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Assessing Deaf College Students with Attention Deficit Hyperactivity Disorder:
Behavior Rating Inventory of Executive Function – Adult Version versus CAARS.

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Abstract

This study examined the sensitivity of two instruments used in assessing Attention Deficit Hyperactivity Disorder (ADHD) with deaf individuals. Forty deaf college students, 20 with a diagnosis of ADHD and 20 controls, completed the Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A) and the Connors’ Adult ADHD Rating Scale (CAARS). An analysis of variance (ANOVA), multivariate analyses of variance (MANOVA), and sensitivity, specificity, and predictive value analyses found that both the BRIEF-A and CAARS were adequate behavior rating scales for measuring ADHD symptoms in a deaf population. Results also revealed that the BRIEF-A was a more specific measure whereas the CAARS was a more sensitive measure.
Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most recurring mental health disorders in children (Bren, 2004). The National Institute of Mental Health reports approximately three to five percent of all children in the United States have ADHD (American Psychiatric Association, 1994, 2000; Barkley, 1998; Bren, 2004). In comparison to the incidence rate of ADHD in hearing individuals, the percentage of deaf diagnosed with ADHD is between 3.5 to 38.7 percent (Parasnis, Samar, & Berent, 2003).

The assessment for ADHD begins by comparing the pattern of behavior exhibited by an individual against the criteria established by the American Psychiatric Association (DSM-IV, 2000). A typical evaluation includes cognitive tests, questionnaires, and rating scales. Questionnaires and rating scales completed by parents, teachers, and informants close to the individual provide useful information about the presence and frequency of symptoms. More specifically, rating scales that focus on ADHD symptoms and behaviors can be used to assess an individual’s inattentive, hyperactive, and impulsive behaviors (Bren, 2004). Examples of rating scales are Connors’ Rating Scale – Revised (CRS-R) and the Connors’ Adult ADHD Rating Scale (CAARS). The CRS-R is completed by parents, teachers, and adolescents whereas the CAARS is a self-report measure for adults (Angello et al., 2003; PAR, 2006).

Children with ADHD display established and replicated weaknesses in neuropsychological executive functioning (EF) (Nigg, Stavro, Ettenhofer, Hambrick, Miller, & Henderson, 2005). Specific deficits in executive functioning have been found to cause ADHD, revealing a relationship between executive functioning deficits and ADHD symptoms (Nigg et al., 2005).
In comparison to the CAARS, the Behavior Rating Inventory of Executive Function (BRIEF) is a self-report measure designed to evaluate everyday behavioral manifestations of an individual’s executive control functions (Gioia, Isquith, Retzlaff, & Espy, 2002).

Typical behaviors exhibited by deaf individuals are frequently misinterpreted as ADHD symptoms. For example, fatigue experienced from prolonged periods of verbal communication has been interpreted as difficulty in providing sustained attention. Also, a compromised auditory perception or a language deficit has been seen as someone choosing not to listen (O’Connell & Casale, 2004). Due to some of these similarities between the symptoms of ADHD and behaviors exhibited by the deaf, evaluators who are unfamiliar with deaf mannerisms often quickly jump to the possibility of ADHD (Parasnis et al., 2003). One way to prevent this from occurring is to determine whether rating scales used with hearing individuals are able to differentiate ADHD from non-ADHD behaviors in deaf individuals.

The purpose of this study was to examine the strengths and weaknesses of two rating scales commonly used in the hearing population with deaf individuals. Forty college students participated in this study. Of the 40 participants, 20 were diagnosed with ADHD prior to the study. All of the participants completed the Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A) and the Connors’ Adult ADHD Rating Scale (CAARS).

Definition of Terms

Attention Deficit Hyperactivity Disorder is a developmental childhood illness characterized by signs of inattention, hyperactivity, and impulsivity. Impairment must occur in at least two settings and before the age of seven (DSM-IV, 2000).
Deafness is viewed as a hearing loss in the medical community and is legally classified as a disability (Williams & Abeles, 2004). A person who has a 30-40 decibel (dB) loss is mildly deaf or hard of hearing whereas a person with a 90 dB loss or greater is categorized as profoundly deaf (Pagliaro, 2001). The higher rates occur in children with acquired deafness, as opposed to hereditary deafness (Parasnis et al., 2003). The word Deaf is capitalized to represent the social, cultural, and political affiliation with the Deaf community (Colangelo & McWhirter, 2001; Tucker, 1998).

Research Question

It is hypothesized that the BRIEF-A is a more sensitive measure in detecting ADHD symptoms than the CAARS in the deaf population.
Assessing Deaf College Students with Attention Deficit Hyperactivity Disorder:  
Behavior Rating Inventory of Executive Function – Adult Version versus CAARS. 

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most ubiquitous mental health disorders in children, according to the American Psychiatric Association (American Academy of Pediatrics, 2000; Barkley, 1991; Bren, 2004). The National Institute of Mental Health estimates three to five percent of children in the United States have ADHD (American Psychiatric Association, 1994, 2000; Barkley, 1998; Bren, 2004). Approximately, 50 percent of referrals to child mental health clinics are for the assessment and treatment of ADHD (Bren, 2004). Risk factors, such as environmental factors, parental divorce, and a history of abuse or neglect, are common in individuals susceptible of ADHD. Multiple foster placements, neurotoxin exposure, infections at childbirth, drug exposure in uteri, and mental retardation are also associated with ADHD (DSM-IV, 2000).

There are three types of ADHD, which are inattentive, hyperactive-impulsive, and combined (DSM-IV, 2000). Six inattention or hyperactivity and impulsivity symptoms need to be exhibited before a diagnosis of ADHD can be considered. These symptoms must continue for at least six months and be more frequent and severe when compared to same age peers. Symptoms should also cause significant damage to social, academic, or work functioning and must not be caused by another disorder. The damage to functioning must occur in two settings or more before age seven (See Table 1) (DSM-IV, 2000).

Assessing and Diagnosing ADHD

ADHD is one of the most difficult conditions to assess (Hutchinson, 1996). A clear pattern of impairment has yet to be determined because of high comorbidities with other
Assessing Deafness disorders (Jarratt, Riccio, & Siekierski, 2005). Moreover, there is no nationwide, standard, or specific comprehensive test for this disorder (Bren, 2004; Deutscher & Fewell, 2005; Jarratt et al., 2005). Symptoms often become visible when a child enters preschool and is required to provide sustained attention. For many, the hyperactive symptoms fade over time; however, the inattentive symptoms continue well into adolescence and adulthood (Bren, 2004).

An assessment for ADHD is made by comparing the pattern of behavior exhibited against the criteria established by the American Psychiatric Association (Bren, 2004; DSM-IV, 2000; Nahlik, 2004). Familiarity with developmental milestones is important when making suitable comparisons between normal and abnormal development (Hutchinson, 1996). It is critical to be able to distinguish developmentally appropriate activities from behaviors that fall in the ADHD spectrum, such as disruptive behavior, constant movement, incessant talk, and emotional outbursts (Bren, 2004). A comprehensive evaluation should include clinical judgment by a qualified evaluator; a detailed history with medical, psychological, developmental, social, educational, and familial components; an evaluation of academic achievement; and the use of objective/standardized ADHD rating scales, psychometric tests of intellectual and cognitive functioning, and continuous performance tests (CPTs) (Nahlik, 2004; Parasnis et al., 2003). Norm-referenced and psychometrically sound measures should be utilized to ensure that decisions are valid and the assessment process should extend over two or more sessions (Jarratt et al., 2005; Parasnis et al., 2003).

It is crucial that the child is assessed by a health professional, one with training in ADHD and mental disorders (Bren, 2004). A trained health professional is able to determine whether comorbidity exists or other psychiatric disorders account for the symptoms exhibited (Homer et al., 2000; Jarratt et al., 2005). Approximately half of the clinic-referred children with ADHD are
diagnosed with Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD). The rates of co-occurrence of ADHD with these disorders are higher than any other mental disorders, occurring more with the hyperactivity-impulsivity and combined types (DSM-IV, 2000). The lesser common comorbidities are learning disabilities and/or disruptive behaviors, such as mood disorders, anxiety disorders, tics, and Tourette’s syndrome (TS) (Homer et al., 2000; O’Connell & Casale, 2004). There are a small percentage of children with both TS and ADHD, and typically the onset of ADHD precedes the onset of TS (DSM-IV, 2000).

The standard guideline for assessing ADHD should not be applied to individuals with mental retardation, pervasive developmental disorder, moderate to severe sensory deficits such as visual and hearing impairment, chronic disorders associated with medication, and those who have experienced child or sexual abuse (Homer et al., 2000). These guidelines can only be applied to comparably uncomplicated cases in primary care settings (Homer et al., 2000).

**ADHD across Different Age Groups**

ADHD symptoms that are present during the adolescent years are frequently overlooked leading to many not being appropriately assessed for ADHD (Nahlik, 2004). For example, doctors are less likely to assess for ADHD due to other behavior problems exhibited with adolescents (Nahlik, 2004). ADHD is less obvious as these symptoms in adolescents are more of inattention and mental restlessness than physical restlessness. In addition, the established diagnostic criteria are primarily childhood ADHD based with rating scales designed for a younger population. There is also more difficulty in obtaining information from secondary school teachers than elementary school teachers. The occurrence of other psychiatric comorbidities can mask vital symptoms and point to inaccurate classifications (Nahlik, 2004). Up to two-thirds of adolescents have comorbidity with ADHD (Homer et al., 2000).
As children with ADHD mature into adolescence and adulthood, the consequences of ADHD can increase in severity and occurrence (Bren, 2004). Adolescents are more at risk for severe academic difficulties (Barkley, 1990). They are more likely to drop out of high school and less likely to enter college (Bren, 2004). They also engage more in risky behaviors, such as substance abuse and sexual involvement. Collectively, adolescents and adults with ADHD have more vehicular accidents and twice the number of severe accidents resulting in vehicle damage and bodily injury than those without ADHD. Adolescents with ADHD are more susceptible for coordination deficits, less able to maneuver vehicles in traffic, a slower reaction time, and an inability for constant attention (Bren, 2004).

Furthermore, adults with ADHD are at risk for depression and anxiety (Bren, 2004). They are more likely to be fired from jobs and divorced from their spouses (Bren, 2004). They also show difficulty paying attention and planning ahead, lack of organizational skills, and memory loss (Healy, 2004). Of the ADHD population, approximately five to seven percent continue to exhibit ADHD behaviors into adulthood (Wasserstein, 2005). Doctors need to be cautious in moving quickly towards a conclusion of ADHD because adults often have other mental or physical illnesses, such as substance abuse, antisocial behavior, residual learning disabilities, conduct disorders, and mood and anxiety disorders; the medications taken may confound the assessment process (Healy, 2004; Wasserstein, 2005). Also, when assessing an adult for ADHD, it is imperative that the childhood history be taken into account. This allows for differentiation between this disorder and other clinical syndromes that may cause similar symptoms, such as mood disorders, substance abuse, and personality disorders (Barkley, 1998; Stein et al., 1995; Wender, 1995).
Symptoms of ADHD also hinder interpersonal relationships and employment for adults (Barkley, Murphy, & Kwasnik, 1996; Hechtman & Weiss, 1983; Mannuzza et al., 1991; Weiss & Hechtman, 1993; Wender, 1987). Social incompetence, the inability to facilitate appropriate interpersonal interactions in a social environment, includes the expression and control of verbal and nonverbal communication. Behavioral disinhibition, a core feature of ADHD, affects the development of socially appropriate behaviors. Impairments of these behaviors stem from symptoms of hyperactivity and impulsiveness (Friedman et al., 2003). Hence, adults have a hard time identifying, regulating, and expressing emotions, and employ an increased reactivity level with a decreased level of frustration tolerance (Barkley, 1997a, 1997b; Saarni, 1999). One rationale is that even though adults have heightened emotional reactions, they are less able to differentiate amongst specific emotions or are less inclined to do so (Friedman et al., 2003). This implies that they may have difficulties performing in the workplace and these difficulties may have serious effects, such as whether one gets a promotion or is considered a team player.

Approximately one to four percent of the college population has ADHD (DuPaul et al., 2001; Glutting, Watkins, & Youngstrom, 2005; Heiligenstein, Conyers, Bern, & Smith, 1998; Weyandt, Linterman, & Rice, 1995). Less information is available about college students with ADHD than children or adults. Few studies have been conducted incorporating college students. However, Glutting et al. (2005) found that those with ADHD who attended college showed higher ability levels, exhibited greater academic success in primary and secondary school, and had more sophisticated compensatory skills than individuals with ADHD in the general population. They also experienced different forms of stress than adults who did not seek postsecondary education. By adapting to higher level academia challenges and demands, these college students created a different subset within the ADHD population (Glutting et al., 2005).
The Increase in ADHD Diagnoses

Paul Andreason, M.D., drug reviewer for the Division of Neuropharmacological Drug Products, reported that many health professionals believe that ADHD is over-diagnosed (Bren, 2004). A child should be examined by a doctor and diagnosed with ADHD before placed on any stimulants, and even then doctors need to be prudent when using the diagnosis of ADHD (Bren, 2004). The diagnosis of ADHD often meets the needs of parents more than the child and seems to relieve the parents of some real or perceived stress from educators, family, and friends (Smelter & Rasch, 1996).

Doctors, parents, and teachers are all responsible for the increase in the ADHD diagnosis. Doctors are prescribing psychostimulants with little or no independent evaluation based on parents showing school reports stating that the child has a behavior problem and should be assessed for ADHD (Hutchinson, 1996). When the child becomes docile, the teachers are satisfied and the parents are relieved that the problem has disappeared. On the other hand, the teachers do not realize that not all of these children have ADHD and are taking medication regardless. They assume that all disruptive behaviors are the result of ADHD and wrongly encourage pinning this label on other students (Hutchinson, 1996).

Children can exhibit unusual behaviors similar to symptoms of ADHD as a result of family and social adjustment problems (Hutchinson, 1996). Inattention, impulsivity, and hyperactivity also occur for a number of conditions, such as depression, anxiety, developmental problems, and learning disorders (Hutchinson, 1996). To prescribe medication in these circumstances would be unwise and possibly dangerous because it is unlikely that individuals will respond well to treatment when the difficulties are not caused by ADHD (Orford, 1998).
In the past, gifted students were misdiagnosed with ADHD more than their counterparts (Mika, 2006). Gifted, or bright, students often demonstrate behaviors that are indicative of more than one diagnosis, such as ADHD, learning disabilities (LD), and gifted/talented (Baum & Olenchak, 2002). However, there is no current empirical evidence proving that the diagnoses of ADHD and LD occurred more frequently because of the gifted/talented component (Mika, 2006). Regardless, these diagnoses contributed greatly to students’ continued failure in the learning environment (Baum & Olenchak, 2002). Such a diagnosis of ADHD for these gifted students led to unbeneficial treatment, such as stimulant medication (Mika, 2006).

The global use of psychostimulant medication has tripled from 1993 to 2003 (Scheffler, Hinshaw, Modrek, & Levine, 2007). In 2005, 2.5 million children were taking medications (Daily News Central, 2005). Furthermore, in 2007 one out of 25 children and adolescents were taking medication for ADHD (Anwar, 2007). Stimulants like methylphenidate (MPH) and dextroamphetamine are commonly prescribed because of the effects, such as an increase in attention and decrease in problem behaviors (Baren, 1994).

**Executive Functioning**

Children with ADHD have established and replicated weaknesses in neuropsychological executive functioning (EF). EF is the ability to regulate behavior based on the context and to maintain a set response (Nigg et al., 2005). Imitation, planning, shifting of thought or attention, organization, inhibition of inappropriate thought or behavior, and efficiently sustained and sequenced behavior are elements of the EF construct. Executive dysfunction (EdF), the foremost feature of ADHD, is a characteristic feature seen in a variety of children with clinical disorders (Barkley, 1997a, 1997b, 1998, 2000; Mahone et al., 2002a). EdF refers to disorganized actions and strategies for everyday tasks and functions. Some examples are difficulty with planning and
sequencing complex behaviors, inability in paying attention to more than one component simultaneously, weak comprehension of complex situations, low resistance to distractions and interruptions, and difficulty controlling behavioral output for prolonged periods (Pineda et al., 1998). Individuals with the combined type of ADHD struggle most with inhibitory control and have a difficult time executing certain executive functions, such as inhibition. These difficulties are prominent and cause breakdowns, or weaknesses, in sustained problem-solving scenarios (Barkley, 1997a, 1997b, 1998, 2000). In addition, individuals with damage to the prefrontal areas, where the regulation and execution of executive functions occur, exhibit poor performance on measures that incorporate novelty, planning, inhibition, and organization (Mahone et al., 2002a).

Furthermore, adults with ADHD have EF deficits in the areas of set shifting, response inhibition, and stopping tasks. Deficits in the executive functioning are often related to symptoms of inattention-disorganization, rather than hyperactivity-impulsivity (Nigg et al., 2005). Both children and adults with ADHD show consistency of difficulties in sustaining attention, with deficits found in one or more areas of EF (Mahone et al., 2002a). For many, the symptoms of ADHD decrease over time with maturation into early adulthood, between 18 and 30 years of age. However, findings show that some adults with ADHD continue to exhibit difficulties with one or more EF construct, such as slowness in responses. This suggests a difficulty with vigilance, alertness, activation, effort, and other possible state regulations (Nigg et al., 2005). A quintessential model of executive functioning should view ADHD as an underlying factor that propels other functions, such as working memory, emotional regulation, and goal-directed analysis and synthesis in problem solving (Gioia et al., 2002). Such a model would be ideal for identification and detection (Gioia et al., 2002).
Performance-based measures can be altered by a variety of factors, such as diverse and imprecise definitions of EF, variation in the criteria defining experimental populations with ADHD, effects of medication during testing, and the developmental relationship between EF and sex, EF and age, and EF and intelligence quotient (IQ) (Mahone et al., 2002a). Lovejoy et al. (1999) found that when using EF measures to predict possible diagnostic classifications for ADHD, positive predictive power was high despite the presence of false negatives. This shows that performance-based measures of EF are sensitive enough to detect hidden or imperceptible symptoms; yet, caution must be exercised with how specific the instruments are. Screening tests have cut-off points that distinguish between a clinical or normal result. A clinical, or positive, result indicates the presence of the disorder whereas a normal, or negative, result reflects the absence of the disorder. In other words, sensitivity means the proportion of cases where the diagnoses given was correct and specificity means the proportion of cases where the lack of diagnoses was correct. All screening tests should strive to be 100% sensitive and 100% specific (Kline, 2004).

Neuropsychological tests that measure executive functioning provide useful information in supporting the results of assessments for ADHD (Nahlik, 2004). However, using these tests as indicators of executive dysfunction in neurological groups is complicated for two reasons. First, the dysexecutive syndrome may be insignificant compared to the features of cognitive dysfunction (Burgess, Alderman, Evans, Emslie, & Wilson, 1998). The dysexecutive syndrome is comprised of impairments that cause damage to the frontal lobes. Difficulties caused by these impairments are seen in high-level tasks, such as planning, organizing, imitating, monitoring, and adapting behavior (Wilson, Alderman, Burgess, Emslie, & Evans, 1996). Hence, some of the impairments associated with the dysexecutive syndrome could overlap with other deficits.
caused by cognitive dysfunction. Such an overlap would cause an inability in distinguishing specific causes between the dysexecutive syndrome and cognitive dysfunctions. Second, it is not clear whether the executive system consists of impaired processes with its own behavioral and cognitive sequelae (Burgess et al., 1998). At certain times, it is also not apparent how many executive processes are impaired. The number of impaired processes inadvertently would prevent an estimation of the ecological utility of an executive task. To lessen the effects of these complicating factors, the relationship between the measures completed by individuals with dysexecutive functioning and their symptoms should be considered. This should be in place instead of a sole application of one test when measuring the overall severity of deficit (Burgess et al., 1998). For example, when an individual performs poorly on the Wisconsin Card Sorting Test (WCST), the poor performance suggests that the cognitive processes needed to complete this test are impaired. However, one should consider the overall sensitivity of the measure, especially when some of the behavioral symptoms are strong indicators of deficits in executive functioning (Burgess et al., 1998). Overall, correlations between symptoms and test scores often do not offer sufficient information about the level of impairment exhibited. Furthermore, most correlations are based more on the sensitivity than the specificity, implying a greater accuracy in whether the diagnosis given is appropriate (Burgess et al., 1998).

Assessment Tools

There are several ways to assess the severity and intensity of ADHD characteristics, such as continuous performance tests (CPTs) and rating scales completed by parents and teachers.

The CPT tasks require participants to maintain vigilance and react to the presence or absence of a specific stimulus while certain distracters are presented continuously. As opposed to other laboratory measures, these tests have the advantage of being standardized and
computerized. The CPTs demonstrate more strengths, such as the discrimination between ADHD and normal controls, lack of correlation with age and subject socio-economic status (SES), and lack of influence from order or fatigue effects, visual-motor integration, fine motor speed, and visual processing speed (McGee, Clark, & Symons, 2000). Generally, CPTs converge well with other measures of sustained attention and the overall index is not easily influenced by internalizing and externalizing behavior problems, remaining robust to many threats of validity (McGee et al., 2000).

In comparison to other CPTs, the Connors’ CPT illustrated several weaknesses. There was no univariate or multivariate association between the overall index of the Connors’ CPT and parent/teacher ratings of inattention or hyperactivity. Also, the overall index of the Connors’ CPT did not distinguish a difference between children with ADHD and clinical controls. Significant variance was exhibited between the overall index and the measures of phonological awareness as well; as phonological awareness decreased, the Connors’ CPT overall index score increased. Based on the controversial results from various studies, it was concluded that despite its strengths as a cognitive measure, the usage of the Connors’ CPT is debatable as a diagnostic instrument (McGee et al., 2000).

Burgess et al. (1998) conducted a study to determine how individuals perceive themselves and the severity of their executive functioning. Both patients and people who knew about the patients’ executive problems completed questionnaires. On a range of neuropsychological tests, the patients’ performance on executive function measures was poorer than the performance of the control group except on the Cognitive Estimates test. The patients viewed themselves as exhibiting less severe dysexecutive signs than noted by their observers. The control group rated themselves having significant severity of dysexecutive signs in everyday
life, substantially higher than those who knew them well. This suggests a lack of insight in personal difficulties for both groups. Overall, neuropsychological tests were better predictors of everyday problems than self-reports from individuals (Burgess et al., 1998).

In addition to performance-based neuropsychological tests including CPTs, there are rating scales completed by self, parents, teachers, and informants. Rating scales and questionnaires are useful in gathering individualized information about symptoms from the individual and close sources (Nahlik, 2004). While diagnoses should not be based only on responses to rating scales, specialized rating scales for ADHD symptoms should be chosen (Nahlik, 2004). Longer rating scales provide detailed information and are accordingly more reliable; however, they are not practical or efficient when multiple informants are involved. Follow-up individual and group interviews should be conducted with the individual, his/her parents, and close sources to verify the information reported on the rating scales (Nahlik, 2004).

**ADHD Rating Scales**

There are numerous current, direct, and widely used rating scales that have been developed to focus on ADHD symptoms. For example, the ADHD Rating Scale IV (ADHD-4) focuses on the presence and occurrence of ADHD symptoms. This rating scale is for ages five to 17 and has home and school versions available (Sprafkin, Gadow, & Nolan, 2001). Another popular tool for assessing ADHD is the Behavior Assessment System for Children: Monitor for ADHD (BASC Monitor). Geared for individuals aged four to 18, the BASC Monitor differentiates between the three types of ADHD. Also, teacher and parent versions are available with an observation component and the Student Observation System (SOS) (Angello et al., 2003). Another one is the Connors’ Rating Scale, which has long and short versions available for parents, teachers, and adolescents. Parents and teachers can use this with individuals aged
three to 17 and adolescents can complete the self-report (Angello et al., 2003). An additional rating scale is the ADHD Symptom Checklist – 4 (SC-4), a screening tool for individuals between ages three and 18. This rating scale categorizes disruptive behaviors, including side effects that may be experienced due to stimulant medication. Also, it is capable of monitoring the efficacy of interventions for disruptive behavior based on the inclusion of Peer Conflict and Stimulant Side Effect Checklist (Angello et al., 2003). The Attention Deficit Disorders Evaluation – Second Edition (ADDES – Second Edition) is another rating scale for individuals between ages four to 18 with three purposes, which are the screening for ADHD, assisting in the diagnosis of ADHD, and assisting in the development of individualized goals, objectives, and intervention strategies for both home and school environments (Angello et al., 2003). In addition, the ADD-H Comprehensive Teacher’s Rating Scale (ACTeRs), for individuals aged five to 12, has potential in monitoring efficacy of treatment (Angello et al., 2003).

These simple, brief questionnaires are designed to gather information from parents and teachers on symptoms exhibited in the past six months (Angello et al., 2003). All of the rating scales, except for ADDES – Second Edition, reported a large standardization sample. All were easy to administer and interpret and appropriately fit the DSM-IV symptom criteria of ADHD. The ADHD-4 and CSR-R provided a Spanish version, which is beneficial for primarily Spanish speaking parents and families. However, none of the rating scales appeared to include a significant number of students of different ethnicities and cultural backgrounds in the standardization sample. The norms may be more inclined or favorable towards a certain cultural or racial group, such as Caucasian (Angello et al., 2003).

Epstein et al. (2005) found that teachers who assisted in keeping track of the occurrences and severity of ADHD symptoms in the classroom with standardized rating scales were more
inclined to rate culturally diverse students negatively. The teachers rated African American (AA) children showing more ADHD-related behaviors than Caucasian children. Asian and Hispanic children were rated with lower levels of ADHD-related behaviors than both Caucasian and AA children. These ratings were similar across a variety of teacher rating scales and geographic locations in the United States. Ratings that were amplified by teachers based on ethnic status suggest the possibility of overidentification of ADHD among certain ethnic groups (Epstein et al., 2005).

For adults, the Connors’ Adult ADHD Rating Scale (CAARS) is a standardized self-report measure designed to assess, diagnose, and monitor treatment of ADHD. This rating scale consists of self-report ratings and observer ratings. The eight scales (Inattention/Memory Problems, Hyperactivity/Restlessness, Impulsivity/Emotional Liability, Problems with Self-Concept, DSM-IV Inattentive Symptoms, DSM-IV Hyperactive-Impulsive Symptoms, DSM-IV ADHD Symptoms Total, and ADHD Index) provide multimodal assessments of the behaviors and problems exhibited (Pearson Assessments, 2006). An in-depth review of the CAARS showed that the dimensions, such as Inattention/Cognitive Problems, Hyperactivity/Restlessness, Impulsivity/Emotional Liability, and Problems with Self-Concept, correlated significantly with scores from a well established measure used in the evaluation of ADHD in adults. As well, sensitivity and specificity were high with an overall diagnostic efficiency rate of 85% (Erhardt, Epstein, Connors, Parker, & Sitarenios, 1999).

In addition, the Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A) is a standardized self-report measure designed to evaluate everyday behavioral manifestations of an adult’s executive control functions (Gioia et al., 2002). The nine clinical scales (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory,
Play/Organize, Task Monitor, and Organization of Materials) assess executive functioning. These scales comprise the Behavioral Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite scores (GEC) (Jarratt et al., 2005). The BRIEF was primarily developed with the capacity of a rating scale to assess executive functioning from a more everyday, typical perspective (Gioia et al., 2002).

The supporters for the BRIEF believe it is more sensitive to life problems of individuals and reveals a more accurate prediction of real world difficulties that are encountered at a later age (Denckla, 2002). The BRIEF correlates with at least one aspect of executive functioning through the identification and effects of executive functioning deficits. Proving to be a better measure than the majority of third-party observer questionnaires and rating scales, the BRIEF also employs higher specificity and contains less complex terminology (Denckla, 2002).

The BRIEF’s Inhibit and Working Memory scales seem to sufficiently overlap with the diagnostic criteria of ADHD, especially for the inattentive and hyperactive-impulsive types (Mahone et al., 2002a; Gioia et al., 2000). Mahone et al. (2002a) examined the convergent and discriminant validity of the BRIEF in 76 children, between the ages of six and 16, with ADHD and/or Tourette’s syndrome (TS). They further hypothesized that parents rate their children with ADHD more impaired on the BRIEF than those children without ADHD, regardless of comorbidity with TS, because those with ADHD exhibit deficits of EdF whether or not they have TS. A second hypothesis stated that the parents would rate the TS-only group with more EF difficulties on the BRIEF than a control group. The third hypothesis stated that the parent ratings on the BRIEF would show a more significant correlation with performance-based measures of EF rather than general intellectual and academic measures. The last hypothesis was that the Inhibit and Working Memory scales of the BRIEF would significantly correlate with other parent
ratings of behavioral disturbance, especially symptoms of ADHD. The participants completed structured interviews, Wechsler Intelligence Scale for Children – Third Edition (WISC-III), Wechsler Individual Achievement Test (Reading and Math Composites), Controlled Oral Word Association Test, Tower of London, and the Test of Visual Attention – Fifth Edition. The parents completed the BRIEF Parent Form, ADHD Rating Scale IV – Home Version, Child Behavior Checklist – Parent Report Form, Diagnostic Interview for Children and Adolescents – Fourth Edition, and the Four-Factor Index of Social Status. The findings showed that the presence of ADHD carried a strong influence on the BRIEF and accounted for most of the variance in the BRIEF ratings. The presence of TS did not alter the BRIEF ratings. The parent BRIEF ratings and other parent ratings of behavioral dysfunction were significant and showed a strong correlation with one another (Mahone et al., 2002a). Mahone et al. (2002a) concluded that their findings provide support for the discriminant validity of the BRIEF when used with children with different ADHD profiles as well as the factor structure and discriminant and convergent validity of the ADHD indices in the BRIEF. The BRIEF is an useful instrument in the identification, description, and measurement of EdF and can be used further because of the focus on the patterns of behaviors associated with various EF constructs. Despite the overlap of scales between the BRIEF and ADHD rating scales in groups with significant EF dysfunction, the BRIEF was able to outline distinctive behaviors that are part of the diagnostic criteria for ADHD or a learning disability (Mahone et al., 2002a).

In another study, Jarratt et al. (2005) compared the psychometric qualities of the BRIEF and the Behavior Assessment System for Children (BASC) with individuals suspected of ADHD. The participants without a clinical diagnosis were compared to those with a diagnosis of ADHD to determine the usefulness in these two measures when identifying children with
attention difficulties. The procedure consisted of participants completing a comprehensive evaluation of cognitive, achievement, language, memory, executive function, attention, and behavioral emotional status. The BRIEF, BASC, and WISC-III were also administered. The findings showed that the BRIEF and BASC measures quantified similar constructs linked to ADHD behaviors and both were able to provide sufficient information on behavioral regulation and externalizing behaviors. However, the BRIEF did not tap into internalizing disorders to the same extent as the BASC (Jarratt et al., 2005). Yet, the BRIEF had more items in the Working Memory and Metacognition domains, which may explain why the BRIEF scales were equally as important as the BASC scales. While it was determined that the BRIEF and BASC measured similar behavioral constructs, the BRIEF honed in certain areas, such as working memory and metacognition (Jarratt et al., 2005).

McCandless, McClellan, and O’Laughlin (2007) conducted a study examining the clinical utility of the BRIEF in conjunction with an ADHD diagnosis. The validity and clinical usefulness of the BRIEF were evaluated with 70 children, between the ages of five and 13, who had a current diagnosis of ADHD and were referred for assessment of ADHD. The findings showed that even though there was low interrater reliability, the convergent validity was adequate. Ratings received from parents on the Behavioral Regulation scale were significantly different between three groups, ADHD – Combined, ADHD – Inattentive, and non-ADHD. In addition, the Metacognition Index was able to distinguish both ADHD subtypes from the non-ADHD group. This supports the clinical utility of this measure with a clinic-referred sample (McCandless, McClellan, & O’Laughlin, 2007).

Rabin et al. (2006) conducted a study evaluating executive functioning with a population of individuals with amnestic mild cognitive impairment (MCI), a healthy non-depressed group
with significant cognitive complaints (CC), and a demographically matched group of healthy older adults with no complaints (HC) based on results from the BRIEF-A. The findings showed that the MCI and CC participants were more likely to report clinically significant executive problems than the HC group. However, the researchers were unable to show a strong correlation between the BRIEF-A and standardized neuropsychological tests of executive function. Nonetheless, it appears that the BRIEF-A was sensitive enough to detect subtle changes in MCI and CC participants. The decision of whether executive complaints are predictive of clinical course should be determined by further research (Rabin et al., 2006).

Assessing ADHD in the Deaf Population

ADHD has genetic, prenatal, and possible perinatal causes. There is no evidence showing genetic aggregation of deafness and ADHD nor is there substantial proof that deafness causes ADHD. Yet, some of the recognized causes for ADHD, such as anoxia and drug toxicity, do cause deafness (Parasnis et al., 2003). In addition, a higher incidence of ADHD exists in the deaf population, between 3.5 to 38.7 percent, and is most likely the highest secondary disability (Williams & Abeles, 2004). Some causes may be errors in the diagnostic process, low birth weight, and genetics (Deutscher & Fewell, 2005; Nigg, Blaskey, Stawicki, & Sachek, 2004; Parasnis et al., 2003). However, many typical behaviors exhibited by deaf individuals are perceived as evidence of inattentiveness or distractibility by an evaluator unfamiliar with the communication modality used and the cultural consequences of deafness. The use of rating scales and psychometric tests with deaf individuals has been a challenge (Parasnis et al., 2003). These measures have language, cultural, and procedural difficulties and often do not include norms comprised of deaf individuals. Test materials and instructions are not typically available in signed format (Parasnis et al., 2003). When using non-standardized methods, such as
assessment tools that include unrepresentative norms, to estimate a child’s ability, the possibility of over- or underestimating increases (Schum, 2004). A relatively objective, culture-, and language-free assessment tool should be included in a comprehensive ADHD evaluation protocol, especially when assessing the deaf so their performance is fairly compared to same age children of normal hearing (Parasnis et al., 2003).

When assessing ADHD in deaf individuals, professionals need to be aware of the patterns of communication, characteristics of academic and social-emotional aspects that may be delayed or impaired, and properties of deaf culture. The challenge lies in differentiating behavior from hearing loss and a language deficit from behaviors resulting from a long-term pattern of attention deficits that are not typical of students with only hearing loss (See Table 2). Moreover, students with ADHD exhibit social deficits, executive deficits, and memory impairments. These deficits and impairments must be evaluated carefully as to not confuse them with tendencies of the deaf (Rhode et al., 2005).

Based on clinical impressions, psychological and CPT testing, and cross-cultural comparisons, deaf children are more likely to engage in short-sighted actions and display a lack of internalized control when compared to their hearing counterparts (Parasnis et al., 2003). They are impulsive for a number of reasons, such as auditory deprivation, lack of adequate development in verbal language, lack of higher-level coping styles, negative parental attitudes towards deafness, poor parental rearing practices, and physical and social isolation from the environment. Impulsivity associated with deafness can also be a behavioral trait, generally and dynamically, linked to the unavailability of auditory input rather than as a characteristic of early personality development (Parasnis et al., 2003). In addition, cultural factors can influence the clinical manifestation of disruptive behaviors in ADHD. For any psychiatric assessment to be
comprehensive and culturally valid, it should incorporate a number of variables, such as
ethnicity, religion, habits, and values (Rhode et al., 2005).

Factor analytic results support that the Test of Visual Attention (TOVA), a CPT, is
sensitive to underlying behavioral dimensions in deaf and hearing individuals (Parasnis et al.,
2003). The TOVA is also sensitive to differences in overall attentional behavior between adults
without ADHD in both the deaf and hearing populations (Parasnis et al., 2003).

Metacognition is a higher-order thinking process that includes recognition,
discrimination, judgment, and cognitive restructuring. Brown (1978) and Flavell (1976, 1978,
1979) found that there were no significant differences between the hearing and deaf groups on
metacognition as well as between the males and females of the deaf group. Thus, metacognition
differences are not a contributing factor for why the deaf are assessed more often for ADHD,
leaving the accountability to fall on other assessment tools (Al-Hilawani, 2001).

**Attitudes and Perceptions toward the Deaf**

Attitude is the reflection of a person’s predisposition to behave in a stereotypical and
predictable manner towards, or in, the presence of members of a particular group. Attitudes
shape how people behave and react towards individuals with certain qualities, often based on
personal self-perceptions and previous relationships with similar individuals (Case, 2000).
Studying attitudes towards groups with disabilities provides pivotal information on the negative
attitudes, discrimination, and biased behaviors towards individuals with disabilities. Such
attitudes often include the notion that all individuals with disabilities are dependent, isolated, and
emotionally unstable and corresponding labels carry negative connotations (McCaughey &
Strohmer, 2005; Wright, 1988). Consequently, these attitudes have led to stereotyped views that
include lower role expectations, hesitancy to develop interpersonal relationships, and an
unwillingness to employ qualified individuals with disabilities (McCaughey & Strohmer, 2005).
Many features associated with physical disabilities are highly visible and not socially desirable (Wright, 1988). In addition, individuals without disabilities express discomfort and uncertainty in the presence of an individual with a disability (McCaughey & Strohmer, 2005).

Therefore, the development of positive perceptions of deaf people is not a simple process, but rather arduous and lengthy that warrants careful planning (Nikolaraizi & Makri, 2004). The hearing population perceives deafness as a disability and shows little understanding or knowledge regarding deaf culture (Filer & Filer, 2000). When deaf individuals do not behave according to the expectations of the mainstream culture, they are considered deviant. This behavior is reflected in the general education system when a deaf child does not behave similar to hearing peers. Due to that, the deaf child is excluded from the school community by teachers and peers because he/she is seen as different or disabled (Williams & Abeles, 2004).

McCaughey and Strohmer (2005) conducted a study focusing on three things, 1) the prototypical characteristics of six disability groups, 2) how these prototypes of specific disability groups differ, and 3) the implications of these prototypes for research and practice in rehabilitation counseling. Prototypicality is defined as how much an object or person has in common with other members in its category as well as the lack of common attributes with members of other categories. Individuals commonly have certain attitudes based on prototypical characteristics of disability groups and these characteristics often influence their predictions about a member of a disability group and guide how they behave towards that member. In this study, 122 participants selected disability groups that were general and familiar with the public. Schizophrenia, mental retardation, and ADHD were categorized as common mental disabilities. Visual impairment, spinal cord injury, and hearing impairment were the most frequently listed
physical disabilities. After categorizing the disabilities, participants were asked to list at least 10 characteristics for a member from each of the six disability groups. The prototypical characteristics listed supported societal perceptions that individuals with disabilities need help from others and the presence of a disability is central to defining a person (McCaughey & Strohmer, 2005). The data from participants also showed that their prototypes of disabilities included common misconceptions and overgeneralizations. One fourth of participants stated that people with visual and hearing impairments experience heightening of other senses following loss of a primary sense. In addition, one overgeneralization was that individuals with hearing impairments attend special schools and experience negative emotions, such as frustration and loneliness. Prototypical characteristics seem to be a significant cause for biased behaviors towards individuals with specific disabilities (McCaughey & Strohmer, 2005).

Nikolarazi and Makri (2004) conducted a study that explored hearing and deaf people’s opinions about the capabilities of deaf children in a specific geographical location. One hundred participants completed the Opinions About Deaf People (OADP) scale, a 20-item scale that include 10 positive and 10 negative items discussing widely known conceptions that hearing people hold regarding the capabilities of deaf people. The findings revealed that participants held positive opinions about the capabilities of deaf people. However, there is a need to continue studies that expand on this study across age and setting (Nikolarazi & Makri, 2004).

Perceptions of the Deaf toward the Hearing

Deaf individuals often have negative experiences with the hearing world. Some of these experiences have been described as alienation, oppression, and paternalism (Filer & Filer, 2002). Many deaf individuals grew up in nonsupportive environments where they felt lonely, rejected, misunderstood, discriminated against, or singled out for unwanted attention (Israelite, Ower, &
Goldstein, 2002). This indicates that the deaf felt they were misunderstood by the hearing world and also treated in harmful ways, which may be why many limit their association with hearing individuals (Filer & Filer, 2000).

For adults who become deaf later in life, there are three common themes many experience, which are emotional trauma; oppression, exclusion, and isolation within the family; and, general oppression, exclusion, and social isolation. This was evident from a study that examined the psychological and social effects of becoming deaf as an adolescent or adult (Aguayo & Coady, 2001). Aguayo and Coady (2001) found that deaf participants in this study had difficulty coping with the diagnosis of deafness as well as continuing life with hearing loss. Many of the deaf participants also experienced anxiety, grief, and mourned for a period of time. All reported feelings of inadequacy, self-doubt, and uncertainty about the future. They were also angry, frustrated, embarrassed, and ashamed of themselves. Many experienced difficulty maintaining a strong bond with their families with communication problems causing strain and stress. Some felt excluded from their families and their hearing loss was either minimized or ignored entirely. All of the participants reported feeling shut out from society in some way. They felt embarrassed, fearful, inadequate, and incompetent in social settings. They were also neglected, shunned, or discriminated against by other individuals (Aguayo & Coady, 2001).

Furthermore, deaf clients, especially older ones, are more likely to experience personal conflicts about their language usage and cultural identity (Lala, 1998). The biggest barrier that arises in working with Deaf clients in mental health settings is the communication mode, which has consequently led to a lack of adequate access to appropriate psychiatric and psychological services (Lala, 1998; Williams & Abeles, 2004). The process and effectiveness of the intervention are dependent on language usage and comprehension (Williams & Abeles, 2004).
Deaf people have the same psychological and psychiatric range of behaviors and concerns as hearing people (Lala, 1998). However, poor communication has led to an abundance of misdiagnoses, such as mental retardation (Lala, 1998). When adapting therapeutic styles, therapists need to be aware of modifications that take advantage of the strengths of the ASL language. Reliance on eye contact is greater and the use of nonverbal communication increases. Approximately 90 percent of communication occurs in a nonverbal manner. Attention is sought in more physical approaches, such as waving, flicking the lights, and greeting one another in a tactile manner. Hugs and longer salutations are used. Personal space is defined differently, with understanding and intimacy of sharing details shown through physical closeness. A greater distance is used when the client is trying to take in all of the visual information while processing new information and concepts (Williams & Abeles, 2004).

**ADHD, Deafness, and the Assessment Process**

The criteria listed for ADHD in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) is a list of symptoms and does not include other possibilities or underlying states that one needs to be aware of (Orford, 1998). Educators and professionals are encouraged to become aware of and sensitive to diverse backgrounds including variations in age, gender, race, and culture. However, the culture of Deaf people is constantly overlooked and frequently discriminated against by the majority, even in an unconscious manner (Pagliaro, 2001). It would be beneficial to include specific concerns of the culturally Deaf, which would lead to a prevention of untold frustrations resulting from errors in the assessment process and/or misdiagnoses. Often, poor communication between Deaf clients and mental health professionals has led to many deaf individuals either misdiagnosed as mentally retarded or labeled as inferior (Lala, 1998). For example, when a deaf nine year old student was being
evaluated, the student asked the interpreter questions and the psychologist administering the assessment was not aware that the interpreter was clarifying the questions. The psychologist did not take into account the effects of being deaf when administering and interpreting the results (Leigh, Corbett, Gutman, & Morere, 1996). Familiarity with hearing loss can greatly assist psychologists and mental health professors in recognizing and classifying symptoms appropriately and selecting fitting interventions or assessment methods (Leigh et al., 1996).

O’Connell and Casale (2004) offer a guideline for those inexperienced in working with the D/deaf when assessing ADHD. First, the student should be observed in various settings. Consultation should be sought from a teacher of the deaf or professionals who have experience working with individuals with hearing loss if school professionals and educators have not yet experienced this situation. Second, an independent evaluation should be conducted by an interdisciplinary team with experience in working with children who have hearing loss and ADHD. This evaluation should include assessment of psychological, communication, and academic aspects. Third, an intervention should focus on which factors may account for a student’s inattention, such as inappropriate educational placement, insufficient support services, or lack of adequate accommodations. The intervention can be set to increase wanted behaviors while decreasing problem behaviors and observational data should be collected after a six-month period with a reexamination of results. Fourth, a diagnosis should be obtained based on the school and home observations and the interdisciplinary evaluations. This should be presented to the student’s primary care provider, a clinical psychologist, or a psychiatrist for review. The mental health professional should not only review the records, but directly evaluate the student, interview the family, and consult with the student’s educational team. Fifth, once a diagnosis of ADHD has been given, an intervention plan that targets behaviors of concern should be
developed and implemented to further encourage the student to do well academically. This may include medication and a variety of accommodations made available at home and at school. Last, since students’ learning styles and behaviors vary, their academic needs should be reviewed and revised appropriately on a periodic basis (O’Connell & Casale, 2004). Caution, creativity, and vigilance should be used in assisting or assessing those with ADHD (Schlozman & Schlozman, 2000).

Due to a limited amount of studies with deaf individuals assessed for ADHD, it is suggested that an analysis of ADHD rating scales be conducted with a deaf only population. Utilizing such participants would provide additional information for whether certain rating scales are better equipped than others and can distinguish between typical behaviors of ADHD and deafness. The majority of studies, though few, appear to be centered more on the usage of CPTs with deaf participants (Parasnis et al., 2003). CPTs have been found to be an adequate measure for both hearing and deaf individuals. Any physical or cultural differences between these two groups have not caused any adverse results on CPTs. However, rating scales are used more often than CPTs for a variety of reasons. They are easily utilized in the classroom and at home, can be given to multiple informants, and obtain numeric data regarding the intensity and duration of symptoms exhibited. The evaluation of such rating scales with a deaf population would supply much needed information for whether they are valid and reliable with this population.

This study’s hypothesis was to investigate two rating scales to see whether they were effective screening measures for use with deaf and hard of hearing individuals. For deaf college aged students, the CAARS proved to be a more sensitive measure than the BRIEF-A. However, an instrument with a focus on executive functioning (i.e., the BRIEF-A) may be better at differentiating symptoms of ADHD in a deaf individual.
Method

Participants

Forty deaf participants from a western New York college volunteered to participate in this study. There are 1,147 deaf undergraduate students and 1,250 deaf graduate students enrolled. The participants were recruited via flyers that were placed around campus. Announcements were made at several club events, club meetings, and e-mails and flyers were sent to various academic support departments asking faculty and staff members to inform their students about this study. The participants were 18 to 33 years old and the mean age was 22.65 years. The majority were male (70%) and the remaining were females (30%). For all forty participants, 75% used speech to communicate, 40% rated themselves as able to understand ASL, 45% reported that they were able to understand someone signing ASL, and 72.5% reported being a member of the Deaf community. The majority of participants attended mainstream secondary programs (30%) (See Table 3). The senior institutional researcher for this college noted that additional information on the overall college population regarding communication styles was not available for comparison.

Instrumentation (Apparatus/Materials)

Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A)

The Behavior Rating Inventory of Executive Function – Adult Version (BRIEF-A) rating scale is a 75-item standardized self-report measure designed to evaluate everyday behavioral manifestations of an individual’s executive control functions (Gioia et al., 2002). Items are based on a frequency scale that ranges from (N) Never, (S) Sometimes, to (O) Often (PAR, 2006). The BRIEF-A uses T-scores; the mean is 50 and the standard deviation is 10. Scores
above 65 are considered to fall in the clinically significant range. The nine clinical scales are Inhibit, Shift, Emotional Control, Initiate, Self-Monitor, Working Memory, Play/Organize, Task Monitor, and Organization of Materials. Scores from these nine scales create the Behavioral Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite scores (GEC) (Jarratt et al., 2005).

**Connors’ Adult ADHD Rating Scale (CAARS)**

The Connors’ Adult ADHD Rating Scale – Self: Long Version (CAARS-S:L) is a 66-item standardized self report measure designed to assess, diagnose, and monitor treatment of ADHD in adults. Items are based on a four-point Likert Type Scale that ranges from (0) Not at all, never, (1) Just a little, once in a while, (2) Pretty much, often, to (3) Very much, very frequent (PAR, 2006). The CAARS uses T-scores; the mean is 50 and the standard deviation is 10. Scores above 65 are considered to fall in the clinically significant range. The eight scales are Inattention/Memory Problems, Hyperactivity/Restlessness, Impulsivity/Emotional Liability, Problems with Self-Concept, DSM-IV Inattentive Symptoms, DSM-IV Hyperactive-Impulsive Symptoms, DSM-IV ADHD Symptoms Total, and ADHD Index (Pearson Assessments, 2006).

**Demographic Information Form**

The Demographic Information Form is a two-page confidential document asking participants to provide background information about themselves, classifications, and their involvement academically and community-wise as a deaf individual (See Appendix A).

**Procedure**

This study was approved by the institute’s Institutional Review Board (IRB) (See Appendix B). The participants were recruited from August 2006 to April 2007. After viewing flyers or reading the e-mails sent out, participants contacted the Deaf Studies Lab (DSL), which
is a group of deaf undergraduate psychology students led by a researcher at the institute (See Appendix C). Of this group, four undergraduate students who were members of DSL received training in administering and scoring the BRIEF-A and CAARS prior to the start of the study. After the participants contacted a DSL team member, a day and time were scheduled either on an individual or group basis. Testing occurred on-campus in private conference rooms or at the Deaf Studies Lab.

Prior to completing the rating scales, participants were informed that their completion was voluntary and that they could leave at any time. The measures given were a demographic information form, the BRIEF-A, and the CAARS. They were administered consistent with standardization, and the BRIEF-A and CAARS protocols were distributed in a counterbalancing manner. The test sessions varied in length based on the individual being assessed. An individual session typically lasted 30 to 45 minutes. Participants were also given ten dollars upon completion.

This study used a quasi-experimental research design with nonrandom assignment and posttest assessments. All participants, regardless of the existence of an ADHD diagnosis, completed both the BRIEF-A and CAARS.

Data Analyses

The research question addressed in this study was whether the BRIEF-A was a more sensitive measure than the CAARS in distinguishing ADHD symptoms among deaf individuals. In order to address the research question, data analyses consist of descriptive statistics, analysis of variance (ANOVA), multivariate analyses of variance (MANOVA), and sensitivity, specificity, and predictive value analyses.
Results

Analysis of Variance of the BRIEF-A Global Executive Composite (GEC) and CAARS ADHD Index Score

A two way analysis of variance (ANOVA) was conducted with ADHD status as the independent variable (ADHD diagnosis or non ADHD diagnosis) and the global indexes, one from the BRIEF-A (Global Executive Composite) and one from the CAARS (ADHD Index Score) as the dependent variables. There was a significant difference between the two group means on the BRIEF-A Global Executive Composite, $F(1,39) = 19.611$, $p < .000$, and a significant difference for the two group means on the ADHD Index Score, $F(1,39) = 20.163$, $p < .000$. For both global indexes the means were significantly higher for the ADHD diagnosed group (See Table 4).

Multivariate Analyses of Variance of the BRIEF-A Behavioral Regulation Index (BRI), Metacognition Index (MI), and CAARS DSM-IV Indices

A multivariate analysis of variance (MANOVA) was conducted with ADHD status as the independent variable (ADHD diagnosis or non ADHD diagnosis) and four index scales (Behavior Regulation Index, Metacognition Index, DSM-IV Inattentive, DSM-IV Hyperactive-Impulsive, and DSM-IV ADHD Symptoms Total) as the dependent variables. This MANOVA was significant ($\lambda = .513$, $p < .000$) indicating that there was a significant main effect. There were significant differences on all of the scales between the two groups on the Behavioral Regulation Index, $F(1,39) = 19.139$, $p < .000$; Metacognition Index, $F(1,39) = 13.239$, $p < .001$; DSM-IV Inattentive, $F(1,39) = 20.336$, $p < .000$; DSM-IV Hyperactive-Impulsive, $F(1,39) = 28.300$, $p < .000$; and, DSM-IV ADHD Symptoms Total, $F(1,39) = 33.565$, $p < .000$. 
Subsequent univariate tests showed that for all four scales the means were higher for the ADHD group (See Table 4).

**Multivariate Analyses of Variance of the BRIEF-A and CAARS Scales and Indices**

A multivariate analysis of variance (MANOVA) was conducted with ADHD status as the independent variable (ADHD or not) and 20 scales and indices from the BRIEF-A and CAARS as the dependent variables. The MANOVA was significant ($\lambda = .299, p = .043$) indicating that there was a significant main effect. Subsequent univariate tests showed that for all 20 scales and indices the means were higher for the ADHD group. The means ranged from 51.40 to 71.90 (See Tables 4-5).

**Sensitivity, Specificity, and Predictive Value Analyses**

Several scales of the BRIEF-A and CAARS were selected to compare the sensitivity, specificity, and predictive values. Scales were selected based on three different rationales. First, the global indexes from the BRIEF-A and CAARS were compared to detect any overall global scale differences. Second, based on literature, similar instrument constructs that are considered good predictors for detecting ADHD behaviors (i.e., memory and inhibition) were compared. Third, correlations of the number of scales from the BRIEF-A and CAARS were examined and those scales with correlations of .76 or above were chosen for further analysis. A correlation of .76 or higher is significant at the .001 level. For all these comparisons the sensitivity, specificity, and predictive value analyses showed that the BRIEF-A scales were more specific and had higher positive predictive values whereas the CAARS scales were more sensitive and had greater negative predictive values. The cut off point was set at 65, so any scores at and above that number were considered to be clinically elevated. In addition, scores that were at 64 or below were considered to be irrelevant and insignificant (See Tables 6-8).
Discussion

The purpose of this study was to examine the sensitivity of two rating scales, the BRIEF-A and the CAARS, in detecting ADHD symptoms within a deaf population. Contrary to the formulated hypothesis, both the BRIEF-A and CAARS were sensitive in differentiating those who were diagnosed with ADHD and those without an ADHD diagnosis. This shows that both measures accurately identified participants with an ADHD diagnosis. For both measures, the means were significantly higher for those respondents who were diagnosed with ADHD suggesting that both self-report measures are valid tools and can be used as part of an assessment for diagnosing ADHD in deaf college students.

This finding is not consistent with what was assumed with regards to the assessment of ADHD in deaf individuals. Both self report measures appeared to show criterion validity for the deaf population. This sample of deaf students appears to be more similar to the hearing population than possibly a sample comprised of deaf adolescents or deaf community members who are not college educated. This finding is most likely due to the fact that participants at a college level have adequate language and communication skills. When completing a self-report measure, the individual must understand the intention of the questions asked and be able to correctly express his/her answer. Participants involved in this study completed the rating scales with minimal, if any, questions.

Burgess et al. (1998) states that due to flaws in self-report measures, neuropsychological performance tests are better predictors of everyday problems. The validity of self-report measurements depends greatly on the type of behavior investigated (Danckaerts, Heptinstall, Chadwick, & Taylor, 1999). Individuals may perceive themselves exhibiting more or fewer symptoms than noted by informants, other individuals who live or work with them (Burgess et
al., 1998). Furthermore, a variety of factors influence how individuals and informants rate these behaviors, such as age, format of questions, and type of rating scale used (Mahone, Zabel, Levey, Verda, & Kinsman, 2002b). For example, parents rated their children having more problems on the BRIEF, but not on the BASC. More specifically, these children reported more problems on the BRIEF Behavioral Regulation Index, but not on similar scales from the BASC (Mahone et al., 2002b). In addition, Rabin et al. (2006) found that while evaluating participants with mild cognitive impairment and cognitive complaints, a strong correlation could not be made between the results of the BRIEF-A and standardized neuropsychological tests of executive function. Moreover, Vriezen and Pigott (2002) reported that after investigating the relationship between the BRIEF and individually administered neuropsychological tests for children with traumatic brain injury, it was determined that the Metacognition Index from the BRIEF correlated with Verbal IQ. However, none of the index scores from the BRIEF correlated with any of the performance-based tests of executive functioning (Vriezen & Pigott, 2002). This suggests that there are numerous internal and external factors that influence individuals, such as those of younger ages or with mental and/or physical impairments, and how they respond on rating scales. In contrast, Magnusson et al. (2006) concluded that correlations between ADHD rating scales across a variety of informants support convergent and divergent validity. These self-report scales and informant scales had adequate sensitivities and specificities. In addition, it was determined that ADHD rating scales possess strong psychometric properties, especially with at-risk populations (Magnusson et al., 2006). Also, Danckaerts et al. (1999) reported that the measures used for detecting ADHD are well validated. Rather, complications are generated by the individuals completing the measures. For example, adolescents tend to underestimate their
struggles with ADHD behaviors. The underestimation leads to inaccuracies when reporting the frequency and intensity of inattentive and hyperactive symptoms (Danckaerts et al., 1999).

In this study, the CAARS was more sensitive whereas the BRIEF-A was more specific. This shows that the CAARS identified participants who had an accurate diagnosis of ADHD. The BRIEF-A was better at distinguishing the non-ADHD participants. Moreover, it was noted that one non-ADHD participant consistently responded in a manner that caused him/her to appear as if he/she had ADHD on the BRIEF-A. These responses altered the sensitivity and specificity values on that measure and inadvertently caused the CAARS to be viewed a more sensitive measure than the BRIEF-A. This could have occurred for a variety of reasons, such as this participant having ADHD but was never diagnosed, rushing through the BRIEF-A, or answering the questions in a false, untruthful manner. An analysis without this participant’s responses found the BRIEF-A to be equally, if not more, sensitive than the CAARS.

Limitations and Recommendations

There were a few limitations in this study. First, the participants were all college aged students. This limits the generalizability of the findings to an elite group of college aged or college educated deaf individuals. A recommendation for a future study is to study a community based sample of deaf individuals to examine whether there are similar findings. In addition, it would be interesting to use an adolescent population and see if similar results are found. This would broaden and deepen the findings of this current study.

A second limitation was the sample size of 40 participants. If possible, future studies should incorporate larger sample sizes. This would allow for further generalizability as well as reduce the number of potential biases involved.
A third limitation was the validity of participants’ reporting the existence of an ADHD diagnosis. They were not required to provide evidence that they had been diagnosed. The identification of ADHD participants should be validated in some manner. A doctor’s note or copies of an old psychological file from school are examples. Verifying the diagnosis information would provide additional information, such as the onset and severity. Doing so would also ensure that certain analyses, such as the sensitivity and specificity, are run accordingly.

Furthermore, similar studies should be conducted using a variety of rating scales that are commonly used by doctors, teachers, and school psychologists when assessing for ADHD. Comparing more than two rating scales would provide additional information on the strengths and weaknesses of each one, especially for use with deaf individuals. More importantly, it would be crucial to include a sample of deaf individuals who are less well educated to see if these self-report ratings are sensitive enough to be used with deaf individuals who may not be able to read as well. In conclusion, the BRIEF-A and CAARS appear to be adequate in detecting ADHD behaviors in deaf college aged students.
References


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Appendix A

Demographic Information Form

BACKGROUND INFORMATION

AGE: __________ MALE or FEMALE

WHAT COLLEGE ARE YOU ENROLLED IN: __________________________________

ARE YOU AN INTERNATIONAL STUDENT? YES or NO

HOW DO YOU TYPICALLY DESCRIBE YOURSELF?

A. WHITE – NOT HISPANIC
B. BLACK – NOT HISPANIC
C. HISPANIC OR LATINO
D. ASIAN OR PACIFIC
E. AMERICAN INDIAN OR ALASKAN NATIVE
F. NONE OF THE ABOVE

I AM (CHECK ONE): [ ] DEAF [ ] HARD OF HEARING

PLEASE RATE YOURSELF FROM 1 TO 7 ON THESE CHARACTERISTICS:

Willing to try new things 1 2 3 4 5 6 7 Don’t like change

Reliable 1 2 3 4 5 6 7 Unreliable

Outgoing 1 2 3 4 5 6 7 Reserved

Helpful 1 2 3 4 5 6 7 Rude

Worrying 1 2 3 4 5 6 7 Calm
HAVE YOU BEEN DIAGNOSED WITH:  (PLEASE CIRCLE)
LEARNING DISABILITY  DEPRESSION
ADD/ADHD  BIPOLAR
ANXIETY  OTHER ___________________________
NONE

ARE YOU CURRENTLY TAKING MEDICATION?  YES or NO
HAVE YOU TAKEN MEDICATION FOR THE ABOVE CONDITION(S)?  YES or NO
ARE YOU NO LONGER ‘DIAGNOSED’ WITH THE ABOVE CONDITION?  YES or NO

PLEASE ANSWER THE FOLLOWING QUESTIONS

1. DO YOU USE SPEECH TO COMMUNICATE?  YES or NO

2. CAN YOU UNDERSTAND MOST OF OTHERS’ SPEECH?  YES or NO

3. CAN YOU SIGN USING ASL?  YES or NO

4. CAN YOU UNDERSTAND SOMEONE SIGNING ASL?  YES or NO or I DON’T KNOW

5. ARE YOU A MEMBER OF THE DEAF COMMUNITY?  YES or NO

6. YOUR MOTHER (OR FEMALE CARETAKER) IS:  DEAF or HARD-OF-HEARING or HEARING

7. YOUR FATHER (OR MALE CARETAKER) IS:  DEAF or HARD-OF-HEARING or HEARING

8. DO YOU HAVE A DEAF OR HARD-OF-HEARING SIBLING?  YES or NO

9. GROWING UP, DID YOUR FAMILY USE SIGN LANGUAGE?  YES or NO

10. WHAT KIND OF SCHOOL DID YOU GO TO?  DEAF, STAYED IN DORM or DEAF, DAY STUDENT or DEAF, MAINSTREAMED or MAINSTREAM SPECIAL PROGRAM
Appendix B

Institutional Review Board Acceptance Letter

RIT

Rochester Institute of Technology
RIT Institutional Review Board for the
Protection of Human Subjects in Research
141 Lomb Memorial Drive
Rochester, New York 14623-5604
Phone: 585-475-5343
Fax: 585-475-7830
Email: marsha.johnson@rit.edu

Form C
IRB Decision Form

TO:        Rebecca Mowell/Jennifer Lukomski
FROM:      RIT Institutional Review Board
DATE:      August 25, 2006
RE:        Decision of the RIT Institutional Review Board

Project Title: Determining ADHD

The Institutional Review Board (IRB) has taken the following action on your project named above.

☐ Exempt 46.101 (b) (2)

Now that your project is approved, you may proceed as you described in the Form A

Heather Foti
Associate Director, Office of Human Subjects Research

Revised 3-21-05
Subject: Deaf and Hard-of-hearing students needed for a study

Hi, my name is Becca Mowell. I'm a graduate student in the School Psychology program. For my thesis requirement, I am examining the validity of behavior rating scales to determine ADHD symptoms in deaf individuals. Participants will need to fill out two rating scales along with background information. The total time to complete the rating scales will take less than one hour. All information will be confidential. I need both deaf and hard-of-hearing students, who have ADHD and students who do not have ADHD.

If you are willing to participate, please contact me through e-mail (Mowell.thesis@gmail.com).

Participants will get $10 upon completion. Thank you for your time.
Do you have ADD/ADHD?

Willing to participate in a research study for 20 minutes?

You will be paid $10 for your time.

You will be asked about your attention, memory, impulse control and organization skills. This is being conducted by two faculty members: Dr. Jennifer Lukomski and Dr. Peter Hauser. This study has been approved by the Institute Review Board for the Protection of Human Research Studies.
### Table 1

**DSM-IV Criteria for ADHD**

<table>
<thead>
<tr>
<th>Inattention Symptoms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fails to give close attention to details</td>
</tr>
<tr>
<td>• Difficulty sustaining attention</td>
</tr>
<tr>
<td>• Does not seem to listen</td>
</tr>
<tr>
<td>• Does not follow through on instructions</td>
</tr>
<tr>
<td>• Difficulty organizing tasks or activities</td>
</tr>
<tr>
<td>• Avoids tasks requiring sustained mental effort</td>
</tr>
<tr>
<td>• Loses things necessary for tasks</td>
</tr>
<tr>
<td>• Easily distracted</td>
</tr>
<tr>
<td>• Forgetful in daily activities</td>
</tr>
<tr>
<td><strong>Hyperactive-Impulsive Symptoms:</strong></td>
</tr>
<tr>
<td>• Fidgets with hands and feet or squirms in seat</td>
</tr>
<tr>
<td>• Leaves seat in classroom inappropriately</td>
</tr>
<tr>
<td>• Runs about or climbs excessively</td>
</tr>
<tr>
<td>• Has difficulty playing quietly</td>
</tr>
<tr>
<td>• Is “on the go” or “driven by a motor”</td>
</tr>
<tr>
<td>• Talks excessively</td>
</tr>
<tr>
<td>• Blurs out answers before questions are completed</td>
</tr>
<tr>
<td>• Has difficulty awaiting turn</td>
</tr>
<tr>
<td>• Interrupts or intrudes on others</td>
</tr>
</tbody>
</table>

**Additional criteria:**

- Duration of 6 months
- Developmentally inappropriate levels
- Cross-setting occurrence of symptoms
- Impairment in major life activities
- Onset of symptoms/impairment by age 7
- Exclusions of severe mental retardation, Pervasive Developmental Disorder, psychosis

(Adapted from DSM-IV, American Psychiatric Association, 2000)
Table 2

**DSM-IV (1994) diagnostic criteria for ADHD (inattention symptoms) compared to related behaviors that may result from hearing loss**

<table>
<thead>
<tr>
<th>DSM-IV ADHD Criteria for Children with Normal Hearing</th>
<th>Related Behaviors that Can Result from Hearing Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inattention Symptoms:</strong></td>
<td><strong>Related Behaviors:</strong></td>
</tr>
<tr>
<td>• Fails to give close attention to details</td>
<td>• May lack necessary language competence on verbal and written language tasks.</td>
</tr>
<tr>
<td>• Difficulty sustaining attention</td>
<td>• Fatigue from the strain of extended periods of verbal communication may require a break.</td>
</tr>
<tr>
<td>• Does not seem to listen</td>
<td>• Compromised auditory perception and a language deficit may prevent comprehension.</td>
</tr>
<tr>
<td>• Does not follow through on instructions</td>
<td>• May not understand instructions due to limitations in vocabulary and impoverished linguistic structures.</td>
</tr>
<tr>
<td>• Difficulty organizing tasks or activities</td>
<td>• Reading and oral communication deficits may interfere with organizational skills.</td>
</tr>
<tr>
<td>• Avoids tasks requiring sustained mental effort</td>
<td>• If tasks involve verbal communication, may be related to fatigue resulting from required effort to communicate.</td>
</tr>
<tr>
<td>• Loses things necessary for tasks</td>
<td>• May lose things due to lack of understanding of directions or reluctance to use special equipment such as an FM system.</td>
</tr>
<tr>
<td>• Easily distracted</td>
<td>• May be distracted by background noise, difficulty tuning out irrelevant auditory information, or using visual cues to scan the environment for information.</td>
</tr>
<tr>
<td>• Forgetful in daily activities</td>
<td>• Forgetfulness may be related to poor auditory access or language comprehension.</td>
</tr>
</tbody>
</table>

(O’Connell & Casale, 2004)
Table 3

Demographic Characteristics of the Student Population (N = 40)

<table>
<thead>
<tr>
<th>General Characteristics</th>
<th>Percentage (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>70 (28)</td>
</tr>
<tr>
<td>Female</td>
<td>30 (12)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>80 (32)</td>
</tr>
<tr>
<td>Black</td>
<td>7.5 (3)</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Asian or Pacific</td>
<td>7.5 (3)</td>
</tr>
<tr>
<td><strong>Family</strong></td>
<td></td>
</tr>
<tr>
<td>Mother’s hearing status</td>
<td></td>
</tr>
<tr>
<td>Deaf</td>
<td>10 (4)</td>
</tr>
<tr>
<td>Hard of Hearing</td>
<td>2.5 (1)</td>
</tr>
<tr>
<td>Hearing</td>
<td>87.5 (35)</td>
</tr>
<tr>
<td>Father’s hearing status</td>
<td></td>
</tr>
<tr>
<td>Deaf</td>
<td>10 (4)</td>
</tr>
<tr>
<td>Hard of Hearing</td>
<td>2.5 (1)</td>
</tr>
<tr>
<td>Hearing</td>
<td>87.5 (35)</td>
</tr>
<tr>
<td>Siblings who are Deaf or HOH</td>
<td>22.5 (9)</td>
</tr>
<tr>
<td><strong>Diagnoses</strong></td>
<td></td>
</tr>
<tr>
<td>Number of diagnoses</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>45 (18)</td>
</tr>
<tr>
<td>1</td>
<td>37.5 (15)</td>
</tr>
<tr>
<td>2</td>
<td>6 (6)</td>
</tr>
<tr>
<td>3</td>
<td>2.5 (1)</td>
</tr>
<tr>
<td>Existence of diagnosis</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15 (6)</td>
</tr>
<tr>
<td>No</td>
<td>85 (34)</td>
</tr>
<tr>
<td>Type of diagnosis</td>
<td></td>
</tr>
<tr>
<td>ADHD</td>
<td>50 (20)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Depression</td>
<td>12.5 (5)</td>
</tr>
<tr>
<td>Bipolar</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Other</td>
<td>1 (4)</td>
</tr>
<tr>
<td>Currently diagnosed</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>17.5 (7)</td>
</tr>
<tr>
<td>No</td>
<td>32.5 (13)</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td></td>
</tr>
<tr>
<td>Use speech to communicate</td>
<td>75 (30)</td>
</tr>
<tr>
<td>Understand most of other’s speech</td>
<td>62.5 (25)</td>
</tr>
<tr>
<td>Able to sign ASL</td>
<td>40 (16)</td>
</tr>
<tr>
<td>Understand someone signing ASL</td>
<td>45 (18)</td>
</tr>
<tr>
<td></td>
<td>Percentage</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Member of the Deaf community</td>
<td>72.5</td>
</tr>
<tr>
<td>Use sign language in the house</td>
<td>57.5</td>
</tr>
<tr>
<td><strong>School setting</strong></td>
<td></td>
</tr>
<tr>
<td>Deaf, stayed in dorm</td>
<td>10</td>
</tr>
<tr>
<td>Deaf, day student</td>
<td>0</td>
</tr>
<tr>
<td>Deaf, mainstreamed</td>
<td>30</td>
</tr>
<tr>
<td>Mainstream special program</td>
<td>17.5</td>
</tr>
<tr>
<td>Mixture</td>
<td>15</td>
</tr>
<tr>
<td>Hearing, public</td>
<td>27.5</td>
</tr>
</tbody>
</table>
Table 4

Means, Standard Deviations, and Mean Differences for the BRIEF-A and CAARS Indices

<table>
<thead>
<tr>
<th>ADHD Indices</th>
<th>ADHD Group</th>
<th>Non-ADHD Group</th>
<th>Mean Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRIEF-A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioral Regulation*</td>
<td>61.85</td>
<td>48.25</td>
<td>13.60</td>
</tr>
<tr>
<td>Metacognition**</td>
<td>64.75</td>
<td>50.70</td>
<td>14.05</td>
</tr>
<tr>
<td>Global Executive Composite*</td>
<td>63.35</td>
<td>48.70</td>
<td>14.65</td>
</tr>
<tr>
<td>CAARS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DSM-IV Inattentive*</td>
<td>69.10</td>
<td>52.30</td>
<td>16.80</td>
</tr>
<tr>
<td>DSM-IV Hyperactive-Impulsive*</td>
<td>65.30</td>
<td>47.85</td>
<td>17.45</td>
</tr>
<tr>
<td>DSM-IV ADHD Symptoms*</td>
<td>71.90</td>
<td>50.65</td>
<td>21.25</td>
</tr>
<tr>
<td>ADHD Index*</td>
<td>56.20</td>
<td>44.60</td>
<td>11.60</td>
</tr>
</tbody>
</table>

* p < .000
** p < .001
### Table 5

**Means, Standard Deviations, and Mean Differences for the BRIEF-A and CAARS Scales**

<table>
<thead>
<tr>
<th>ADHD Scales</th>
<th>ADHD Group</th>
<th>Non-ADHD Group</th>
<th>Mean Diff.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRIEF-A</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhibit*</td>
<td>64.70</td>
<td>49.75</td>
<td>14.95</td>
</tr>
<tr>
<td>Shift**</td>
<td>56.25</td>
<td>49.75</td>
<td>6.50</td>
</tr>
<tr>
<td>Emotional Control**</td>
<td>54.80</td>
<td>47.20</td>
<td>7.60</td>
</tr>
<tr>
<td>Self-Monitor*</td>
<td>64.25</td>
<td>47.95</td>
<td>16.30</td>
</tr>
<tr>
<td>Initiate**</td>
<td>59.60</td>
<td>49.25</td>
<td>10.35</td>
</tr>
<tr>
<td>Working Memory*</td>
<td>64.65</td>
<td>48.50</td>
<td>16.15</td>
</tr>
<tr>
<td>Plan/Organize*</td>
<td>63.10</td>
<td>51.10</td>
<td>12.00</td>
</tr>
<tr>
<td>Task Monitor**</td>
<td>62.75</td>
<td>52.60</td>
<td>10.15</td>
</tr>
<tr>
<td>Organization of Materials**</td>
<td>55.55</td>
<td>46.45</td>
<td>9.10</td>
</tr>
<tr>
<td><strong>CAARS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inattention/Memory*</td>
<td>58.60</td>
<td>45.90</td>
<td>12.70</td>
</tr>
<tr>
<td>Hyperactivity/Restlessness**</td>
<td>60.15</td>
<td>49.45</td>
<td>10.70</td>
</tr>
<tr>
<td>Impulsivity/Emotional Liability*</td>
<td>54.40</td>
<td>42.20</td>
<td>12.20</td>
</tr>
<tr>
<td>Prob. with Self-Concept**</td>
<td>51.40</td>
<td>46.00</td>
<td>5.40</td>
</tr>
</tbody>
</table>

* * p < .000  
** ** p < .05
Table 6

*Sensitivity, Specificity, and Predictive Value Analyses for the Global Indices of the BRIEF-A and CAARS, Inhibit and Impulsivity/Emotional Liability, and Working Memory and Inattention/Memory Scales*

<table>
<thead>
<tr>
<th>Rating Scale</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Analysis (+PV)</th>
<th>Negative Predictive Analysis (-PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) GEC ADHD Index</td>
<td>.875</td>
<td>.593</td>
<td>.350</td>
<td>.950</td>
</tr>
<tr>
<td>b) Inhibit Impulsivity/Emot.</td>
<td>.800</td>
<td>.600</td>
<td>.400</td>
<td>.900</td>
</tr>
<tr>
<td>c) Working Memory Inattention/Mem.</td>
<td>1.00</td>
<td>.606</td>
<td>.350</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>.555</td>
<td>.200</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Table 7

_Correlations between BRIEF-A and CAARS Scales At or Above .76_

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Inatten./Mem.</th>
<th>Impulsiv./Emot.</th>
<th>DSM-IV Inatten.</th>
<th>DSM-IV Hyper-Impul.</th>
<th>DSM-IV ADHD</th>
<th>ADHD Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Memory</td>
<td>---</td>
<td>---</td>
<td>.828</td>
<td>---</td>
<td>.811</td>
<td>---</td>
</tr>
<tr>
<td>Plan/Organize</td>
<td>.840</td>
<td>.814</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Metacognition</td>
<td>.777</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Behavioral Regulation</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>.759</td>
<td>---</td>
<td>.840</td>
</tr>
</tbody>
</table>
### Table 8

*Sensitivity, Specificity, and Predictive Value Analyses for the BRIEF-A and CAARS Scales and Indices*

<table>
<thead>
<tr>
<th>Rating Scale</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Analysis (+PV)</th>
<th>Negative Predictive Analysis (-PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) BRI ADHD Index</td>
<td>.875</td>
<td>.593</td>
<td>.350</td>
<td>.950</td>
</tr>
<tr>
<td>b) BRI DSM-IV H-I</td>
<td>.875</td>
<td>.593</td>
<td>.350</td>
<td>.950</td>
</tr>
<tr>
<td>c) Plan/Organize Inattentive/Memory</td>
<td>.875</td>
<td>.593</td>
<td>.350</td>
<td>.950</td>
</tr>
<tr>
<td>d) Plan/Organize Impulsivity/Emot.</td>
<td>.875</td>
<td>.593</td>
<td>.350</td>
<td>.950</td>
</tr>
<tr>
<td>e) Working Memory DSM-IV Inattentive</td>
<td>1.00</td>
<td>.689</td>
<td>.550</td>
<td>1.00</td>
</tr>
<tr>
<td>f) Working Memory DSM-IV ADHD</td>
<td>1.00</td>
<td>.689</td>
<td>.550</td>
<td>1.00</td>
</tr>
<tr>
<td>g) Metacognition Impulsivity/Emot.</td>
<td>.750</td>
<td>.607</td>
<td>.450</td>
<td>.850</td>
</tr>
<tr>
<td>h) Task Monitor Inattention/Memory</td>
<td>.855</td>
<td>.575</td>
<td>.300</td>
<td>.950</td>
</tr>
</tbody>
</table>

- Rating Scale values are rounded to two decimal places.
- Positive Predictive Analysis (PPA) and Negative Predictive Analysis (NPA) values are rounded to one decimal place.
School Psychology Thesis Committee:

First Reader – Dr. Jennifer Lukomski
Second reader – Dr. Scott Merydith