data collected was projected to determine the need for further assessment (Reynolds, & Kamphaus, 1992, 1998). Research suggested that the SDH was perhaps most useful within the initial stages of the assessment process as it generated questions of information that were not routinely asked or produced opportunities for follow-up questions that expanded upon provided information (Gladman & Lancaster, 2003). The SDH was previously criticized because it was not incorporated within the development or standardization of the BASC system (Jones & Witt, 1994). Additionally, there was not much information found within the manual that provided interpretation guidelines for the client's responses (Sandoval & Echandia, 1994). It was suggested that the BASC-SDH could be improved with the inclusion of questions related to the participant's family ethnicity, and country of origin (Gladman & Lancaster, 2003).

The BASC-3 system also included the SRP. The SRP was broken down into several different age-level forms: child (ages eight through 11), adolescent (ages 12 through 21), and young adult attending a postsecondary school (ages 18 through 25). The provided items included both *True/False* questions and a four-point scale of frequency that ranged from *Never* to *Almost Always.* The estimated completion time for the BASC-3 SRP was about 30 minutes and the results were helpful in clinical diagnoses based on criteria within the DSM-5. Within the college version of the SRP, the participant answered questions that identified behavioral and emotional conditions that interfered with academic performance. The major benefit of the SRP was that it provided the clinician with a tool to measure the inner thoughts, feelings, attitudes, and internal

reactions to people and events. The BASC-3 also measured several validity indexes that helped the clinician know the quality of the responses. The validity index measured factors such as failure to pay attention, carelessness, portraying oneself in an overly negative or positive light, lack of motivation to answer truthfully, and poor comprehension.

The released BASC-3 SRP – College Form (BASC-3 SRP COL) contained four composite scores: Internalizing Problems, Inattention/Hyperactivity, Emotional Symptoms Index, and Personal Adjustment. Within the internalizing problems' composite score, there were seven individual scales measured: Atypicality, Locus of Control, Social Stress, Anxiety, Depression, Sense of Inadequacy, and Somatization. Within the Inattention/Hyperactivity composite score, the BASC-3 SRP COL measured a person's level of Attention Problems and Hyperactivity. The Emotional Symptoms Index measured a person's levels of Social Stress, Anxiety, Depression, Sense of Inadequacy, Self-Esteem, and Self-Reliance. Finally, the Personal Adjustment composite score measured a person's Relationship with Parents, Interpersonal Relations, Self-Esteem, and Self-Reliance.

The established score interpretation of the BASC-3 took the scores within each of the different subscales and produced Probability, Functional Impairment, and EF indices. Within the probability index, the BASC-3 provided results for ADHD likelihood. The ADHD Probability Index was derived using samples of participants identified with the condition. The individual items that were flagged as corresponding with ADHD were

included based on the magnitude of effect size, the effect size across different clinical groups, and the clinical importance of the item. The Functional Impairment indices were created by a comparison of differences observed in the numerical scores of participants within an ADHD group and individuals who were not labeled as ADHD. Particular interest was made in items that related to everyday functioning such as relationships and emotional regulation. The Executive Functioning Index was established by the identification of items as one of four executive components: Problem-Solving, Attentional Control, Behavioral Control, and Emotional Control.

When the BASC-3 SRP normative comparisons were conducted, data from 900 participants were gathered from April 2013 through November 2014 by 311 examiners across 44 states. The sampling controlled for sex, race/ethnicity, geographic area, socioeconomic variables, and special education factors, but not for age. The coefficient alpha reliabilities for the BASC-3 SRP COL composites were .95 and .86 for the clinical and adaptive scales. The test-retest reliabilities for the SRP COL composites were .92 and .84 for the clinical and adaptive scales. While correlation scores of the BASC-3 SRP COL presented similar patterns with other assessments, none of the assessments fell within the category of appropriate college-aged individual assessments. Instead, all of the comparison assessments, except for the BASC-2 data, provided comparison data for individuals younger than college-aged individuals (Reynolds & Kamphaus, 2015).

Rationale

The purpose of this study was to determine the classification accuracy of the

BASC-3 Inattention/Hyperactivity composite *t*-score within a college-aged population.

Hypothesis

The following was the specific hypothesis tested in this study:

I. The BASC-3 Inattention/Hyperactivity composite *t*-score will show strong classification accuracy for ADHD diagnosis.

CHAPTER III: Method

Development of this study required a thorough understanding of ADHD within a college adult population, different diagnostic methods, and knowledge of variables such as ADHD comorbid conditions that may distort the client's condition determinization. Critiques of adult ADHD assessment suggested that adult perceptions of childhood symptoms may have lacked validity. As such, the validity of certain assessment strategies such as the BASC-3 came into question. As mentioned, the purpose of this study was to determine if the BASC-3 broadband assessment was a valid predictor of ADHD diagnosis within a college student population.

Participants

Participants for the study included college-aged individuals attending a regional comprehensive institution of higher education. Predicted demographics for the participants reflected that of the university student body (approximately 60% White, 18% Hispanic, 15% Black, 1% Asian, 6% Other, and 70% Female) (Stephen F. Austin State University, 2022). Archival case files dating from 2013-2022 were incorporated into the study. All case files with completed reports filed within the Stephen F. Austin State University School Psychology Assessment Clinic during the designated time frame were included in the review. Exclusionary factors included case files that did not have a completed report. Appendix A presents the Institutional Review Board (IRB) approval form which denotes that the data collection process for this study was reviewed and

approved by the IRB board.

Participant BASC-3 and ADHD Diagnosis Data Collection

Data on BASC-3 scores was collected in order to gather information from at least 30 individuals. All of the files were reviewed for the following information: Inattention/Hyperactivity composite score on the BASC-3 and an ADHD diagnostic impression. Each participant file under review was coded as Clinically Significant (CS) if the individual obtained a BASC-3 Inattention/Hyperactivity composite *t*-score of 70 or higher. The file was coded as Not Significant (NS) if the BASC-3 Inattention/Hyperactivity composite *t*-score was less than 70. Each file was also coded as either diagnosis positive (DP) if the individual received an ADHD diagnosis, or diagnosis negative (DN) if the individual did not receive a diagnosis.

Procedure

A review of case files from the Stephen F. Austin State University (SFASU) School Psychology Assessment Center (SPAC) was completed. Inclusive factors were cases of college-aged students (ages 18-25) seeking psychological assessments which have a signed, completed client report containing a diagnostic impression section. After identifying completed reports of college-aged individuals, the files were reviewed for a collection of the BASC-3 Inattention/Hyperactivity *t*-score and diagnostic impressions information. After collecting the BASC-3 *t*-scores and the diagnostic impression for each of the individual files, the cases were coded as one of four results: (a) True Positive if the file contained a Clinically Significant score and a Diagnosis Present; (b) True Negative if

the file was coded as Not Significant and Diagnosis Negative; (c) False Positive if the BASC-3 score was Clinically Significant, but then the diagnosis was Diagnosis Negative; (d) False Negative if the participant's BASC-3 score was Not Significant, but the diagnosis determination was Diagnosis Present.

Design

This study was a quantitative mixed methods design. The study reviewed SFASU SPAC cases of college-aged students with signed, completed reports containing diagnostic determinations. The BASC-3 Inattention/Hyperactivity composite *t*-score and diagnosis determination for each report were coded. Next, it was determined for each case whether or not the BASC-3 Inattention/Hyperactivity composite *t*-score had classification accuracy. A lack of classification accuracy was determined if the case resulted in a false positive or false negative. For false positive and false negative cases, further investigation was done to determine what factors apart from the BASC-3 Inattention/Hyperactivity composite *t*-score were better predictors of an ADHD diagnosis.

CHAPTER IV: Results

Demographics

Before conducting the analyses, the sample of SFASU SPAC cases was described in terms of demographic variables. The number of cases included in the data analysis consisted of 70 completed reports of college-age individuals who had completed the BASC-3 SRP COL. The cases were then divided into four diagnosis classifications: true positives, true negatives, false positives, and false negatives. The division of groups resulted in 21 true positive cases, 32 true negative cases, nine false positive and eight false negative cases.

Within the True Positive (TP) group (N = 21), 42.9% of the participants were 18-19 years of age, 42.9% were 20-21 years of age, 9.5% were 22-23 years of age and 4.8% were 24 years of age or older. The ethnicity of the TP participants was reported to be 4.8% Hispanic, 4.8% Asian, 47.6% White, 9.5% Black, 0% Other, and 33.3% Not Indicated. Females consisted of 57.1% of the group while males comprised 42.9%. The results also indicated that 38.1% of the group had a previous diagnosis and 61.9% did not, while 33.3% of the participants reported currently taking medication while 66.7% did not.

The ages of the True Negative (TN) group (N = 32) consisted of 18.8% 18-19 years of age, 46.9.5% 20-21 years of age, 18.8% 22-23 years of age, and 15.6% 24 years of age or older. The ethnic diversity was reported to be 3.1% Hispanic, 0% Asian,

28.1% White, 21.9% Black, 6.3% Other, and 40.6% Not Indicated. Female participants consisted of 75%, male participants 21.9% and 3.1% reported as other. Reported diagnosis consisted of 59.4% of the participants while 40.6% reported no previous diagnosis. Concerning medication, 87.5% reported they did not take medication while 12.5% reported they did take some form of medication.

The False Positive (FP) group (N = 9) had an age breakdown of 33.3% within 18-19 years of age, 22.2% within 20-21 years of age, 33.3% within 22-23 years of age, and 11.1% within 24 years of age or older. The ethnicity prevalence of the group was reported to be 11.1% Hispanic, 0% Asian, 55.6% White, 11.1% Black, 0% Other and 22.2% Not Indicated. Females consisted of 88.9% of the group while 11.1% were male. Within the group, 33.3% of the participants indicated a previous diagnosis while 66.7% reported no previous diagnosis, 22.2% reported they took medication and 88.9% reported they did not take medication.

The False Negative (FN) group (N = 8) consisted of 25% 18–19 years of age, 37.5% 20-21 years of age, 25% 22-23 years of age, and 12.5% 24 years of age or older. The ethnicity of the group was reported to be 0% for Hispanic, Asian, Black, and Other while 75% reported as White and 25% as Not Indicated. The group consisted of 75% females and 25% males. The presence of a previous diagnosis included 75% of the group while 25% of the group did not note a previous diagnosis. Regular medication use was reported by 50% while 50% of the group did not indicate medication use. Please see Table 1.

Table 1

Descriptive Statistics for the Final Sample

	True Positive (*N* = 21)	**True Negative (*N* = 32)**	**False Positive (*N* = 9)**	**False Negative (*N* = 8)**
	N (Percentage)	*N* (Percentage)	*N* (Percentage)	*N* (Percentage)
Age				
18-19	9 (42.9%)	6 (18.8%)	3 (33.3%)	2 (25%)
20-21	9 (42.9%)	15 (46.9%)	2 (22.2%)	3 (37.5%)
22-23	2 (9.5%)	6 (18.8%)	3 (33.3%)	2 (25%)
24+	1 (4.8%)	5 (15.6%)	1 (11.1%)	1 (12.5%)
Race				
H	1 (4.8%)	1 (3.1%)	1 (11.1%)	0 (0%)
A	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)
W	10 (47.6%)	9 (28.1%)	5 (55.6%)	6 (75%)
B	2 (9.5%)	7 (21.9%)	1 (11.1%)	0 (0%)
O	0 (0%)	2 (6.3%)	0 (0%)	0 (0%)
N/I	7 (33.3%)	13 (40.6%)	2 (22.2%)	2 (25%)
Gender				
F	12 (57.1%)	24 (75%)	8 (88.9%)	6 (75%)
M	9 (42.9%)	7 (21.9%)	1 (11.1%)	2 (25%)

Table 1 (Continued)

	True Positive (*N* = 21)	**True Negative (*N* = 32)**	**False Positive (*N* = 9)**	**False Negative (*N* = 8)**
	N (Percentage)	*N* (Percentage)	*N* (Percentage)	*N* (Percentage)
Gender				
O	0 (0%)	1 (3.1%)	0 (0%)	0 (0%)
Previous Diagnosis				
Yes	8 (38.1%)	19 (59.4%)	3 (33.3%)	5 (75%)
No	13 (61.9%)	13 (40.6%)	6 (66.7%)	3 (25%)
Medication				
Yes	7 (33.3%)	28 (87.5%)	2 (22.2%)	4 (50%)
No	14 (66.7%)	4 (12.5%)	7 (88.9%)	4 (50%)

Note. *N* = Number of Participants; H = Hispanic; A = Asian; W = White, B = Black; O = Other; N/I = Not Indicated

Sensitivity and Specificity

The sensitivity of the BASC-3 Inattention/Hyperactivity composite *t*-score was analyzed to determine how well the assessment measurement could provide a Clinically Significant score for individuals who also met the criteria for an ADHD diagnosis. The sensitivity of the BASC-3 Inattention/Hyperactivity composite *t*-score was calculated to be 72%. These results suggest that the BASC-3 SRP COL was able to rule in 72% of the individuals with ADHD accurately.

The specificity of the BASC-3 Inattention/Hyperactivity composite *t*-score was examined to conclude how well the composite *t*-score was able to adequately score an

individual below the Clinically Significant range who also did not meet the criteria for ADHD. The specificity of the BASC-3 Inattention/Hyperactivity composite *t*-score was determined to be 78%. This suggested that the BASC-3 SRP COL was able to rule out 78% of individuals who were not diagnosed with ADHD.

The positive and negative predictive power values of the BASC-3 Inattention/Hyperactivity composite *t*-score were also calculated to determine how well the measurement could detect the presence or absence of future ADHD cases. The results of the study demonstrated a positive predictive power value, or the ability to detect the presence of ADHD, at a percentage of 70%. The findings also suggested a negative predictive power value of 80% which was the ability of the BASC-3 SRP COL to detect the absence of ADHD. The false positive rate, or the proportion of true negative results that were classified as positives, was 30%. The false negative rate, or the proportion of BASC-3 SRP COL results that did not indicate Clinically Significant levels of Inattention/Hyperactivity when the person ended up meeting the diagnostic criteria for ADHD based on other variables, was 20%.

Profile Analysis

A profile analysis comparison of the four classifications and the collected BASC-3 SRP COL scale scores was conducted. These different scores included the Internalizing Problems and Inattention/Hyperactivity composite scores as well as the subscale scores for each of the composite scores. Table 2 and Figure 1 present the mean score for each of the four classifications as well as the results of a regression analysis that compares mean-

variance.

Table 2

Mean Values for BASC-3 SRP COL Scales Within Each of the Four Diagnosis Groups

	TP ***M(sd)***	**TN** ***M(sd)***	**FP** ***M(sd)***	**FN** ***M(sd)***	***F***	***p*<**	**eta^2**
IPCS	61.42 (12.4)	58.49 (11.56)	65.56 (10.36)	62.25 (12.54)	.913	.430	.040
ATP	57.76 (10.78)	56.13 (12.14)	56.11 (9.64)	53.88 (8.41)	.252	.860	.012
LC	54.95^{a} (11.71)	54.58^{a} (10.95)	66.11^{b} (6.23)	55.88^{ab} (9.51)	2.97	.038	.120
SS	60.48 (13.82)	57.26 (11.45)	62.33 (8.97)	57.88 (11.22)	.583	.628	.026
ANX	61.57 (13.63)	59.74 (9.44)	61.67 (9.27)	60.75 (10.17)	.146	.932	.007
DEP	57.14 (16.76)	56.55 (12.08)	64.44 (12.87)	59.63 (15.79)	.787	.506	.035
SI	64.71 (15.05)	60.87 (10.88)	66.44 (10.65)	71.75 (11.88)	1.842	.148	.078
SOM	59.90 (22.94)	55.77 (10.60)	61.67 (15.54)	60.50 (17.85)	.819	.488	.036
IHCS	78.0^{a} (5.25)	55.21^{c} (9.67)	75.67^{a} (4.72)	63.75^{b} (4.95)	44.829	<.001	.671

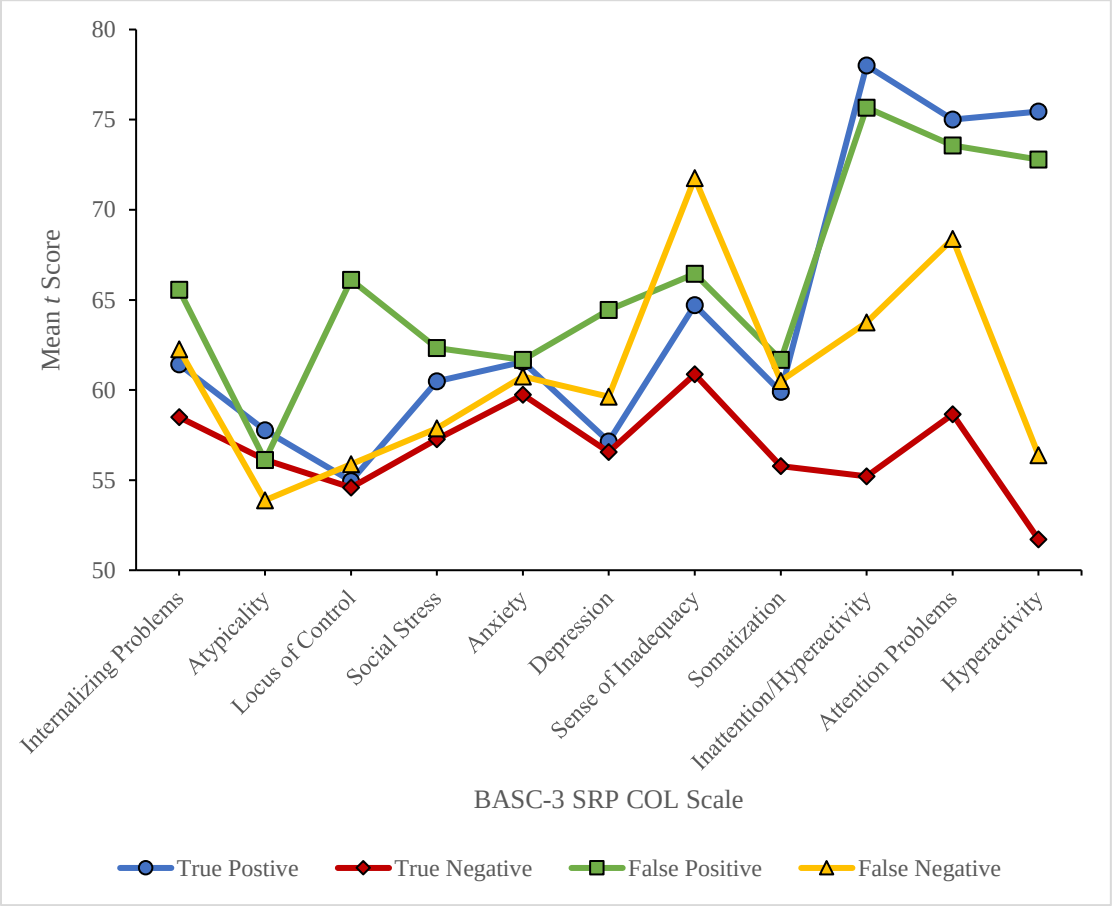
Table 2 (Continued)

	TP ***M(sd)***	**TN** ***M(sd)***	**FP** ***M(sd)***	**FN** ***M(sd)***	***F***	***p*<**	**eta^2**
AP	75.29[a] (4.4)	58.65[b] (10.45)	73.56[a] (5.64)	68.38[a] (5.37)	20.979	<.001	.492
HYP	75.90[a] (7.03)	51.71[b] (9.07)	72.78[a] (5.67)	56.38[b] (7.46)	45.159	<.001	.676

Note. [abc] Row Means with the same letter represent homologous subgroups using Tukey's corrections at $p = .05$. IPCS = Internalizing Problems Composite Score; ATP = Atypicality; LC = Locus of Control; SS = Social Stress; ANX = Anxiety; DEP = Depression; SI = Sense of Inadequacy; SOM = Somatization; IHCS = Inattention/Hyperactivity Composite Score; AP = Attention Problems; HYP = Hyperactivity

Figure 1

Mean Values for BASC-3 SRP COL Scales Within Each of the Four Classifications



A one-way ANOVA was performed to compare the effect of the BASC-3 SRP COL Internalizing Composite score and the corresponding subscale scores on different diagnosis groups. Results revealed that there was not a statistically significant difference in the Internalizing Problems Composite mean score between at least two of the four groups ($F(3, 65) = [.913]$, $p = .430$). Results indicated that there was not a statistically significant difference in the Atypicality mean score between at least two of the four

groups ($F(3, 65) = [.252]$, $p = .860$). The results demonstrated there was not a statistically significant difference in the Social Stress mean score between at least two of the four groups ($F(3, 65) = [.583]$, $p = .628$). Results revealed that there was not a statistically significant difference in the Anxiety mean score between at least two of the four groups ($F(3, 65) = [.146]$, $p = .932$). Results revealed that there was not a statistically significant difference in the Depression mean score between at least two of the four groups ($F(3, 65) = [.787]$, $p = .506$). Results revealed that there was not a statistically significant difference in the Sense of Inadequacy mean score between at least two of the four groups ($F(3, 65) = [1.842]$, $p = .148$). Results revealed that there was not a statistically significant difference in the Somatization mean score between at least two of the four groups ($F(3, 65) = [.819]$, $p = .488$).

A one-way ANOVA demonstrated that there was a statically significant difference in the BASC-3 SRP COL Locus of Control mean score between at least two of the four groups ($F(3, 65) = [2.97]$, $p = .038$). Tukey's HSD Test for multiple comparisons found that the mean value of the Locus of Control score was significantly different between the TP and FP groups ($p = .049$, 95% C.I. = [0.039, 22.278]) as well as the TN and FP groups ($p = .027$, 95% C.I. = [0.963, 22.098]). There was no significant difference in the mean Locus of Control score between the TP and TN groups ($p = .999$), the TP and FN groups ($p = .997$), the TN and FN groups ($p = .990$) or FP and FN groups ($p = .202$).

A one-way ANOVA was performed to compare the effect of the BASC-3 SRP COL Inattention/ Hyperactivity Composite score and the corresponding subscale scores

on different diagnosis groups. The results demonstrated that there was a statistically significant difference in the Inattention/Hyperactivity Composite mean score between at least two of the four groups ($F(3, 66) = [44.829]$, $p < .001$). Tukey's HSD Test for multiple comparisons found that the mean value of the Inattention/Hyperactivity Composite score was significantly different between the TP and TN groups ($p < .001$, 95% C.I. = [17.52, 28.81]) as well as the TP and FN groups ($p < .001$, 95% C.I. = [6.28, 22.98]). It was also determined that there was a significant difference between TN and FP ($p < .001$, 95% C.I. = [12.866, 28.029]) as well as TN and FN ($p = .031$, 95% C.I. = [0.589, 16.474]). A significant difference was determined between FP and FN ($p = .011$, 95% C.I. = [2.153, 21.681]). There was no significant difference in the mean Inattention/Hyperactivity Composite score between the TP and FP groups ($p = .808$).

The findings demonstrated that there was a statistically significant difference in the Attention Problems mean score between at least two of the four groups ($F(3, 65) = [20.979$, $p < .001$). Tukey's HSD Test for multiple comparisons found that the mean value of Attention Problems mean score was significantly different between the TN and TP group ($p < .001$, 95% C.I. = [10.696-22.585]), the TN and FP groups ($p < .001$, 95% C.I. = [6.947-22.874]), and the TN and FN groups ($p = .016$, 95% C.I. = [1.390-18.070]). No significant difference in mean values was determined between the TP and FP groups ($p = .948$), the TP and FN groups ($p = .169$), or the FP and FN groups ($p = .543$).

The results indicated there was a statistically significant difference in the Hyperactivity mean score between at least two of the four groups ($F(3, 65) = [45.159$, p

<.001). Tukey's HSD Test for multiple comparisons found that the mean values of the Hyperactivity Problems scores were significantly different between the TP and TN group (p <.001, 95% C.I. = [18.247-30.144]) as well as the TP and FN groups (p <.001, 95% C.I. = [10.785-28.274]). A significant difference was observed between the TN and the FP groups (p <.001, 95% C.I. = [13.099-29.038]). A significant difference was observed between the FP and FN groups (p <.001, 95% C.I. = [6.176, 26.630). A significant difference was not observed in mean values between the TP and FP groups (p = .759) or between the TN and FN groups (p = .459).

Distribution Patterns and Symmetry

Distribution patterns and symmetry were determined for each of the BASC-3 SRP COL variables within each of the four classifications. Table 3 presented the skewness and kurtosis values for each of the BASC-3 SRP COL variables interpreted. To interpret the Kurtosis value Hair et al. (2010) and Byrne (2010) stated that the normality assumption is not fulfilled when the skewness coefficient is outside the range of ±2 and the kurtosis coefficient is outside the range of ±7.

Table 3

Skewness and Kurtosis for the BASC-3 SRP COL Variables Within the True Positive Group

	Skewness		Kurtosis	
	Statistic	*SE*	*Statistic*	*SE*
Internalizing Problems Composite Score	.223	.501	-.649	.972
Atypicality	.603	.501	-.732	.972
Locus of Control	.676	.501	-.403	.972
Social Stress	.047	.501	-.846	.972
Anxiety	-.402	.501	-1.315	.972
Depression	1.201	.501	.695	.972
Sense of Inadequacy	.321	.501	-.915	.972
Somatization	.093	.501	-1.081	.972
Inattention/ Hyperactivity Composite Score	.664	.501	-.209	.972
Attention Problems	-.403	.501	-.742	.972
Hyperactivity	.316	.501	-.750	.972

Note. SE = Standard error

The skewness values of the Internalizing Problems Composite score, Atypicality, Locus of Control, Social Stress, Depression, Sense of Inadequacy, Somatization, Inattention/Hyperactivity Composite score, and Hyperactivity for the TP classification were positive, indicating that the distributions were right-skewed, but still within a normal distribution pattern. The skewness values of Anxiety, and Attention Problems were negative, presenting left-skewed distributions, but still within a normal distribution pattern. The kurtosis value for all of the interpreted BASC-3 variables fell below 3, which suggested the low presence of extreme values and a distribution that was more light-tailed compared to the normal distribution.

Table 4

Skewness and Kurtosis for the BASC-3 SRP COL Variables Within the True Negative Group

	Skewness		Kurtosis	
	Statistic	*SE*	*Statistic*	*SE*
Internalizing Problems Composite Score	.278	.421	-.765	.821
Atypicality	.897	.421	.189	.821
Locus of Control	.312	.421	-.989	.821
Social Stress	.210	.421	-.883	.821
Anxiety	.012	.421	-.704	.821
Depression	1.210	.421	1.431	.821
Sense of Inadequacy	.605	.421	-.609	.821
Somatization	.583	.421	-.380	.821
Inattention/ Hyperactivity Composite Score	-.619	.421	-.400	.821
Attention Problems	-.094	.421	-.210	.821
Hyperactivity	.090	.421	-1.097	.821

Note. SE = Standard error

Data from Table 4 suggested the skewness values of Internalizing Problems Composite score, Atypicality, Locus of Control, Social Stress, Anxiety, Depression, Sense of Inadequacy, Somatization, and Hyperactivity for the TN classification were positive, indicating that these distributions were right-skewed. The skewness values of the Inattention/Hyperactivity Composite and Attention Problems data were negative or left-skewed distributions. The kurtosis value for all of the interpreted BASC-3 variables fell below 3, which indicated the low presence of extreme values and that the distribution was more light-tailed compared to the normal distribution.

Table 5

Skewness and Kurtosis for the BASC-3 SRP COL Variables Within the False Positive Group

	Skewness		Kurtosis	
	Statistic	*SE*	*Statistic*	*SE*
Internalizing Problems Composite Score	.049	.717	-1.132	1.400
Atypicality	-.162	717	-2.013	1.400
Locus of Control	.278	717	-.652	1.400
Social Stress	.135	717	-1.519	1.400
Anxiety	-.959	717	.631	1.400
Depression	.648	717	-.871	1.400
Sense of Inadequacy	.020	717	-.203	1.400
Somatization	.366	717	-.872	1.400
Inattention/ Hyperactivity Composite Score	.710	717	-.673	1.400
Attention Problems	.280	717	-1.604	1.400
Hyperactivity	.292	717	.287	1.400

Note. SE = Standard error

The skewness values of Internalizing Problems Composite score, Locus of Control, Social Stress, Depression, Sense of Inadequacy, Somatization, Inattention/Hyperactivity Composite score, Attention Problems, and Hyperactivity were positive, indicating that the distributions were right-skewed. The skewness values of Atypicality and Anxiety were negative, which presented left-skewed distributions. The kurtosis value for all of the interpreted BASC-3 variables fell below 3, which suggested the low presence of extreme values and a distribution that was more light-tailed compared to the normal distribution.

Table 6

Skewness and Kurtosis for the BASC-3 SRP COL Variables Within the False Negative Group

	Skewness		Kurtosis	
	Statistic	*SE*	*Statistic*	*SE*
Internalizing Problems Composite Score	1.533	.752	1.846	1.481
Atypicality	.596	.752	-.806	1.481
Locus of Control	2.136	.752	5.603	1.481
Social Stress	.882	.752	-.352	1.481
Anxiety	.405	.752	-1.292	1.481
Depression	1.636	.752	3.344	1.481
Sense of Inadequacy	-.112	.752	1.325	1.481
Somatization	.252	.752	-2.222	1.481
Inattention/ Hyperactivity Composite Score	-1.818	.752	3.123	1.481
Attention Problems	-.269	.752	-1.818	1.481
Hyperactivity	.067	.752	2.463	1.481

Note. SE = Standard error

The Internalizing Problems composite, Atypicality, Locus of Control, Social Stress, Anxiety, Depression, Somatization, and Hyperactivity skewness scores of the negative classification group had positive values, indicating that the distributions were right-skewed. The Sense of Inadequacy, Inattention/Hyperactivity Composite, and Attention Problems scores were negative values, which presented a left-skewed distribution. The kurtosis values for Internalizing Problems, Atypicality, Social Stress, Anxiety, Sense of Inadequacy, Somatization, Attention Problems, and Hyperactivity all fell below 3, which indicated the low presence of extreme values and a distribution more light-tailed compared to the normal distribution. The kurtosis values for Locus of

Control, Depression, and Inattention/Hyperactivity composite were higher than 3, which indicated heavier tails, or a higher prevalence of extreme values.

Clinically Significant and At-Risk Prevalence for Classification Groups

Table 7 demonstrated the percentage of Clinically Significant scores and at-risk scores were calculated for each of the four different classifications within each of the interpreted BASC-3 SRP COL scale scores.

Table 7

Percentages of CS Scores for BASC-3 SRP COL Scales for the Four Classifications

	Clinically Significant Scores				**At-Risk Scores**			
	TP	TN	FP	FN	TP	TN	FP	FN
IP	28.6%	18.8%	44.4%	25%	23.8%	25%	22.2%	12.5%
AY	19%	9.38%	0%	0%	19%	18.8%	44.4%	25%
LC	14.3%	6.3%	22.2%	12.5%	19%	31.3%	66.7%	0%
SS	28.6%	18.8%	33.3%	25%	23.8%	12.5%	33.3%	0%
AX	38.1%	15.6%	22.2%	25%	28.6%	40.6%	33.3%	25%
DP	19.0%	12.5%	22.2%	12.5%	9.5%	21.9%	33.3%	37.5%
SI	33.3%	18.8%	33.3%	50%	23.8%	25%	33.3%	25%
SM	19%	12.5%	33.3%	37.5%	38.1%	25%	22.2%	12.5%
IA/HY	100%	0%	100%	0%	0%	37.5%	0%	87.5%
AP	85.7%	18.8%	66.7%	50%	14.3%	25%	33.3%	50%
HY	85.7%	0%	77.8%	12.5%	14.3%	21.9%	22.2%	0%

Note. TP = True Positive; TN = True Negative; FP = False Positive; FN = False Negative; Internalizing Problems = IP; AY = Atypicality; LC = Locus of Control; SS = Social Stress; AX = Anxiety; DP = Depression; SI = Sense of Inadequacy; SM = Somatization; IA/HY = Inattention/Hyperactivity; AP = Attention Problems; HY = Hyperactivity

Chi-Square Interpretation

A chi-square test of independence was performed to evaluate whether there was a relationship between the proportion of BASC-3 SRP COL scores classified as either Clinically Significant or At-Risk and the various diagnosis groups. The observed number of BASC-3 SRP COL scores that met Clinically Significant or At-Risk criteria within each of the diagnosis groups did not significantly differ from the expected number for the Internalizing composite score [$\chi 2$ (3) = 1.824, p = .610], Atypicality [$\chi 2$ (3) = .897, p = .826], Social Stress [$\chi 2$ (3) = 4.564, p = .207], Anxiety [$\chi 2$ (3) = .831, p = .842], Depression [$\chi 2$ (3) = 2.547, p = .467], Sense of Inadequacy [$\chi 2$ (3) = 5.132, p = .162], or Somatization [$\chi 2$ (3) = 1.994, p = .574]. These values suggested that the observed number of Clinically Significant or At-Risk scores within each of the four groups did not significantly differ from the expected number of individuals. Additionally, there was no observed relationship between the proportion of scores that met Clinically Significant or At-Risk criteria and different diagnosis groups.

The observed number of Locus of Control scores that met At-Risk or Clinically Significant within the groups was dissimilar from the expected number to a significant degree, $\chi 2$ (3) = 11.626, p = .009. This indicated a relationship between the diagnosis group and At-Risk or Clinically Significant levels of Locus of Control. A strong positive relationship was indicated between the two variables φ = .410, p = .009.

The observed number of Inattention/Hyperactivity composite scores that met At-Risk or Clinically Significant within the groups was dissimilar from the expected number

to a significant degree, $\chi 2$ (3) = 30.119, p <.001. This indicated a relationship between the diagnosis group and At-Risk or Clinically Significant levels of Inattention/Hyperactivity. A strong positive relationship was observed between the two variables φ = .656, p <.001.

The observed number of Attention Problems scores that met At-Risk or Clinically Significant within the groups was dissimilar from the expected number to a significant degree, $\chi 2$ (3) = 27.651, p = <.001. This suggested a relationship between the diagnosis group and At-Risk or Clinically Significant levels of Attention Problems. A strong positive relationship was indicated between the two variables φ = .633, p <.001.

The observed number of Hyperactivity scores that met At-Risk or Clinically Significant within the groups was dissimilar from the expected number to a significant degree, $\chi 2$ (3) = 43.561, p <.001. This indicated a relationship between the diagnosis group and At-Risk or Clinically Significant levels of Hyperactivity. A very strong positive relationship was observed between the two variables φ =.795, p <.001.

Case Analysis

False Positive Cases

An exploratory analysis was conducted for the false positive cases to determine assessment variables that could have been more accurate in diagnostic determination. To maintain client confidentiality, the false positive cases were referred to as FP1-FP9. The areas of assessment that were reported included referral information, previous diagnosis, current medications, cognitive testing, the BASC-3 COL SRP, personality assessments,

socioemotional evaluations, executive functioning testing, neurological evaluations, and interview data.

FP1. Client FP1 was a female, 21 years of age, with reported symptoms of attention/concentration and anger/irritability difficulties. FP1 had received a previous diagnosis of ADHD, childhood depression disorder, a learning disorder, and was taking Vyvanse at the time of the assessment process. Her overall cognitive abilities indicated a scaled score of 87 for her Full-Scale Intelligence Quotient (FSIQ), which fell in the Below-Average range. She presented a relative strength in Perceptual Reasoning (ss = 100) and a relative weakness in Working Memory (ss = 80).

FP1's BASC-3 SRP COL scores resulted in Clinically Significant scores for Attention Problems (t = 81), Hyperactivity (t = 75), Inattention/Hyperactivity composite (t = 81), Relations with Parents (t = 8), and Personal Adjustment (t = 26). She also fell in the At-Risk range for School Maladjustment (t = 63), Emotional Symptoms Index (t = 62), Interpersonal Relations (t = 40), Self-Esteem (t = 35), and Self-Reliance (t = 31).

FP1 was administered the Conners Continuous Performance Test II (CPT II V.5). She presented Markedly Atypical scores for Omissions (t = 314.2), Commissions (t = 70.61), Hit Reaction Time Standard Error (t = 71.75), and Variability (t = 67.53). FP1's results suggested that her scores for Omissions, Commissions, Hit RT standard error, Variability, and Detectability met the guideline criteria for Inattention and her Commissions score met the guideline criteria for Impulsive. FP1 was administered the Minnesota Multiphasic Personality Inventory-Second Edition (MMPI-2) to assess her

personality and behavioral patterns. FP1's responses resulted in Elevated scores for Depression (*t* = 64), Masculine Femininity (*t* = 62), Schizophrenia (*t* = 62), and Social Introversion (*t* = 69).

Within the summary of the assessment results, the clinician reported that although the assessment results that were analyzed suggested ADHD-related symptoms and indicated FP1 met ADHD criteria, her behaviors were better explained by an alternative diagnosis. The clinician reported that FP1's elevated scores in the MMPI-2 in conjunction with the presented symptoms and background information gathered through interviews presented evidence that a diagnosis of Major Depressive Disorder better supported the presented symptoms.

FP2. Participant FP2 was a Caucasian female, 20 years of age, who was seeking assessment services due to difficulties with forgetfulness, hyperactivity, inability to study, procrastination, and irritability. She was diagnosed with Oppositional Defiant Disorder when she was 9 years of age. She was not taking any medication at the time of the assessments. Within the assessment process, FP2 completed a clinical interview, a diagnostic criteria interview, and the BASC-3 SRP COL. During the interview portion of the assessment, FP2 endorsed responses with symptoms that met the criteria for ADHD-combined type. The results of the BASC-3 SRP COL indicated that FP2 had Clinically Significant scores in the areas of Attention Problems (*t* = 81), Hyperactivity (*t* = 72), and the Inattention/Hyperactivity composite score (*t* = 79). FP2 was also At-Risk in the areas of Self-Reliance (*t* = 37) and Locus of Control (*t* = 60). The clinicians reported that the

results of the BASC-3 SRP COL and the diagnostic interview indicated that while FP2 may have shown some evidence of ADHD, additional assessments were necessary. However, FP2 disengaged from the assessment process after initial testing. Therefore, her file was classified as a Did Not Qualify (DNQ) due to the lack of sufficient evidence.

FP3. FP3 was a 23-year aged Caucasian male seeking assessment services due to concerns of emotional distress, difficulty concentrating, and lack of interest in social interactions. FP3 reported no previous diagnoses and was not taking any prescribed medication at the time of the assessment. On the cognitive assessment, FP3 scored within the Average range (ss = 100). Other results from the cognitive assessment consistently fell within the Average range.

FP3 was administered the MMPI-2 and received Very Elevated scores for the validity scale of Infrequency, which assessed the consistency of response patterns to similar questions. The clinician reported FP3's profile could be considered valid for interpretation with caution. For the MMPI-2 Clinical Scales, FP3 scored within the Very Elevated range for hypochondriasis (t = 84), Depression (t = 80), Hysteria (t = 76), Psychopathic Deviant (t = 79), Paranoia (t = 86), Psychasthenia (t = 81), Schizophrenia (t = 89), and Social Introversion (t = 83).

On the BASC-3 SRP COL, FP3 scored in the Clinically Significant range for Locus of Control (t = 76), Social Stress (t = 75), Sense of Inadequacy (t = 76), Somatization (t = 88), the Internalizing Problems composite score (t = 82), Hyperactivity (t = 78), the Inattention/Hyperactivity composite score (t = 76), the Emotional Symptoms

Index (*t* = 81), Relations with Parents (*t* = 12), Interpersonal Relations (*t* = 22), Self-Esteem (*t* = 25), Self-Reliance (*t* = 28) and Personal Adjustment composite score (*t* = 14). FP3 also scored in the At-Risk range for Atypicality (*t* = 66), Anxiety (*t* = 69), Attention Problems (*t* = 69), and School Maladjustment (*t* = 69). The Beck Hopelessness Scale (BHS) was administered to FP3 and his results scored within the Moderate levels of hopelessness (score = 13). He was administered the Beck Depression Inventory, Second Edition (BDI-II), and scored in the Severe Depression range (score = 37). FP3 was administered the Beck Anxiety Inventory (BAI) and scored in the Moderate Anxiety range (score = 21). The Beck Suicide Scale (BSS) was given to FP3 to assess his risk for suicidal ideation and/or suicidal behaviors. Within his responses, FP3 indicated that he had a weak wish to live and a weak wish to die. He also reported that his reasons for living or dying were about the same. He also noted that he fluctuated between keeping himself from committing suicide and being unsure if he would. He did admit to previously attempting suicide two or more times and had refrained from sharing this information with anyone else. When the clinician followed up with FP3, he reported that his wife kept him from dwelling on or acting out suicidal thoughts. The results gathered from the BHS, BDI-II, BSS, and BAI indicated significant levels of anxiety and depression. The clinician administered a DSM-5 diagnostic interview for Cannabis Use Disorder, Schizoid Personality Disorder, Major Depressive Disorder, Generalized Anxiety Disorder, and Posttraumatic Stress Disorder.

A CPT II V.5 assessment was given to FP3 and his results fell in the Mildly

Atypical for Hit Reaction Time (RT) Standard Error (t = 59.08) and Detectability (t = 58.99). His scores met the Inattention guidelines for Hit Rt Standard Error and Detectability, but he did not meet any elevated levels of Impulsivity and Vigilance. FP3 was also administered the Wisconsin Card Sorting Test (WCST) and his results indicated Above Average scores for Total Errors (t = 59), Perseverative Responses (t = 67), Perseverative Errors (t = 64), Nonperseverative Errors (t = 57), and Conceptual Level Responses (t = 55). FP3 was administered the Wisconsin Card Sort Test (WCST) to follow up on expressed concerns of attentional deficits and received a score of t = 114 for Total Error and t = 70 for Total Correct. The results from the entire evaluation indicated that the difficulties with inattention may be better explained by a diagnosis other than ADHD. The clinician determined that the information gathered through the DSM-5 diagnostic interview helped confirm a diagnosis of Posttraumatic Stress Disorder, Generalized Anxiety Disorder, and Major Depressive Disorder.

FP4. FP4 was a 19-year aged female seeking assessment services due to difficulties focusing in class. It was reported by FP4 that she did not have a previous diagnosis and did not take any medications at the time of the evaluation. Her cognitive scores indicated that her overall General Intelligence Assessment score fell in the Average range (ss = 91). She presented a relative weakness in the Comprehension-Knowledge scale (ss = 87) and a relative strength in Long-Term retrieval (ss = 102).

On the BASC assessment, FP4 scored in the Clinically Significant range for Hyperactivity (t = 74) and the Inattention/Hyperactivity composite scale (t = 73). Her

results indicated At-Risk scores for Atypicality (*t* = 64), Locus of Control (*t* = 66), Social Stress (*t* = 60), Internalizing Problems composite score (*t* = 61), and Attention Problems (*t* = 67). FP4 was administered the CPT II V.5 and scored in the Mildly Atypical range for Detectability (*t* = 60.84) and the Hit Standard Error by Inter Stimulus Interval score (*t* = 58.95). The clinician administered the BDI-II and FP4's results fell in the Moderate Depression range (score = 22). A diagnostic interview for ADHD and Adjustment Disorder with depressed and anxious mood was conducted. The clinician reported that when the results of the diagnostic interview for ADHD were reviewed, FP4 did not exhibit a sufficient number of symptoms to meet the criteria. It was concluded from the information gathered through interviews that FP4 had developed significant emotional symptoms within 3 months of experiencing several stressors. It was further determined that these emotional symptoms had caused FP4 impairments in academic functioning. As such, the clinician determined a diagnosis of Adjustment Disorder with depressed and anxious mood supported the presented symptoms.

FP5. FP5 was a 22 year-aged female seeking assessment services due to difficulties with focus, concentration, irritability, and anxiety. FP5 reported she experienced anxiety and mood disturbances in which she alternated between highs and lows. She had not received any previous diagnoses or taken any prescribed medication. Cognitive testing indicated results within the Superior range with significant strengths in the areas of fluid reasoning, nonverbal concept formation, visual perception, and organization.

Results of the BASC indicated Clinically Significant scores in the areas of Social Stress (t = 70), Anxiety (t = 72), Somatization (t = 72), Internalizing Problems composite score (t = 70), Attention Problems (t = 74), the Inattention/Hyperactivity composite score (t = 72), and the Emotional Symptoms Index (t = 72). Results also presented At-Risk scores in the area of Locus of Control (t = 69), Depression (t = 66), Sense of Inadequacy (t = 67), Hyperactivity (t = 64), and Alcohol Abuse (t = 61). FP5 was administered a BAI Assessment and obtained a score within the Severe Anxiety severity range (score = 49). She was also administered the BDI-II and obtained a score within the Severe Depression score range (score = 35).

The Millon Clinical Multiaxial Inventory (MCMI) was administered to gain measurements of FP5's personality and patterns of various clinical syndromes. FP5's results indicated scores in the Elevated range for the Borderline scale (Base Rate Score = 78), the Very Elevated range for the Avoidant scale (Base Rate Score = 92), and the Very Elevated range for the Dependent scale (Base Rate Score = 85). Within the clinical syndrome scales, FP5 presented elevated scores in the areas of Major Depression (Base Rate Score = 93), Anxiety (Base Rate Score = 89), Bipolar-Manic (Base Rate Score = 100), and Dysthymia (Base Rate Score = 80).

The clinician conducted a DSM-5 diagnostic interview covering the symptom criteria for Major Depressive Disorder, Generalized Anxiety Disorder, and Bipolar Depressive Disorder I. FP5 endorsed symptoms that met the criteria for Major Depressive Disorder and for Generalized Anxiety Disorder, but did not meet the criteria for Bipolar

Depressive Disorder I. Scores within the MCMI, the BAI, and the BDI-II presented similar elevated scores related to anxiety, depression, and social problems. As such, the clinician determined a diagnosis of Major Depressive Disorder and Generalized Anxiety Disorder reflected the presented symptoms.

FP6. FP6 was a 24-year aged female who was requested an evaluation to update her records and possibly receive school accommodations. During the intake interview, FP6 reported that she had a previous diagnosis of Generalized Anxiety Disorder and was prescribed antidepressant medication. The results of her cognitive assessment indicated a General Intellectual Ability standard score in the High Average Range (ss = 115). A relative strength was her Oral Vocabulary (ss = 128) and a relative weakness was in Verbal Attention (ss = 82).

Results from FP6's BASC-3 COL SRP indicated Clinically Significant scores for the Inattention/Hyperactivity composite score (t = 74), Attention Problems scale (t = 71), and Hyperactivity scale (t = 72). She scored within the At-Risk range for the Somatization (t = 60), and Interpersonal Relations scales (t = 40). FP6 was administered the MMPI-2 and received Very Elevated scores on the Infrequency validity scale (t = 65) which suggested she may have responded exaggeratedly or superlatively and her responses needed to be taken with caution. FP6 scored in the Very Elevated range for Hypochondriasis (t = 65), Hysteria (t = 73), Psychopathic Deviant (t = 66), Paranoia (t = 70), Psychasthenia (t = 68), and Schizophrenia (t = 69). Her results also presented Elevated scores for Depression (t = 55), and Masculine Femininity (t = 57). As a follow-

up, FP6 was administered the ASRS v.1.1 and endorsed 5 out of 6 symptoms. A clinical interview was conducted to gather additional information about social interaction skills, executive functioning abilities, and concentration/attention difficulties. When FP6's scores were analyzed cumulatively, skills deficits were observed in the areas of attention, hyperactivity, hysteria, deviant behavior, and paranoia. Additionally, the background information indicated her attentional deficits were dependent on environmental factors and she had been assessed 2 other times, neither of which indicated symptom severity that met ADHD diagnostic criteria. As such, a diagnosis of Generalized Anxiety Disorder was retained by history to better support the presented symptoms.

FP7. FP7 was an 18-year aged Caucasian Female who was seeking a comprehensive evaluation due to self-reported difficulties paying attention, maintaining focus, and feelings of anxiety. At the time of the assessment, FP7 did not have a previous diagnosis nor did she take any medications. The results of the cognitive assessment indicated that FP7 had an overall FSIQ score in the High Average range (ss = 111), Verbal Comprehension in the Average range (ss=108), Perceptual Reasoning in the High Average range (ss = 113), Working Memory in the Average range (ss = 95) and Processing Speed in the Superior range (ss = 120).

Results from the BASC-3 SRP COL indicated Clinically Significant scores in the areas of Anxiety (t = 70), Sense of Inadequacy (t = 74), Attention Problems (t = 79), Hyperactivity (t = 83), and the Inattention/Hyperactivity composite score (t = 84). FP7 also scored in the At-Risk range for Atypicality (t = 66), Locus of Control (t = 64), Social

Stress (*t* = 62), Depression (*t* = 66), Internalizing Problems (*t* = 68), Emotional Symptom Index (*t* = 67), School Maladjustment (*t* = 60), and Self-Esteem (*t* = 37).

FP7 was administered the MMPI-2 and scored within the Clinically Significant range for the following scales: Depression (*t* = 83), Hysteria (*t* = 84), Paranoia (*t* = 81), Psychasthenia (*t* = 78), and Schizophrenia (*t* = 72). At-Risk scores were obtained for the Hypochondriasis scale (*t* = 65) and the Social Introversion scale (*t* = 68). The AMAS-C was administered to FP7 and an overall Total Anxiety Score within the Clinically Significant range (*t* = 72). The results of the BAI indicated Severe Anxiety symptoms levels (score = 28) and the score on the BDI-II indicated Severe levels of Depression symptom levels (score = 26). FP7 endorsed 4 out of the 6 questions on Part A of the ASRS v1.1.

On the CPT-II administered, FP7 obtained Markedly Atypical scores for Omissions (*t* = 69.35), Hit RT Std. Error (*t* = 74.03), Variability (*t* = 79.19), Hit RT Block Change (*t* = 68.67), Hit SE Block Change (*t* = 78.05), Hit RT ISI Change (*t* = 80.45), and Hit SE ISI Change (*t* = 77.03). A diagnostic interview was conducted for Generalized Anxiety Disorder, PTSD, ADHD, and Major Depressive Disorder. This was determined by the clinician due to scores from the BASC-3 SRP COL, BAI, BDI-II, and MMPI-II as well as the intake interview information. For the diagnostic determination, the clinician determined a diagnosis of Generalized Anxiety and Major Depression Disorder better supported the presented symptoms. The clinician ruled out ADHD due to the presented symptoms not indicated to have been present before the age of 12.

FP8. FP8 was a 22-year aged Hispanic female seeking assessment services due to reported difficulties in focusing memory, overthinking, anxiety, and panicked feelings. At the time of the assessment, FP8 did not have a previous diagnosis or regularly take any medication. The results of her cognitive assessment indicated results in the Low to Superior range. Her General Intellectual Ability score was in the Low Average (standard score [ss] = 89). Long-term retrieval was identified as a relative weakness (ss = 74) and Fluid Reasoning was suggested to be a relative strength (ss = 121).

Score results from the BASC-3 SRP COL indicated Clinically Significant scores in the areas of the Internalizing Problems composite score (*t* = 74), Sense of Inadequacy (*t* = 84), Somatization (*t* = 77), the Inattention/Hyperactivity composite score (*t* = 70), Hyperactivity (*t* = 70), Relations with Parents (*t* = 29), Interpersonal Relations (*t* = 25), and Personal Adjustments (*t* = 26). FP8 was administered the Adult Manifest Anxiety Scale-College assessment. Her results presented Clinically Significant scores in the areas of Physiological Anxiety (*t* = 68), Social Concern/Stress (*t* = 73), and the Total Anxiety score (*t* = 68). The BDI-II was administered and she obtained a score within the Moderate levels of Depression (score = 30). Due to comments made within the initial interview that suggested suicidal ideation, FP8 was administered a Beck Suicide Scale (BSS). Within the BSS, FP8 endorsed that she had a weak wish to live, had equal reasons for living or dying, accepted the idea of killing herself, was unsure if she had the courage or ability to commit suicide, had held back telling people that she wanted to kill herself and that the primary reason for killing herself was primarily based on escaping her problems. It was

determined through the BSS responses that although FP8 demonstrated thoughts of suicide, she did not have a plan to act on her thoughts. The Beck Hopelessness Scale (BHS) was administered and her results indicated Moderate levels of Hopelessness (score = 11).

FP8's results from the MCMI indicated Abnormal Type levels of Avoidant (Base Rate score = 82), Melancholic (Base Rate score = 79), Dependent (Base Rate score = 78), and Negativistic (Base Rate score = 24). FP8 also presented Abnormal Type levels of Paranoid behavioral patterns (Base Rate score = 76). Within the psychopathology section of the MCMI, FP8 presented Prominent levels of Generalized Anxiety (Base Rate score = 100), Persistent Depression (Base Rate score = 91), and Major Depression (Base Rate score = 88). A clinical interview was then conducted that further investigated her feelings of sadness, guilt, failure, and difficulties with obtaining regular sleep. The clinician noted that when FP8's scores were examined cumulatively, as well as the reported information within the clinical interview, a diagnosis of Major Depressive Disorder accurately reflected FP8's presented symptoms.

FP9. FP9 was an 18-year aged Caucasian female seeking services to determine a possible diagnosis of depression, Post-Traumatic Stress Disorder (PTSD), and/or ADHD. Reported symptoms included difficulties with concentration, racing thoughts, crying spells, forgetfulness, and loss of childhood memories. The results of the cognitive assessment indicated FP9 had a General Intellectual Ability score in the Average range (ss = 107), a Comprehensive Knowledge score in the Average range (ss = 101), and a

Superior score for Fluid Reasoning (ss = 124).

Scores in the BASC-3 SRP COL indicated Clinically Significant scores for the following subscales: Social Stress (*t* = 73), Depression (*t* = 83), Interpersonal Relations (*t* = 25), and Self-Esteem (*t* = 25). Clinically Significant scores were also observed for the following composite scales: Internalizing Problems (*t* = 73), Inattention/Hyperactivity (*t* = 72), Emotional Symptoms Index, and Personal Adjustment. At-Risk scores were indicated for Atypicality (*t* = 66), Locus of Control (*t* = 62), Anxiety (*t* = 65), Sense of Inadequacy (*t* = 67), Somatization (*t* = 67), Hyperactivity (*t* = 67), Maladjustment (*t* = 67), Relations with Parents (*t* = 32) and Self-Reliance (*t* = 39). The MCMI-IV was administered to FP9 which presented a Base Rate (BR) score for the Avoidant (BR = 107) scale within the Clinically Significant range, and BR scores within the Abnormal Type range for the Melancholic (BR = 81), Schizoid (BR = 79), Negativistic (BR = 77), Schizotypal (BR = 80), and Borderline (BR = 78) scales. A Prominent score was indicated for the Generalized Anxiety (BR = 91) scale.

FP9 was administered the Child PTSD Symptom Scale for DSM-V (CPSS-V SR-5) and the results indicated a score of 62, which fell in the Very Severe Symptoms range for PTSD. Specifically, FP9 mentioned previous verbal and emotional neglect, sudden family member deaths, as well as assaults in which she felt that she was were going to die. The Adult Manifest Anxiety Scale -College (AMAS-C) was administered and FP9's Total Anxiety score fell in the Mild Elevation range (*t* = 59). FP9 was administered the BDI-II and obtained an overall score of 24 which fell in the Moderate Depression range.

The results of the Conners-3rd edition Self-Report administered indicated a Very Elevated score for Inattention (t = 84) and Family Relations (t = 78), an Elevated score for Hyperactivity/Impulsivity (t = 66) and Defiance Aggression (t = 66). A diagnostic interview was conducted for Major Depressive Disorder, ADHD, and PTSD. Within the ADHD diagnostic interview, FP9 endorsed several ADHD-related symptoms; however, the client was unable to provide information about the symptoms being present before the age of 12. Due to this lack of data, the clinician determined that a diagnosis of ADHD was not supported. It was determined that a diagnosis of PTSD better supported the provided information.

Although the reviewal of each case in isolation provided insight similar to what the clinician experienced within the evaluation process, general patterns which were examined across the FP group also provided important information for determining patterns and possible causations for the FP classification. Scores for the socioemotional assessments administered for each FP case are presented in Table 8.

Table 8

Summary of Psychological Evaluation Variables for False Positive Cases

	PD	BASC-IP	BASC-ANX	BASC- DEP	BDI	BAI	BHS	MCMI	MMPI	DX
FP1	ADHD	56	58	51	-	-	-	DEP	-	ODD
FP2	ODD	51	43	51	-	-	-	-	-	DNQ
FP3	N/A	82	69	85	37	21	13	-	DEP	GA, MDD, PTSD
FP4	N/A	61	57	55	22	-	-	-	-	AD-DEP & ANX
FP5	N/A	70	72	66	35	49	-	ANX, DEP		GA, MDD
FP6	GAD	55	55	55	-	-	-	-	DEP	GA
FP7	N/A	68	70	66	26	28	-	-	DEP	GA, MDD
FP8	N/A	-	64	66	-	30	11	GA, MD, PD	-	MDD
FP9	N/A	73	65	83	24	-	-	GA	-	PTSD

Note. FP = False Positive; BASC-IP = BASC-3 SRP COL Internalizing Problems composite standard score; BASC-ANX = BASC-3 SRP COL Anxiety standard score; BASC-DEP = BASC-3 SRP COL Depression standard score; BDI = Beck Depression Inventory-second edition total score; BAI = Beck Anxiety Inventory; BHS = Beck Hopelessness Scale total score; MCMI = Millon Clinical Multiaxial Inventory elevated anxiety and/or depression clinical score; MMPI- Minnesota Multiphasic Personality Inventory elevated depression score; DX = Final Diagnosis; ANX = Anxiety; DEP = Depression; ODD = Oppositional Defiance Disorder; DNQ = Did Not Qualify; GA = Generalized Anxiety; MDD = Major Depressive Disorder; PTSD = Post-Traumatic Stress Disorder; AD-DEP & ANX = Adjustment Disorder with Depression and Anxiety; PD = Persistent Depression; MD = Major Depression

False Negative Cases

An exploratory analysis was conducted for the false negative cases to determine what assessment variables ended up being more effective in providing evidence for ADHD. Because the BASC was not able to identify these individuals as having symptoms clinically significant enough for ADHD classification, an analysis was conducted to determine the presence of clinically significant levels of ADHD symptoms within the results of other assessments. Results of the ASRS v1.1 and the CPT II V.5 were analyzed to determine if the measured ADHD symptoms and Executive Functioning skills were able to be better identified in those measurements than by the BASC. Of the 70 cases analyzed in the study, eight individuals qualified as false negatives. To maintain client confidentiality, the false negative individuals were referred to as FN1-FN8.

Referral Information, Previous Diagnosis, and Prescribed Medication. Data gathered from the referral information indicated that the FN individuals included six females and two males with the racial breakdown of six White and two non-identified clients. The age of the clients within this group included: one 18 years-aged, one 19 years-aged, three 20 years-aged, two 23 years-aged, and one 24 years-aged. Of the eight clients within the group, six of them had a previous diagnosis, and three of those six were previously identified with only ADHD. The diagnoses of the remaining three included: (a) Major Depressive Disorder, PTSD, and ADHD, (b) Learning Disorder and ADHD, and (c) depression disorder. Two of the clients within the FN group took Vyvanse, one took Strattera, and one took Prozac.

ADHD and Executive Functioning Testing. The Adult ADHD Self-Report Scale (ASRS v1.1) was used with four of the FN individuals as a checklist rating scale to assist clinicians in determining the presence of symptoms commonly associated with ADHD. Results of the ASRS v1.1 demonstrated that FN3, FN4, and FN7 scored below the total score threshold indicative of ADHD (score = 2, score = 2; score = 3). The case FN8 presented ASRS v1.1 results that were above the score threshold indicative of ADHD related symptoms.

All of the FN individuals except FN5 completed the Conners Continuous Performance Test Third Edition (CPT 3) assessment. A study by Epstein et al. (2003) determined that the d-prime variable presented a very strong relationship to the ADHD symptoms listed in the DSM-IV. The findings from the study suggested that d-prime (d') was among the most comprehensive indicative CPT 3 parameters measuring ADHD symptomatology. The manual of the CPT 3 defined d' as an indicator of the ability of an individual to discriminate non-targets (i.e., the letter X) from targets (i.e., all other letters). Results for the d' variable on the Conners CPT 3 are reverse-scored. This means the higher that the raw score and T-score values, the worse performance or poorer discrimination skills the individual presented.

A low d' score from FN4 (t = 44) suggested good discrimination ability and a lower likelihood of ADHD symptoms. The d' scores for FN1 (t = 55.44), FN2 (t = 56), FN3 (t = 57.62), FN7 (t = 59.52), and FN8 (t = 58.95) fell in the High Average range representing lower than average detectability skills and higher than average indication of

ADHD symptoms. The results from FN6 (t = 61.92) presented within the elevated score range which suggested a poor ability to differentiate and the presence of inattentive tendencies.

Narrowband Assessments. When the FN cases were examined, it was determined that FN2, FN5, and FN6 were administered the Beck Depression Inventory (BDI-II). The results indicated that FN5 and FN6 scored in the Low range (score = 10; score = 14) and FN2 scored in the Moderate range (score = 25). FN2 and FN6 were also administered the Beck Anxiety Inventory. The results for FN2 fell within the Moderate range (score = 23) and the score of FN6 fell in the Low range (score = 10).

When trying to determine the cause for the individuals classified as FP, case file information reviewed and compared included interview information related to previous ADHD diagnosis and prescribed medication, BASC-3 COL Inattention/Hyperactivity scores, BASC-3 SRP COL Attention Problems scores, BASC-3 SRP COL Hyperactivity scores, ASRS v1.1 rating scale scores, CPT 3 d' scores, and Working Memory scores. None of the FN individuals were administered the Wisconsin Card Sort assessment so this variable was excluded from the comparison. The results from each of these assessment variables are summarized in Table 9.

Table 9

Summary of Psychological Evaluation Variables for False Negative Cases

	Prior ADHD Diagnosis	**Medication**	**BASC-I/H**	**BASC-A.P.**	**BASC-H**	**ASRS**	**CPT**	**WM**
FN1	Yes	Yes	66	75*	54	-	55.44+	100
FN2	No	No	60	63	56	-	56+	113
FN3	Yes	No	68	73*	59	2	57.62+	94
FN4	Yes	Yes	53	63	43	2	44	-
FN5	Yes	Yes	65	69	59	-	-	88
FN6	No	No	67	61	70*	-	61.92++	-
FN7	ADHD	No	65	73*	54	3	59.52+	104
FN8	No	No	66	70*	56	4*	58.95+	69

Note. FN = False Negative; BASC-I/H C.S. = BASC-3 SRP COL Inattentive/Hyperactivity standard score; BASC-A.P. = BASC-3 SRP COL Attention Problems standard score; BASC-H = BASC-3 SRP COL Hyperactivity standard score; ASRS = ASRS v1.1 total score; CPT = Conners' Continuous Performance Test II d' *t*-score; WM = Working Memory standard score; * = Clinically Significant score; + = High Average Score; ++ = Elevated score.

CHAPTER V: Discussion

The present study was designed to determine the classification accuracy of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score in predicting the final clinical-based diagnosis of ADHD in a college-aged population. The research also analyzed cases in which the BASC-3 SRP COL Inattention/Hyperactivity composite score was not a good indicator of an ADHD diagnosis to identify which, if any, separate assessment variables were more effective or accurate as a diagnostic identifier. The proposed hypothesis stated that the BASC-3 Inattention/Hyperactivity composite *t*-score would show strong classification accuracy for ADHD diagnosis.

BASC-3 SRP COL Inattention/Hyperactivity Composite *t*-score Accuracy Determination

To determine the classification accuracy of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score, the sensitivity and specificity were calculated. The sensitivity value was used to determine how well the BASC-3 SRP COL assessment measurement could provide a Clinically Significant score for individuals who also met the criteria for an ADHD diagnosis. The specificity of the BASC-3 Inattention/Hyperactivity composite *t*-score measured the ability of the composite score to correctly classify an individual as not having Clinically Significant symptoms level (Parikh et al., 2008). To better interpret the sensitivity and specificity values, the following ranges and qualitative descriptors presented by Lange and Lippa (2017) for

sensitivity/specificity score percentages were referenced: (a) <10% = Very Low; (b) 10-24% = Low; (c) 25-39% Low-Moderate; (d) 40-59% = Moderate; (e) 60-74% = Moderate-High; (f) 75-89% = High and (g) 90-100% = Very High.

Although the measurements of sensitivity and specificity provided valuable information to determine the diagnostic accuracy of assessment strategies, positive predictive power (PPP) and negative predictive power (NPP) statistical values established an even stronger understanding of whether the diagnostic accuracy applied to an individual patient. PPP statistics determined what the probability was that the patient actually had a condition if they were identified by a measurement as having that condition. The NPP statistic value determined patients identified by a measurement as not having the condition that also did not have the condition (Ivnik et al., 2001).

The statistical results for the current study presented the sensitivity percentage score for the BASC-3 Inattention/Hyperactivity composite *t*-score to be 72% which fell in the Moderate-High referenced range (Lange & Lippa, 2017). These results suggested that the BASC-3 SRP COL was able to rule in 72% of the individuals with ADHD accurately. The results indicated a specificity value of 78% which fell in the High Specificity referenced range (Lange & Lippa, 2017). This suggested that the Inattention/Hyperactivity composite *t*-score ruled out 78% of cases accurately. The PPP value for the current study was .70. This indicated that 70% of the time an individual received a Clinically Significant score for the Inattention/Hyperactivity composite score, they ended up with an ADHD diagnosis. The value for the NPP for the current study was

.20. This value indicated that if an individual received a score less than the determined Clinically Significant score of 70, there was a 20% chance the individual did not receive a diagnosis of ADHD.

The sensitivity and specificity scores for this study were based on the same cutoff score suggested by Reynolds and Kamphaus (2015). These two researchers determined the BASC-3 cutoff score should be a score of 70 or higher for a Clinically Significant score classification. To determine if the suggested cutoff score of 70 was optimal for the examined population, different cutoff scores were used to observe and compare changes to the sensitivity and specificity scores. When the cutoff score was changed to a Clinically Significant score equal to 75 or higher, the altered sensitivity score was lowered to .55 and the specificity was raised to .88. This can be expected due to the more stringent criteria needed to qualify as Clinically Significant. When the cutoff score was lowered to a Clinically Significant score set as 65 or above, the sensitivity score increased to .93 and the specificity lowered to .65. Because altering the cutoff scores presented an inverse relationship between the sensitivity and specificity scores, it can be determined that the suggested cutoff value of 70 was the most optimal score analyzed, because the two scores were most alike at this cutoff point and neither statistic lost a great deal of reliability.

The calculated sensitivity and specificity values for this study were compared to those same measurements from other studies to determine comparability. A research study by Kessler et al. (2007) determined for the ASRS v1.1 a sensitivity of 90% but a

specificity of only 35%. Pettersson et al. (2018) conducted a similar research study on the ASRS v1.1 and determined a sensitivity of 92% and specificity of 27%. When analyzed with the results from the exploratory analysis, the results highlight the difficulty clinicians have in ruling out a condition based on the ASRS v1.1. Within the group of false positive cases, or those who scored Clinically Significant on the BASC but who did not receive a diagnosis, two individuals were administered the ASRS v1.1. In both cases, the individuals presented elevated ASRS v1.1 responses (score = 5; score = 6). The inaccurate scoring of the BASC for these false positive cases aligned with the trends which showed lower specificity scores of the ASRS v1.1 within the examined college-aged population. Within the group of false negative cases, four individuals were administered the ASRS v1.1. Of these individuals, three out of the four individuals had low ASRS v1.1 scores, which suggested a trend of higher sensitivity for the ASRS v1.1 within a college-aged population. These results, along with data from aforementioned studies, suggest that clinicians should rely on measures other than the ASRS v1.1 to rule out ADHD, but that the measurement could be considered in rule-in scenarios.

A study by Stein et al. (1999) determined from a group of 511 individuals that the optimal cut-off for BAI was a total score of 20. For individuals with a score of 20 or more, the results indicated a sensitivity of .67 and specificity of .93. It was also determined that a cut-off score of 20 produced a PPP of .46 and an NPP of .97. These findings suggested that a score of 20 or more produced Moderate-High sensitivity and Very High specificity (Lange & Lippa, 2017). When applied to the exploratory analysis

data, a score of 20 or more on the BAI should have been a good indicator of an anxiety condition and scores below 20 should have been an even better indicator to rule out an anxiety condition. Of the false positive cases, four individuals were administered the BAI, all of which scored higher than 20 (scores=21, 49, 28, and 30). Every single case within the current study that included an individual who received a Clinically Significant score on the BASC Inattention/Hyperactivity composite score who did not end up with an ADHD diagnosis scored above the suggested cutoff score of 20 or more for the BAI (Stein et al., 1999). Within the false negative group, two individuals were administered the BAI. The scores for the individuals were split above and below the suggested 20-point cutoff score (scores = 23 and 10). There was insufficient data to determine BAI specificity trends within the false negative group. However, it was determined that the FN2 case with a score of 23 ended up with a comorbid condition of ADHD and Generalized Anxiety disorder. When the results from the current study were collectively analyzed, it was suggested that the BAI could be a strong assessment tool to incorporate when determining potential anxiety conditions in college-aged populations.

A study by Park et al. (2020) determined the BDI-II to have a .833 sensitivity and .868 specificity with a .365 PPP and a .983 NPP. These values were based on the proposed cutoff scores from Beck et al. (1996). The research group established that a score of 17 or greater was the optimal cut-off for the BDI-II. When this information was compared to the exploratory analysis data collected from the current study, it was noted that five out of the nine FP individuals were administered the BDI-II. Of these five

individuals, 100% of them scored above a score of 17, which aligned with the Park et al. (2020) findings. This suggests that in cases in which a BDI-II is administered and a score of 17 or more is obtained, the clinician can rule in a depression symptom with about 80% accuracy. This trend was confirmed when the results from the FN group were analyzed. Of the three individuals who were administered the BDI-II within the FN group, two scored below the proposed 17 score cutoff point.

When the outcomes of the sensitivity, specificity, PPP, and NPP were collectively analyzed, the scores supported the hypothesis that the BASC-3 Inattention/Hyperactivity composite *t*-score showed strong classification accuracy for ADHD diagnosis. The results of the study indicated that the proposed Inattention/Hyperactivity score on the BASC-3 SRP COL had good sensitivity and specificity in comparison to other assessment measurements, such as the ASRS v1.1, BAI, and the BDI-II. In addition, it was determined that the proposed cutoff score of 70 as a marker for Clinically Significant symptoms level also provided optimal sensitivity and specificity for the BASC-3 SRP COL Inattentive/Hyperactivity composite score.

Causations for False Positive Cases

In addition to determining the sensitivity and specificity of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score, further analyses were conducted to determine possible causes for the FP cases. A mean score comparison was conducted to determine whether there were significant differences between the TP, TN, FP, and FN groups for the Inattention/Hyperactivity composite score, Attention Problems subscale

score, and Hyperactivity subscale score. It was determined that the FP group was not significantly different from the TP group for the Inattention/Hyperactivity composite score, Attention Problems subscale score, or Hyperactivity subscale score. These results suggested that the individuals within the TP and FP groups presented similar levels of symptoms within all three scales. For the Inattention/Hyperactivity composite score, both the TP group and the FP group were significantly different from the TN and TP groups. For the Attention Problems subscale, scores from the TP group did not significantly differ from the FP or FN groups. These results suggested that individuals from the TP, FP, and FN groups all presented similar levels of attention problems. The scores from the Hyperactivity scale indicated that the TP group was not significantly different from the FP group. Additionally, it was determined that the Hyperactivity scores from the TN group were not significantly different from the FN group. These results suggested that the TP and FP groups had similar levels of hyperactivity problems while the TN and FN groups had similar levels of symptoms.

For the individuals that ended up classified as FP, information was needed to establish possible causations for why the results of the BASC-3 SRP COL indicated a Clinically Significant score for the Inattention/Hyperactivity composite score, but the individual was not classified as having ADHD. Previous research by Grant and Chamberlain (2022) established that several psychological conditions have been associated with impaired attention behaviors, and simply because an individual experienced difficulties with focusing, this is not necessarily indicative of ADHD. The

research also determined that other psychological conditions may have considerably greater attentional deficits. The research concluded that clinicians who suspect attentional issues in a client need to screen for a variety of other disorders. As such, the FP cases were analyzed for additional screeners and results associated with other conditions that accounted for the Clinically Significant scores on the BASC-3 SRP COL Inattention/Hyperactivity *t*-score.

When the results within Table 8 were analyzed and compared, it was determined that the FP individuals who received a diagnosis for depressive and/or anxiety-related conditions presented symptoms that also qualified as Clinically Significant for the BASC-3 SRP COL Inattentive/Hyperactivity composite *t*-score. One proposed reason for the elevated scores on the BASC was that the depressive or anxiety condition symptoms created attentional and/or hyperactive symptom patterns similar to what was observed in other individuals who received a diagnosis of ADHD. A separate causation for the FP cases could have stemmed from clinician error. For example, FP1 did not receive any elevated scores for the Internalizing Problems composite score, the Anxiety scale, or the Depression scale. FP1 did receive an elevated score on the MMPI personality assessment, but no additional narrowband assessments were used in the evaluation. The clinician decided that the information from the interview portion of the evaluation indicated a diagnosis of MDD. Just from the information gathered in the report, and without the narrowband testing, it is difficult to determine whether a diagnosis of MDD was accurate for MDD.

Another example of possible clinician error was observed in the case of FP4, in which the client did not receive any elevated scores on the BASC-3 SRP COL Internalizing Problems composite score, the Anxiety scale, or the Depression scale. The client did receive a BDI-II score in the moderate range, but no other socioemotional testing was completed. As such, it can be inferred that the diagnostic determination of Adjustment disorder with depression and anxious mood was based primarily on the information provided within the interview portion of the evaluation, and/or there was clinician error.

The final case that called into question the diagnostic determination was the case of FP6. The client did not indicate an elevated score on the Internalizing Problems composite score, received an elevated depression score on the MMPI personality assessment, but was not administered any additional narrowband socioemotional assessments. The clinician decided to maintain support for the Generalized Anxiety diagnosis retained by history. It was inferred that the clinician based their final diagnostic determination on interview information and/or there was clinician error.

The remaining FP cases indicated elevated scores from two or more different socioemotional assessments. These results, in combination with the additional information gathered from the interview more strongly supported the diagnostic determination of the FP cases. The results of the FP cases indicated that depressive and anxious-related diagnoses were the most prominent. These findings suggest that elevated levels of inattention and/or hyperactivity scores on the BASC-3 SRP COL need to be

further screened to more accurately determine if anxiety or depression diagnoses better support the presented symptoms. This claim was supported by the mean comparison statistical results that suggested the TP group and the FP group presented similar levels of symptoms within the BASC Inattention/Hyperactivity scale, Attention Problems subscale, and the Hyperactivity subscale. The results from Table 7, which presented the percentages of Clinically Significant scores for the BASC-3 SRP COL scale for each of the four groups, also indicated elevated scores for internalizing problems within the FP group. It was determined that the FP group had higher Clinically Significant scores than the TP group for all of the measured BASC internalizing scales except Atypicality and Anxiety. These findings suggest that when a client scores high on the ADHD-related scales on the BASC-3 SRP COL, clinicians should use Clinically Significant scores from Internalizing Problems composite scores and subscales to help guide decisions regarding ADHD versus other socioemotional diagnoses.

Causations for False Negative Cases

The individuals that resulted as FN were analyzed to determine what additional evaluation variables made it possible for the clinician to determine ADHD besides the BASC-3 COL SRP results. As such, the FN cases were analyzed for additional screeners and results associated with other conditions that accounted for the Clinically Significant scores on the BASC-3 SRP COL Inattention/Hyperactivity *t*-score. The scores from the ASRS v1.1 and the CPT II V.5 provided insight into the client's ADHD-related symptoms and Executive Functioning skills. Additionally, information from referral

forms and interview portions of the evaluation was considered if it was included in the diagnosis determination.

From the interview information, it was determined that five out of the eight individuals had a previous ADHD diagnosis (FN1, FN3, FN4, FN5, and FN7). The information also indicated that FN3, FN4, and FN5 were on ADHD medication at the time of the evaluation. Of the FN cases, none of the cases scored Clinically Significant for the BASC-3 SRP COL Inattention/Hyperactivity composite score, four cases scored Clinically Significant for Attention Problems (FN1, FN3, FN7, and FN8) and on case scored Clinically Significant for Hyperactivity (FN6). Within the FN group, four of the cases were administered the ASRS v1.1, one of which scored above the suggested cutoff score (FN8) and FN3, FN4, and FN7 scored below the suggested cutoff. Results from the CPT 3 indicated that seven of the eight FN cases were administered the test. The case FN4 received a low d' score, results for FN1, FN2, FN3, FN7, and FN8 fell in the High Average range, and the d' of FN6 (t = 61.92) fell in the Elevated score range. The reviewed cognitive assessment portions of the FN cases presented 6 Working Memory scores. FN8 received a low score, FN5 received a low average score, FN1, FN3, and FN7 received average scores, and FN2 scored above average.

Of the psychological evaluation variables examined, it can be concluded that the clinicians relied more heavily on the information provided within the interview portion of the evaluation than the results of the BASC, ASRS v1.1, CPT 3, and Working Memory scores. This was supported due to several instances when assessment scores fell below

the Clinically Significant cutoff point, but an ADHD diagnosis was ultimately given. For example, FN4 and FN5 scored below the cutoff point for all ADHD-related assessments that were administered, but had a prior ADHD diagnosis and was prescribed medication for ADHD symptom control. It can be interpreted that the clinicians in these cases determined the ADHD diagnosis based on the information the client expressed and less on the outcomes of the assessments.

Implications

This study provided clinicians with additional insight into the accuracy of the BASC-3 SRP COL assessment as a predictor for ADHD in a college-aged population. Additionally, this study examined other assessment strategies that may be beneficial in the process of differentiating between different conditions. The results of this study could provide clinicians with greater confidence in determining assessment strategies as well as within the diagnosis decision-making processes within college-aged populations.

No single diagnostic symptom or behavior has been determined to be the best indicator of ADHD within any age group. As such, multifaceted decision-making practices that require extensive training and experience are essential to reach an accurate ADHD determination (Schneider et al., 2019). Previous research established that certain groups of clinicians felt uncertain of their ability to correctly diagnose ADHD within an adult population (Knutson & O'Malley, 2010). Other research determined that groups of clinicians reported having insufficient training to make ADHD determinations in adult populations (Adler et al., 2009). A study by Schneider et al. (2019) surveyed clinicians

who regularly worked with adults with ADHD and determined that a majority (79.9%) of the individuals reported having “a few hours” of ADHD-specific training, and 25% reported not having read diagnostic guidelines for ADHD. The study also determined that the major challenge to ADHD diagnosing within the adult population was reported to be the lack of consensus regarding “gold standard” measure(s) (33.1%) and a lack of knowledge and experience (31.8%). Individuals could be diagnosed by other health professionals, such as their primary care physicians (PCPs). In a study by Adler et al. (2009), it was determined that only 34% of the 400 participating PCPs felt “very or extremely knowledgeable” about ADHD within adult populations. Additionally, only 13% of the respondents felt they had received thorough training, and 44% thought the diagnostic criteria was unclear. Results also indicated that 85% of the sampled PCPs expressed a desire to take a more active role in diagnosing adult ADHD if a quick screening tool with appropriate validity was developed. As such, it is imperative that all individuals who have licensure to make diagnoses familiarize themselves with the most effective decision-making processes in diagnosis determinations.

Research established that individuals with ADHD had impairments that resulted in adverse outcomes for school performance, vocational success, and social relationship building (National Institutes of Health Consensus, 2000). As such, it can be concluded that providing strong evaluation strategies for school-aged individuals is just as critical as having accurate assessments for college-age individuals. It could be argued that having strong assessments for school-aged individuals would provide earlier identification of

diagnosis and therefore earlier support and interventions to promote optimum success both academically and socioemotionally.

Research estimated that more than half of children with an ADHD diagnosis are school-identified as eligible for services under the Individuals with Disabilities Education Act (Barkley, 1998; Reid et al. 1994). The research concluded that the majority of children with ADHD are provided educational support under the special education categories of learning disability (LD), emotional disturbance (ED), or other health impairment (OHI). Studies have shown that children who have ADHD and additional comorbid conditions have even lower self-esteem and higher negative internalized feelings than children with just ADHD or individuals without ADHD (Bussing, et al., 2000). As such, schools need to be able to have strong assessment tools to help measure when ADHD is present, as well as other comorbid conditions, to help provide the necessary support for academic success and appropriate socioemotional development.

Research cited problems in distinguishing individuals without ADHD from those with ADHD (National Institutes of Health Consensus, 2000). However, previous findings have suggested that the BASC-3 is one of the most commonly incorporated assessments for ADHD diagnosis (Pelham et al., 2005). The attention problems and hyperactivity scales of the BASC-3 were shown to have a moderate to high correlation with results from other ADHD assessments, such as the Conners-3 (Conners 3rd Edition; Conners et al., 2011). Additionally, a study by Zhou et al. (2020) demonstrated that the BASC-3 had

a strong ability to help clinicians make differential diagnoses of ADHD and Autism Spectrum Disorder in children and adolescent-aged populations. These results suggested that the BASC-3 can be used to help guide informed and accurate differential diagnoses between populations of individuals with overlapping symptoms. In a study by Jarratt et al. (2005), the BASC was directly compared to the Behavior Rating Inventory of Executive Function (BRIEF) assessment to determine which measurement identified ADHD symptoms more effectively. While the compared assessments provided similar results related to critical behaviors with ADHD, such as behavioral regulation and externalizing behaviors, it was concluded that the BRIEF did not provide as much insight into internalizing disorders as the BASC. As such, it was determined that the BASC assessment was stronger at identifying potential comorbid conditions. However, it was concluded that combining the BASC with the BRIEF provided even stronger evidence for both ADHD and possible comorbid conditions.

Limitations

This study had limitations that should be considered when analyzing the findings. One of the primary limitations of this study was that the data came from archival records. In client care, the initial interactions of a client-provider encounter are vitally important to establish trust and rapport. Previous research suggested that relationships anchored in trust and rapport helped to support better care experiences as well as alleviated feelings of anxiousness and distress (Dean & Street, 2014; Thorne et al., 2005). Although previous research has not suggested a best practice method to organize and analyze the complex

information that is presented in intake sessions, it was found that implicit clinical judgments were a crucial skill in the process of integrating the plethora of material gathered from communication (Nakash & Algeria, 2013). Because this study was based on diagnostic decisions from unobserved clinician-client interactions and communications, conclusions about the decision-making processes or clinical judgments could only be inferred from the information presented in the final reports. In both the FP and FN cases, it was evident in several instances that final diagnostic decisions were based on information gathered through interviews and not quantitative assessment results.

An additional limitation of the study was the sampling population. The data was retrieved from a single clinic within a rural university. After examining the demographics of the clients, it was noted that the sexual and racial composition of the sample was not representative of the general population. Within the current study, the individuals were predominately female clients. This could be due to statically less disruptive behaviors presented by females with ADHD that result in under-identification for females with ADHD. Since most individuals with ADHD are identified as children, and more females go unidentified, the higher percentage of females seeking diagnosis as young adults may be linked (Rucklidge, 2010).

Previous research argued that because the calculation of the PPP and NPP requires knowledge of the base rate of a condition in a particular population, the results from these measurements provide the most potential usefulness of a test in making a diagnosis for a specific setting. However, if the base rate of the condition in one setting differs from the

rate from the base rate within a separate study, the utility of the assessment will not be consistent across testing (Ivnik et al., 2001). Lange and Lippa (2017) argued that due to the complexity of determining the diagnostic accuracy of measurements, sensitivity and specificity measurements should only be interpreted in conjunction with other statistics such as PPP and NPP. Based on research by Marshall et al. (2021), values for sensitivity and specificity are often provided, but a majority of research studies do not include PPP, NPP, or any other diagnostic accuracy statistics. While some of the sensitivity and specificity results from other studies were provided in conjunction with PPP and NPP values, this was not consistent for all studies due to a lack of available information.

A final limitation of the current study was the construct used to calculate the BASC-3 SRP COL classification accuracy for ADHD diagnosis. To truly determine the accuracy of the BASC-3 SRP COL, the ideal method would have been to take individuals who were predetermined as meeting the criteria for ADHD or not, and then administer the BASC-3 separate from the diagnosis, to determine if the individuals with ADHD scored higher on the Inattention/Hyperactivity composite score than individuals who were predetermined to not have ADHD. In the cases of the current study, the individuals were administered the BASC-3 SRP COL as part of the psychological evaluation. As such, it was difficult to isolate the BASC-3 accuracy from the final diagnosis determination. Although the BASC-3 was not designed to be a diagnosis-determining assessment, but rather a screener for socioemotional conditions that requires additional data for diagnosis determinations, it was difficult to confidently know how much the

student clinicians or the supervising Licensed Psychologist relied upon the results of the BASC-3 SRP COL in the final diagnosis determination. Appendix B presents the sensitivity and specificity of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score using the criteria of a DSM-5 ADHD diagnostic interview. This allowed for independent analysis of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score.

Future Studies

Future studies could do additional research on the BASC-3 SRP COL for ADHD classification accuracy by separating the BASC-3 scores from the diagnosis determination. In addition, because a diagnosis of ADHD could be classified as one of three types, and the Inattention/Hyperactivity composite score is comprised of both the Attention Problems scale and the Hyperactivity scale, research could be done to observe how the three different types of ADHD compared in Clinically Significant scores for the three BASC-3 scales within a college population. Further research studies could determine how the BASC-3 scores correlate with an additional measure of ADHD symptoms such as the CPT 3 d' score. The results of these studies would provide further information for clinicians making ADHD determinations within the college-aged population.

Additional future studies are needed for the determination and accurate classification of comorbid conditions that are commonly observed in ADHD. While this study was able to conclude individuals who have a differential diagnosis can also have

attentional issues, determining the number of TP cases that had a comorbid condition was not determined. However, knowing comorbid condition prevalence and patterns of symptoms could be beneficial for clinicians in diagnosis determination and designing effective treatment options.

Assessment creation and development are also needed to have more accurate diagnostic tools for adult-aged individuals seeking ADHD determination. There are few assessment options for diagnosing college-aged individuals and even fewer for older adults. Providing accurate diagnostic measurements for college-aged individuals will help provide not only insight into potential academic support but also vocational success as well.

Conclusion

Previous research established that students with ADHD experienced deficits in skillsets that played a pivotal role in academic success. These included behaviors such as attention maintenance, modulating behavioral levels, impulsive inhibition, and persistence (DuPaul & Stoner, 2003). ADHD was found to negatively impact developmental trajectory, increase the risk for impaired functioning and diminish well-being in adulthood (Cantwell, 1996; Mannuzza et al., 1991, 1993) Adults with ADHD were found less likely to attain the same educational and occupational levels as those without the diagnosis, and this outcome was not observed to be improved by pharmacotherapy (Advokat et al., 2010).

While the BASC-3 was identified as one of the most commonly incorporated

assessments for ADHD diagnosis (Pelham et al., 2005), there is limited information on the classification accuracy of the BASC for college-aged individuals. The current study sought to determine the classification accuracy of the *Behavior Assessment System for Children* (Third Ed.; BASC-3) Inattention/Hyperactivity composite *t*-score in predicting the diagnosis of Attention-Deficit/Hyperactivity Disorder among college students who completed a psychological assessment through the Stephen F. Austin State University School Psychology Assessment Center. The results of the study indicated that the proposed Inattention/Hyperactivity score on the BASC-3 SRP COL had Moderate-High sensitivity and High specificity. It was also observed that the calculated specificity and sensitivity scores were comparable to other socioemotional assessment strategies. In addition, it was determined that the proposed cutoff score of 70 as a marker for Clinically Significant symptoms level provided optimal sensitivity and specificity for the BASC-3 SRP COL Inattentive/Hyperactivity composite score. Further investigation of the FP and FN cases suggested that interview information can also provide information important in diagnostic determinations, as several conditions have overlapping symptoms. The current study method made separating the influence of the BASC-3 on the diagnostic determination difficult, but it still provided beneficial information to clinicians on the accuracy of the BASC-3 SRP COL for ADHD diagnosis in college-aged individuals. Finally, the study highlighted the importance of future studies to determine differences in the ADHD diagnostic classifications within an adult population, the need for additional information on comorbid conditions with ADHD, and the development of additional

adult ADHD assessments.

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APPENDIX A

IRB Approval Form

STEPHEN F. AUSTIN STATE UNIVERSITY
Institutional Review Board for the Protection of Human Subjects in Research
P.O. Box 13019, SFA Station • Nacogdoches, Texas 75962-3046
Phone (936) 468-1153 • Fax (936) 468-1573

Principal Investigator: Luis E. Aguerrevere
College of Education 1153
aguerrevle@sfasu.edu

Co-Principal Investigator: Angela Lucas

RE: *The Behavior Assessment System for Children Third Edition (BASC-3)'s Classification Accuracy for Attention deficit/hyperactivity disorder (ADHD) in young adults*

Case Number: **AY 2023-1014**

TYPE RESEARCH: Dissertation Research

FROM: Emmerentie Oliphant, Chair, IRB-H

DATE: February 3, 2023

Thank you for submitting your project entitled "*The Behavior Assessment System for Children Third Edition (BASC-3)'s Classification Accuracy for Attention deficit/hyperactivity disorder (ADHD) in young adults* "to the IRB for review. It has been reviewed and **approved** based on the following criteria:

Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Your project has approval for one year – through **February 3, 2024.** Should you need additional time to complete the study you will need to apply for an extension prior to that date. The IRB should be notified of any planned changes in the procedures during the approval period, as additional review will be required by the IRB, prior to implementing any changes, except when changes are necessary to eliminate immediate hazards to the research participants. The researcher is also responsible for promptly notifying the IRB of any unanticipated or adverse events involving riskor harm to participants or others as a result of the research.

All future correspondence regarding this project should include the case number **AY 2023-1014.**

AY2023-1014 Exempt/Full/Expedited

APPENDIX B

BASC-3 SRP COL Sensitivity and Specificity Data Using DSM-5 ADHD Diagnostic Interview Criterion

The sensitivity of the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score was examined using the criteria of a DSM-5 ADHD diagnostic interview. Cases were coded TP if the individual met the diagnostic criteria when administered the DSM-5 ADHD diagnostic interview and received a Clinically Significant score on the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score. There was a total of 21 TP cases. A code of TN was given if the Individual did not meet the diagnostic criteria when administered the DSM-5 ADHD diagnostic interview and did not receive a Clinically Significant score on the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score. There was a total of 31 TN cases. Cases were coded FP if the individual received a Clinically Significant score on the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score, but did not meet the diagnostic criteria when administered the DSM-5 ADHD diagnostic interview. There was a total of 2 FP cases. A code of FN was administered if the individual did not receive a Clinically Significant score on the BASC-3 SRP COL Inattention/Hyperactivity composite *t*-score, but met the diagnostic criteria when administered the DSM-5 ADHD diagnostic interview. There was a total of 9 FN cases.

The sensitivity of the BASC-3 Inattention/Hyperactivity composite *t*-score was

determined to be 70%. This suggested that the BASC-3 SRP COL was able to rule in 70% of individuals who also met the ADHD diagnostic criteria when administered a DSM-5 ADHD diagnostic interview. The specificity of the BASC-3 Inattention/Hyperactivity composite *t*-score was examined using the criteria of a DSM-5 ADHD diagnostic interview. The specificity of the BASC-3 Inattention/Hyperactivity composite *t*-score was determined to be 94%. This suggested that the BASC-3 SRP COL was able to rule out 94% of individuals who also did not meet the ADHD diagnostic criteria when administered a DSM-5 ADHD diagnostic interview.

Table B1

BASC-3 SRP COL Sensitivity and Specificity Data Using DSM-5 ADHD Diagnostic Interview Criterion

Statistic	**Value**
Base Rate	.476
Correctly Identified	.825
False Positive Rate	.087
False Negative Rate	.225
Sensitivity	.700
Specificity	.939
PPP	.913
NPP	.775

VITA

Angela Lucas graduated from Carthage High School and then completed her Associate's Degree from Panola College in 2012. She attended the University of North Texas from which she received the Degree of Bachelor of Science in December 2015 in Interdisciplinary Studies. She attended Stephen F. Austin State University and received a Master's of Education Degree in 2017 . In 2018, she entered the doctoral program in School Psychology at Stephen F. Austin State University and anticipates receiving her degree of Doctor of Philosophy in August of 2023.

Angela Lucas is married with one daughter. For requirements of her dissertation, she designed and concluded an independent study, *The Behavior Assessment System for Children Third Edition (BASC-3)'s Classification Accuracy for Attention-Deficit/Hyperactivity Disorder (ADHD) in Young Adults.* In addition, she completed her internship at an APA accredited site and at the University's School Psychology. Assessment Center and Neuropsychology Center.

SFASU Address: 1936 North Street
Nacogdoches, TX 75962

Style manual designation: American Psychological Association (Seventh Edition)

This Dissertation was typed by Angela L. Lucas.