

COMPARISON OF THE BEHAVIOR ASSESSMENT  
SYSTEM FOR CHILDREN AND PERFORMANCE  
BASED MEASURES OF ATTENTION

By

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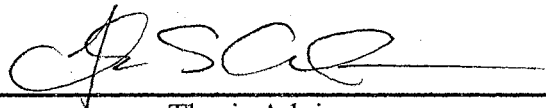
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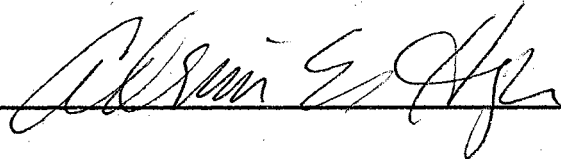

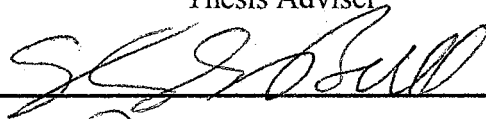
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## CHAPTER I

### Introduction

Since the early twentieth century, the assessment of attention in children and the relationships of environment and attending behavior have been the focus of scientific investigation. The components of attention have been the subject of theoretical debate as to the most productive ways to evaluate how children attend to external events (James, 1898; Titchener, 1924; Mirsky, 1987; Posner, 1988; Cooley & Morris, 1990). Prior to the 1950's, attention was viewed as a single construct. Attention was evaluated in terms of the child's academic underachievement and attempts were made to explain attention deficit as a form of "minimal brain damage" resulting in a learning disorder (Lehtinen, 1955). By the late 1950's, attention was perceived and defined as a multidimensional construct (Hale & Lewis, 1979; Cooley & Morris, 1990). At the present time, attention is viewed as a construct involving: 1) alertness, 2) focus, 3) sustained and/or divided and/or shifting focus (Cooley & Morris, 1990). There is disagreement about the construct of attention in the areas of attentional components involving search, span of focus, distractibility and divided attention (Cooley & Morris, 1990).

There are numerous methods that are used to measure attention in children including rating scales completed by parents and/or teachers, direct observations, interviews, continuous performance tests, and direct performance based tests known as mental control tests (Marshall, 1997). One indirect method used to measure of attention in children and adolescents which is frequently used in research is rating scales. Parent rating scales, for example, are most commonly used in pediatrician assessment practices

(Lahey, Pelham, et.al., 1988). These indirect measures of attention have their advantages and limitations. One advantage is that they allow practitioners to determine the degree to which a child exhibits certain characteristics relative to same-age and same-gender students. In addition, they collapse information across situation and time, and provide insight into concerns experienced by those individuals who work and live with a child. Rating scales are also very cost effective when compared to more direct methods. However, rating scales also have limitations to their usefulness. Specifically, results represent only someone else's opinion and may not be factual. They do not identify strengths that the student may have and utilize. Rating scales must also be interpreted with caution as they are unable to identify misperceptions caused by distortions in memory, misunderstanding of scale items, and informant bias. Results may also be influenced by cognitive, social, emotional, or educational characteristics of the rater (Landau & Burcham, 1995). The Behavior Assessment System for Children (BASC) (Reynolds & Kamphaus, 1992) is an example of a rating scale used to assess attention. The BASC – Parent Rating Scale (PRS) allows for indirect examination behaviors exhibited in community and home settings as it assesses the parent's perceptions of these behaviors through the use of a 4-point frequency scale yielding composite scores of problem behaviors.

In addition to the indirect method of rating scales mentioned above, attention may also be directly assessed. Performance based measures provide empirical evidence of elements presumed to assess attention. Performance based measures also have their advantages and limitations. Performance based measures have the advantage of offering objective results that are not open to the subjectivity of a rater. However, the ecological



validity of these measures are questionable. Ecological validity refers to how well the measured behaviors are a representative samples of behaviors that would occur in a natural setting. Those who oppose using these type of measurements state that “knowing the child’s performance on one or more of these lab techniques contributes little to an understanding of how the child functions in the classroom” (Landau & Burcham, 1995, p. 825). Some examples of these performance based measures include Digit Span tests (Wechsler, 1991), Cancellation of Reoccurring Target Figures (Rudel, Denckla & Broman, 1974), the Knox Cube Test (Stone & Wright, 1980), Stroop Word and Color Test (Golden, 1978) and Trails Making B (Reitan, 1992). Digit Span tests attempt to measure the numerical-mnemonic elements of attention and attention span, while the Cancellation of Reoccurring Target Figures measures vigilance of attention. The Knox Cube Test measures the attentional component of visual capacity, and the Stroop Word and Color Test measures focused attention. In addition, The Trails Making B Test attempts to measure divided attention.

In clinical practice, direct and indirect measures tend to be used, usually separately, to assess attention. A recent consensus statement issued by a panel of experts brought together by the National Institutes of Health (1998) states that diagnoses are most often made by pediatricians, family practitioners, and psychiatrists based on parent rather than teacher input usually in the form of perceptions of the child’s behaviors as indicated by rating scales. Neuropsychologists tend to make decisions regarding the diagnosis of ADHD based more on the results of individually administered performance based measures. The information provided by these measures serves as the foundation for making or refuting a diagnosis of Attention Deficit Hyperactivity Disorder where the

inability to sustain attention is the primary diagnostic criteria. As the conceptual understanding of ADHD has developed and changed over time, so too has the methodology used to assess symptomatology. Earlier assessments of ADHD focused on activity level or hyperactivity, while more recent assessments have focused on the components of inattention and impulsivity (Conte, 1998). While earlier assessments used observation to assess hyperactivity, current research has shown that diagnoses are best made based on multi-informant, multimodal procedures, including parent interviews and rating scales, teacher rating scales, self-report measures, student test results, and examiner observations during the administration of psychometric test batteries (Marshall, 1997).

### Background

Metacognition processes enable a child to focus, select an appropriate task, stay on the selected task, check progress, monitor performance and evaluate work. Of all the processes associated with metacognition, attention has been the most studied in the field of learning disabilities (Mercer, 1997). In addition, attention deficits have been described as deficiencies in information-processing behaviors where there is a failure to use effective strategies for organized cognitive production systems to direct information to a specific task (Torgesen, 1982). Kulpe (1895, cited in Meldman, 1970) stated that the discovery of an accurate and reliable way to measure attention was one of the most important problems facing the experimental psychology of the future. In part, the difficulty in attempting to operationally define attention is that attention is not an isolated process, but a complex construct which is intertwined with other cognitive processes. Furthermore, the behavioral manifestations of these cognitive processes are often

confounded with environmental and situational variables which cannot be fully controlled for during the assessment process. This difficulty in defining attention has also perpetuated an inability for clinicians and researchers to develop a unifying theory of attention. References to attention deficit symptoms have been found in the medical literature for over 100 years with ADHD-like symptoms being one of the most widely researched of all childhood disorders (Shin, 1998).

It is apparent that numerous children with learning disabilities have deficits in various aspects of the attention process, but the precise reasons for attention deficits remain difficult to ascertain. Much of the difficulty in studying attention processes derives from a lack of reliable and valid measures. There are numerous methods that are used to measure attention in children including rating scales completed by parents and/or teachers, direct observations, interviews, continuous performance tests, and direct performance based tests known as mental control tests (Marshall, 1997). These information provided by these methods serve as the basis with which clinicians either support or refute a diagnosis of Attention Deficit Hyperactivity Disorder. Within each of these methods, there are several individual tools which purport to measure attention, but there is no one widely accepted operational definition of attention. This lack of an operational definition therefore makes ADHD difficult to diagnose and is problematic in developing intervention programs for students who are experiencing significant difficulties in school functioning. The constellation of symptoms associated with ADHD are difficult to assess with any single unidimensional assessment tool. In spite of a lack of an accepted operational definition of attention, ADHD is defined in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders DSM - IV (American

Psychiatric Association, 1994). In the DSM- IV, three types of ADHD are identified and they include: 1) Predominately Inattentive; 2) Predominantly Hyperactive-Impulsive Type, and 3) Combined Type Inattentive and Hyperactive-Impulsive.

A limited consensus within empirical literature exists over the role of attention in ADHD, the characteristics of ADHD, and the methods of diagnosing ADHD. Frick and Lahey (1991) state that it is problematic to compare studies of ADHD because 1) there is no widely accepted diagnostic definition, 2) there are no criteria regarding the severity of symptoms to be included in the ADHD samples, 3) studies have used different informants for the diagnosis, such as teacher, parent, child, 4) there are no exclusionary criteria (i.e., conduct disorder, learning disabilities, etc.), and 5) there is no distinction between situational versus pervasive attention problems.

The inability to effectively define ADHD was specifically demonstrated in a study conducted by a group of researchers at the Hospital for Sick Children in Toronto (Schachar, Logan, et. al., 1988). The researchers discovered that children labeled Attention Deficit Disorder did not deteriorate in performance over time on a continuous performance test any more that did a group of so-called normal children. In another study conducted in the Netherlands, children were presented with irrelevant information to see if they would become distracted from their central task which involved identification of groups of dots on a piece of paper (Van der Meere & Sergeant, 1988). Findings revealed that so-called Attention Deficit Hyperactive children did not become distracted any more than the group labeled normal children.

While there have been more than 10,000 studies investigating ADHD (Valentine, 1995), there is a continuing controversy over definition, diagnosis, and treatment

methods. Canter (1997), in her review of this continuing controversy, argues that the controversy persists on many levels and poses many questions. These questions include the following: 1) Is ADHD a definitive disorder, a constellation of symptoms with multiple origins or a catch-all term for annoying behavior? 2) Is ADHD biological or behavioral in origin? 3) Can attention disorders be reliably diagnosed? 4) Is medication an appropriate and effective intervention or does medication merely replace responsibility for behavior management and self-control? 5) What do we know about treatment outcomes for children with attention disorders? and 6) What is fact versus opinion in ADHD research? (p. 111).

Another aspect of the controversy over ADHD is that some practitioners actually doubt the existence of the disorder. In his book, *The Myth of the ADHD Child*, Armstrong (1995) argues that children can have different styles of thinking, attending, and behaving due to broader social and educational influences. Armstrong further elaborates that there are alternative explanations as to why children may have behavior or attention problems which clearly cannot be linked to ADHD. According to Armstrong, the symptoms of hyperactivity, distractibility, and impulsivity are global and may have a wide number of potential causes, such as depression and anxiety.

### The Problem

In summary, diagnosing children with Attention Deficit Hyperactivity Disorder is problematic given the putative nature of the disorder. While most researchers agree a deficit in the ability to sustain attention is the primary characteristic of ADHD, there is a lack of agreement as to an operational definition of attention. This lack of an operational

definition has led to conflicts on how best to assess attention. There are several methods currently employed in the assessment of attention including rating scales, interviews, direct observations, performance based measures and continuous performance tests. Given the high prevalence of diagnosed ADHD and the pervasiveness of its affects on an individual, current practices should be evaluated to determine if these practices are, at least, identifying the same individuals as having attention problems. Theoretically, all methods used to assess attention should identify the same individuals as having deficits in attention. This study seeks to evaluate whether this is true with two specific methods, ratings scales and performance based measures. The hypothesis that will guide this study is that examples of each, rating scales and performance based measures, will identify the same individuals as having attention deficits.

#### The Purpose

The purpose of the present study was to evaluate the use of two different methods which are used to measure attention in children and adolescents and in turn, assist clinicians in making or refuting a diagnosis of Attention Deficit Hyperactivity Disorder. The two methods evaluated were: 1) rating scales (representative of indirect measures) and 2) performance based measures (representative of direct measures). The Behavior Assessment System for Children (Parent Rating Scale) was utilized as an example of the rating scale method. A collection of six performance based measures which claim to measure different aspects of attention were used as performance based measures of attention. These included the following measures: Digit Span, Cancellation of Reoccurring Target Figures, Knox Cube Test, Stroop Word and Color Test, and Trails Making B.

The implications of this study examines several issues. These issues center on the need for guidelines to evaluate the current means of assessing procedures designed to assist in the diagnosis of Attention Deficit Hyperactivity Disorder in children and adolescents. The primary goal of the current research is to examine the usefulness of both rating scale methods and performance based measures methods with respect to the assessment of children with attention problems. Two secondary goals were to contribute to the body of literature on ADHD by identifying adequate and effective measurement methods and procedures to guide new research initiatives and practices.

It is hoped that as a result of the present study, educators, parents and clinicians will have a better understanding of the impact and implications of these two methods in the identification of children with ADHD. This study makes a contribution to the relatively scant body of work available on the use of rating scales versus performance based measures in regard to treating the ADHD student population.

## CHAPTER II

### Review of the Literature

The literature review on ADHD focuses first on the construct of attention and the different methods used to measure the construct. Then both the medical and educational definitions of ADHD are discussed. This discussion is followed by a history of approaches to ADHD diagnosis and an analysis of the difficulties encountered when addressing statistics regarding the prevalence of ADHD in children. Problems with diagnosis, including comorbid conditions and advances in neurological studies are then presented. Finally, different methods used to measure the ADHD construct are evaluated, and the review concludes with a discussion of neurological studies of ADHD.

#### Construct of Attention

A construct is purely theoretical. It is defined as an idea developed from information obtained through observation, previous knowledge and imagination. A construct is a means of organizing experiences with similar causes, consequences, or correlates into categories. (Silva, 1993). The construct of attention refers to internal processes which allow a person to balance the need for continuity of attentional engagement (focus) against the need for interruptibility (can shift when needed) (Allport, 1989). When one is too focused and cannot shift attention, or when one shifts too much, he/she is considered to have an attentional disorder.

In an effort to further delineate the function of the brain in mandating attention, neuropsychologists have further defined the construct of attention in terms of its various components. Previous research indicates that attention is not a unitary function but a



complex collection of components, including vigilance, capacity, divided attention, and focused attention. The following paragraphs describe these components and highlight assessment devices used to assess them:

Vigilance. Vigilance is the ability to sustain and focus attention in itself and is sometimes referred to as sustained attention. Since it is difficult to maintain peak levels of attentiveness over long periods of time, particularly while performing simple monotonous tasks, the typical test of vigilance involves the sequential presentation of stimuli, such as strings of letters or numbers, over a period of time with instructions for the subject to indicate when a given number or letter (i.e., the target stimulus) is perceived. The decline in performance, from the beginning of the task until the end of the task, is known as vigilance decrement. Most of these tests are of the cancellation variety and include the, the Two and Seven Test (Ruff, Niemann, et al., 1992), and the Cancellation of Reoccurring Target Figures (Rudel, Denckla & Broman, 1974).

Capacity. Capacity is another aspect important in attention and has to do with the amount of material that can be grasped at one time. Tests which purport to measure this aspect of attention typically expose the subject to increasingly larger amounts of information. Following the submission of information, instructions are given for the child to repeat what was seen or heard to indicate how much of the stimulus was immediately taken in, as shown by repeating the information supplied by the examiner. Tests which measure capacity include Digit Span (D. Wechsler, 1991) and Knox Cube Test (Stone & Wright, 1980).

Divided attention. Divided attention requires attention to be divided or shared between two or more sources or kinds of information or two or more mental operations.

The two inputs thus share the same limited capacity system and cross- interfere with one another. Assessment tools used to measure divided attention include Trails Making B (Reitan, 1992).

Focused attention. Focused attention involves selectivity in perceiving and responding to a stimulus. It requires that attention be focused on one source or kind of information to the exclusion of others. Mental tests that measure focused attention include Stroop Color and Word Test (Golden, 1978).

Attempts to explain the role of attention as an aspect of learning problems is problematic because the term attention has a variety of meanings across differing disciplines. In the field of psychology, attention centers on a variation in each individual's ability to attend to external events. Attention is a difficult and complicated concept. Moray (1969) identified seven components of attention including mental concentration, vigilance, selective attention, search, activation, set, and analysis by synthesis. In contrast to Moray, Posner (1975) argued that there are only three components to attention which include alertness, selection, and effort.

In studies of ADHD, the inability to pay attention has been studied as a medical condition which has little overlap with the concept of attention as it has been studied within the field of psychology. Diagnostic criteria have been developed and have focused on three primary characteristics: inattention, impulsivity, and overactivity (Wong, 1998). In the case of many ADHD children, it appears that there is insufficient focusing and sustaining of attention, so that the information is not learned in the first place (Swanson, 1988). Attention seems to be a problem at the initial storage end because when children attend to and practice information long enough to comprehend it,

loss of retrieval occurs no faster for ADHD children than for typical learners (Gregory & Bunch, 1959; Underwood, 1964; Brainerd, 1985; Kail, 1986). In addition, researchers have recognized that a fundamental contributor and characteristic of ADHD children is immature attending ability (Keogh, 1973; Dykman et. al., 1983). Mature attending ability includes the ability to be alert to a stimulus, decide on a goal, prepare to respond, focus on appropriate stimuli, consider alternatives and delay responding to stimuli, and finally to decide on an action or on an answer (Smith, 1998). A number of studies have also suggested that it is the inability to focus and sustain attention, rather than the inability to have attention engaged which characterizes ADHD children (Porges et. al., 1975; Richards, et. al., 1990). Whereas sustained attention involves maintaining attention over time, focused attention involves selectivity in perceiving and responding to an initial stimulus to the exclusion of all other stimuli.

#### Definitions of ADHD

The definitions of Attention Deficit Hyperactivity Disorder have centered on two approaches to describing and defining a cluster of behaviors and learning abilities. These approaches include medical criteria for ADHD and educational definitions of ADHD.

Medical Criteria for ADHD. The term “Attention Deficit Disorder” was coined and published in the Diagnostic Manual of Mental Disorders, Third Edition (DSM-III: American Psychiatric Association, 1980) with the first detailed diagnostic definition of the disorder identifying children who have deficits in each of three primary areas: sustained attention, impulsivity, and motor hyperactivity. Diagnostic criteria for this definition appears in Table 1. DSM-III-R again changed the name of this disorder to Attention Deficit Hyperactivity Disorder (American Psychiatric Association, 1987) and

Table 1

Diagnostic Criteria for Attention Deficit Disorder According to DSM-III

The child displays, for his or her mental and chronological age, signs of developmentally inappropriate inattention, impulsivity, and hyperactivity. The signs must be reported by adults in the child's environment, such as parents and teachers. Because the symptoms are typically variable, they may not be observed directly by the clinician. When the reports of teachers and parents conflict, primary consideration should be given to the teacher reports because of greater familiarity with age-appropriate norms. Symptoms typically worsen in situations that require self-application, as in the classroom. Signs of the disorder may be absent when the child is in a new or a one-on-one situation.

The number of symptoms specified is for children between the ages of eight and ten, the peak age range for referral. In younger children, more severe forms of the symptoms and a greater number of symptoms are usually present. The opposite is true of older children.

- A. Inattention. At least three of the following:
- (1) often fails to finish things he or she starts
  - (2) often doesn't seem to listen
  - (3) easily distracted
  - (4) has difficulty concentrating on schoolwork or other tasks requiring sustained attention
  - (5) has difficulty sticking to a play activity
- B. Impulsivity. At least three of the following:
- (1) often acts before thinking
  - (2) shifts excessively from one activity to another
  - (3) has difficulty organizing work (this not being due to cognitive impairment)
  - (4) needs a lot of supervision
  - (5) frequently calls out in class
  - (6) has difficulty awaiting turn in games or group situation
- C. Hyperactivity. At least two of the following:
- (1) runs about or climbs on things excessively
  - (2) has difficulty sitting still or fidgets excessively
  - (3) has difficulty staying seated
  - (4) moves about excessively during sleep
  - (5) is always "on the go" or acts as if "driven by a motor"
- D. Onset before the age of seven.
- E. Duration of at least six months.
- F. Not due to Schizophrenia, Affective Disorder, or Severe or Profound Mental Retardation.

eliminated the distinction among the three dimensions of sustained attention, impulsivity and motor hyperactivity in favor of a unidimensional definition that stated that the child needed to exhibit eight or more from a list of fourteen symptoms that reflected all three dimensions. Diagnostic criteria for this definition appears in Table 2. DSM-IV made the most recent change in the definition of ADHD (American Psychiatric Association, 1994) by utilizing a two-dimensional approach. These two dimensions include attention and hyperactivity-impulsivity. The criteria for diagnosis were at least six of nine symptoms in each of the two dimensions. This definition also provided for three subtypes depending on whether hyperactivity was exhibited or not. Diagnostic criteria for this definition appears in Table 3.

Medical practitioners generally use one of three sources to address the medical needs of children exhibiting symptoms of ADHD. The first is the Diagnostic Statistics Manual – 4<sup>th</sup> Edition. The essential feature of ADHD, according to DSM-IV is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development. Based on the results of this review of symptom pathology, one of three subtype diagnoses can be made. They include Attention-Deficit/Hyperactivity Disorder, Combined Type, Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type, and Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type. There is also a diagnosis of Attention-Deficit/Hyperactivity Disorder Not Otherwise Specified for

Table 2

Diagnostic Criteria of Attention Deficit Hyperactivity Disorder According to DSM-III-R

Note: Consider a criterion met only if the behavior is considerably more frequent than that of most people of the same mental age.

- A. A disturbance of at least six months during which at least eight of the following are present:
- (1) often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)
  - (2) has difficulty remaining seated when required to do so
  - (3) is easily distracted by extraneous stimuli
  - (4) has difficulty awaiting turn in games or group situations
  - (5) often blurts out answers to questions before they have been completed
  - (6) has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g., fails to finish chores
  - (7) has difficulty sustaining attention in tasks or play activities
  - (8) often shifts from one uncompleted activity to another
  - (9) has difficulty playing quietly
  - (10) often talks excessively
  - (11) often interrupts or intrudes on others, e.g., butts into other children's games
  - (12) often does not seem to listen to what is being said to him or her
  - (13) often loses things necessary for tasks or activities at school or at home (e.g., toys, pencils, books, assignments)
  - (14) often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking) e.g., runs into street without looking

Note: The above items are listed in descending order of discriminating power based on data from a national field trial of the DSM-III-R criteria for Disruptive Behavior Disorders.

B. Onset before the age of seven.

C. Does not meet the criteria for a Pervasive Developmental Disorder.

Criteria for severity of Attention-deficit Hyperactivity Disorder:

Mild: Few, if any, symptoms in excess of those required to make the diagnosis and only minimal or no impairment in school and social functioning.

Moderate: Symptoms or functional impairment intermediate between "mild" and "severe".

Severe: Many symptoms in excess of those required to make the diagnosis and significant and pervasive impairment in functioning at home and school and with peers.

Table 3

Diagnostic Criteria for Attention Deficit/Hyperactivity Disorder According to DSM-IV

## A. Either (1) or (2):

- (1) six (or more) symptoms of inattention having persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level

## Inattention

- (a) often fails to give close attention to details or makes careless mistakes in school work, work, or other activities.
  - (b) often has difficulty sustaining attention in tasks or play activities
  - (c) often does not seem to listen when spoken to directly
  - (d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
  - (e) often has difficulty organizing tasks and activities
  - (f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
  - (g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)
  - (h) is often easily distracted by extraneous stimuli
  - (i) is often forgetful in daily activities
- (2) six (or more) symptoms of hyperactivity-impulsivity having persisted for at least six months to a degree that is maladaptive and inconsistent with developmental level

## Hyperactivity

- (a) often fidgets with hands or feet or squirms in seat
- (b) often leaves seat in classroom or in other situations in which remaining seated is expected
- (c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- (d) often has difficulty playing or engaging in leisure activities quietly
- (e) is often "on the go" or often acts as if "driven by a motor"
- (f) often talks excessively

## Impulsivity

- (g) often blurts out answers before questions have been completed
- (h) often has difficulty awaiting turn
- (i) often interrupts or intrudes on others (e.g., butts into conversations or games)

- B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were Present before age 7 years.
- C. Some impairment from the symptoms is present in two or more settings (e.g., at School [or work] and at home).
- D. There must be clear evidence of clinically significant impairment in social, Academic, or occupational functioning.
- E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not Better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

disorders with prominent symptoms of inattention or hyperactivity-impulsivity that do not meet criteria for Attention-Deficit/Hyperactivity Disorder. Unlike mental retardation and learning disabilities, which require formal cognitive tasks for diagnostic assessment, the DSM-IV continues to define ADHD in purely symptomatic terms despite the assumption that it is fundamentally a disorder of cognition (Conners, 1994).

The second source utilized by medical practitioners in the diagnosis of ADHD is the International Classification of Diseases, Ninth Revision, Clinical Modification – Third Edition (Practice Management Information Corporation, 1989). In this manual, Attention-Deficit Hyperactivity Disorder is listed as one of the underlying disorders of Hyperkinetic Syndrome of Childhood along with Hyperkinesis with Developmental Delay, Hyperkinetic Conduct Disorder, Other Specified Manifestations of Hyperkinetic Syndrome and Unspecified Hyperkinetic Syndrome. Criteria for the diagnosis of ADHD are reflected in Table 4.

Finally, Taber's Medical Dictionary (Thomas, 1985) describes Attention-Deficit Hyperactivity Disorder as:

a disease of infancy or childhood characterized by developmentally inappropriate inattention, impulsivity, and hyperactivity. The children do not persist with tasks and problems, and they have difficulty organizing and completing work. Their schoolwork is performed impulsively and is sloppy; and is full of oversights such as omissions, insertions, and misrepresentation of easy items. The children appear not to listen or not to have heard what was said. The hyperactivity component is characterized by the children being unable to sit still and by



Table 4

Diagnostic Criteria for Hyperkinetic Disorders According to the International Statistical Classification of Diseases and Related Health Problems

F90. A group of disorders characterized by an early onset (usually in the first five years of life), lack of persistence in activities that require cognitive involvement, and a tendency to move from one activity to another without completing any one, together with disorganized, ill-regulated, and excessive activity. Several other abnormalities may be associated. Hyperkinetic children are often reckless and impulsive, prone to accidents, and find themselves in disciplinary trouble because of unthinking breaches of rules rather than deliberate defiance. Their relationships with adults are often socially disinhibited, with a lack of normal caution and reserve. They are unpopular with other children and may become isolated. Impairment of cognitive functions is common, and specific delays in motor and language development are disproportionately frequent. Secondary complications include dissocial behavior and low self-esteem.

Excludes: Anxiety Disorders  
Mood (Affective) Disorders  
Pervasive Developmental Disorders  
Schizophrenia

F90.0 Disturbance of activity and attention

Attention deficit:

- Disorder with hyperactivity
- Hyperactivity disorder
- Syndrome with hyperactivity

Excludes: hyperkinetic disorder associated with conduct disorder

F90.1 Hyperkinetic conduct disorder

Hyperkinetic disorder associated with conduct disorder

F90.8 Other hyperkinetic disorders

F90.9 Hyperkinetic disorder, unspecified

Hyperkinetic reaction of childhood or adolescence NOS  
Hyperkinetic syndrome NOS

excessive running and climbing. The activity tends to be haphazard, poorly organized and not goal-directed. (p. 153)

Much of the recent medical evidence on the neurobiological mechanisms underlying ADHD points to a possible frontal lobe dysfunction in the brain. According to Jordan (1994): "Neurological substrates of ADHD can be explored on two global levels: structure (anatomy) and function (physiology). To date there is no clear evidence of neuroanatomical abnormalities in the brains of ADHD children based on computerized tomography scans" (p. 29). On the other hand, there may be an absence of the typical right frontal lobe size advantage in ADHD children as seen on magnetic resonance imaging (MRI) scans (Hynd, Semrud-Clikeman, Lorys, Novey & Eliopoulos, 1990). Although the neurobiological evidence is not definitive, much of the evidence points toward a frontal lobe dysfunction in the form of underarousal. From a medical perspective, the etiology of ADHD appears to be a neurotransmitter imbalance or defects in neural connections (Mercer, 1997). In their study of children with ADHD, Hynd et. al. (1991) found subtle differences in the brains of ADHD children with the corpus callosum appearing smaller than in children who had not been diagnosed with ADHD. The same researchers also found that children with ADHD differed from other children in the width measure of the right frontal region, pointing to a deviation in the expected pattern of asymmetry.

Educational Definitions of ADHD. The relationship between ADHD and academic underachievement has long been acknowledged within educational settings. When the U. S. government tried to clarify the disparate definitions of ADHD, academic deficits were most often cited as one of the ten most commonly identifiable

characteristics of ADHD (Marshall, et. al., 1997). Children diagnosed with ADHD experience great difficulty in the educational setting where demands for attention and impulse and motor control are primary requirements for success. Thus ADHD may not interfere with the cognitive ability to learn, but it does impact the use of these abilities to acquire knowledge. Silver (1990) noted that a learning disability affects the brain's ability to learn, while ADHD interferes with the child's availability to learn. Similarly, Korkman and Pesonen (1994) found that children with ADHD were impaired in impulse and inhibition control, while children with learning disabilities were impaired in phonological awareness, verbal memory span, and storytelling ability. Generally, ADHD diagnosis is revealed in terms of one or more of the following educational performance tasks (Shin, 1998): starting tasks, staying on task, completing tasks, making transitions, interacting with others, following through on directions, producing work at consistently normal levels, and organizing multi-step tasks.

The ADHD child frequently comes to clinical attention in an educational setting due to specific behavior problems that conflict with the requirements of the classroom environment. Some of these problems include the following: talking excessively, having difficulty remaining seated, blurting out answers to questions without waiting to be called upon, and having problems finishing assignments (Jordan & Goldsmith-Phillips, 1994). Additional problems may be created by difficulties with intersensory integration, sequencing, and recall (Koppitz, 1977). The diagnosis of ADHD is often made if the child has a history of these and related behavioral impairments if the problems cannot be attributed to extraneous causes, such as head injury or chaotic family circumstances (Pennington, 1991).

## History of ADHD

In the 1930's, an Oregon physician by the name of Charles Bradley reported using a stimulant medication (Benedrine) to calm the behaviors of hyperactive children. Children were being diagnosed with Minimal Brain Damage, and later with Minimal Brain Dysfunction as far back as 1947. At this time, hyperactivity was a primary characteristic, and it was hypothesized that hyperactivity was a disorder of the central nervous system. When research failed to support that hypothesis, the diagnoses Hyperactive Child Syndrome and Hyperkinetic Reaction of Childhood were used (Armstrong, 1995). Later, primarily as the result of the work done by Virginia Douglas (1989), deficits in attention became the primary focus over hyperactivity or behavioral excesses.

Statistics regarding the prevalence of ADHD are problematic. Frick and Lahey (1991) in their review of the literature, state that the estimates of prevalence in typical school-aged children range from as low as 1% to as high as 12% depending on how the disorder is defined. Societal and situational norms also confound prevalence rates. In a survey conducted in England (Taylor and Sandberg, 1984), only two children out of 2,199 were diagnosed as hyperactive. Conversely, in a study in Israel, 28% of children were rated as hyperactive by their teachers (Margalit, 1983). And, in an earlier study conducted in the United States, teachers rated 49.7% of boys as restless, 43.5% of boys as having a "short attention span", and 43.5% of boys as "inattentive to what people say." (Werry and Quay, 1971).

Conservatively, Barkley (1990) estimates the prevalence of ADHD to be between 3% and 5%. The true impact of this disorder is clearer if researchers look towards other

statistics. Valentine (1995) cites data provided by the Drug Enforcement Administration which indicates that 1,758,000 grams of Ritalin were consumed in the United States during 1991. The next closest country in consumption was Canada with 160,000 grams. When the total world's use of Ritalin (over 80 other countries) is combined, it becomes evident that the United States uses three times more than the rest of the world combined. ADHD is the most commonly diagnosed condition of childhood (Epstein, et al., 1991) and accounts for approximately one-half of all referrals to child mental health clinics (Lerner and Lerner, 1991).

Despite the time, energy, resources attributed to and the prevalence of this disorder, medical practitioners and mental health providers continue to disagree about the appropriate method for diagnosing ADHD. McCormick (1998) believes that ADHD has been overdiagnosed because it is well known and because doctors often feel pressure from parents and teachers to make such a diagnosis. In his study, out of 54 children who were referred to his clinic with ADHD concerns, only 6 (11.1%) of the children received a diagnosis of ADHD which he contends is much lower than that seen in either large psychiatric centers or doctors' offices. Most of the other children in his study received other diagnoses including learning disabilities, internalizing disorders, communication disabilities, conduct/oppositional disorders, and family/psychosocial disorders.

Landau and Burcham (1995) recommend that ADHD assessments should focus less on stringent diagnostic criteria. Instead, it is recommended that the assessment objective for school psychologists is to determine the extent to which attentional problems are interfering with the child's academic, affective, and social needs, so that an

appropriate intervention plan can be developed. This reference provides guidelines that incorporate a problem-solving paradigm into the assessment process.

Concerns extend to children who are diagnosed with Attention-Deficit Hyperactivity Disorder that it is the responsibility of schools to provide a free and appropriate education for students with disabilities. Historically, there have been two vehicles in place to ensure that this is done. The first means is under the Individuals with Disability Act (IDEA). The purpose of IDEA is to ensure the rights and protections of children with disabilities and their parents; to assist public agencies in the provision of services; and to address and ensure effectiveness of these efforts. Attention Deficit Hyperactivity Disorder is not a specific category of disability under the Individuals with Disabilities Education Act. However, in 1991, a letter from the United States Department of Education to state school superintendents (1991) outlined ways in which children labeled ADD could qualify for special education services in public schools under existing laws. Most often services are provided under the funding category of "Other Health Impairment". According to this definition "Other health impairment" means having limited strength, vitality or alertness, due to chronic or acute health problems such as a heart condition, tuberculosis, rheumatic fever, nephritis, asthma, sickle cell anemia, hemophilia, epilepsy, lead poisoning, leukemia, or diabetes that adversely affects a child's educational performance."

Only recently (United States Department of Education, 1999), have new regulations further expanded the original definition to specifically include Attention Deficit Hyperactivity Disorder. Components of the necessary documentation to qualify to receive services under this definition include medical information from a licensed

physician who has diagnosed the student as having ADHD, as well as an individual evaluation of the student's specific educational strengths, weaknesses and academic functioning. Following this diagnosis and evaluation, information provided by a multidisciplinary team of professionals then determines if the impairment significantly interferes with the student's learning so that the child requires special education services. If it is determined that special education services are required, an Individualized Education Plan (IEP) is then developed to address the student's needs. It has been debated that Attention-Deficit Hyperactivity Disorder should be a separate category under IDEA. Some of the reasons for the failure to include such a category may stem from the lack of a clear and accepted definition of ADHD. Also, several national educational and civil rights groups have opposed such a category by arguing that the creation of the category will invite opportunities for abuse and for a disproportionate number of students to be referred to special education, specifically those of culturally different backgrounds (Reid, 1995; Moses, 1990).

Another vehicle for providing services for students diagnosed with Attention-Deficit Hyperactivity Disorder is Section 504 of the Rehabilitation Act of 1973 (Kalan, 1993). Students with ADHD who do not meet eligibility criteria for special education programs may still qualify for educational modifications under this law. The definition of a disability according to this Act is broader than IDEA and provides that accommodations for the student's disability will be provided in the regular classroom if it is determined that the behavioral characteristics of ADHD are substantially interfering with the student's learning. In this case, an Individualized Accommodation Plan (IAP) will be developed.

Historically, clinical research on attention disorders in children has been dominated by ADHD studies. This research has generally found that the component of attention which is impaired is in the sustained dimension. However, debate is still ongoing as to whether ADHD is a deficit in attention, a deficit in persistence, or a sensitivity to consequences (Douglas, 1989; Barkley, 1988).

According to Lyon (1994), there is a promising clinical differentiation underway recently in research on the subtypes of attention deficit disorder assessing those children with and without significant hyperactivity. Research to date suggests that those without hyperactivity may have a disorder of attention, while those children with hyperactivity have an impairment in the sustained component and in response inhibition.

In terms of the broad issue of biological versus environmental factors, there are a number of studies which measure physical maladies, such as chronic disease against environmental factors. These studies also measure the perinatal influences and dietary sensitivities in arriving at a diagnosis of ADHD. The Ontario Child Health Study examined the relative contribution of biological versus environmental factors in ADHD by analyzing the characteristics of children both with and without ADHD. The study subjects were randomly selected from the general population. Findings indicated that developmental problems were 1.8 times as common in ADHD children as in children without ADHD. In addition, children with ADHD were 1.9 times as likely to have a chronic health problem as children without ADHD, and ADHD children were more likely to live in an urban environment (Szatmari et. al., 1989). Researchers felt the data lent credence to theories that ADHD has a biological causation.



### Problems with ADHD Diagnosis

It seems with each new edition of DSM, there has been a change in the definition of ADHD that would include more children. Goodman and Poillion (1992) state:

The field [ADHD] has shifted from a very narrow, medically based category to a much broader, more inclusive and more subjective category... In the past, this could be because the characteristics of ADD have been subjectively defined by a committee rather than having been developed on the basis of empirical evidence.

(p. 38)

A recent consensus statement issued by a panel of experts brought together by the National Institutes of Health (1998) illustrated this problem. They stated that their findings showed that there was a wide variation among types of practitioners with respect to frequency of diagnosis of ADHD. Their data indicated that family practitioners prescribe medication for diagnosed ADHD children more frequently than psychiatrists or pediatricians. Also pediatricians, family practitioners, and psychiatrists tend to rely on parent rather than teacher input in the diagnosis of ADHD. Input is usually in the form of parent perceptions of the child's behavior as indicated by completing rating scales.

Comorbidity with other disorders also compounds the problem of differential diagnosis. Dawson (1996) acknowledges rates of comorbidity are high in students with attention disorders. DSM-IV acknowledges that particularly in early childhood, it may be difficult to distinguish symptoms of ADHD from age-appropriate behaviors in active children. DSM-IV also notes symptoms of inattention are common among children with low IQ who are placed in academic settings that are inappropriate to their intellectual ability. Inattention may also occur when children with high intelligence are placed in

academically understimulating environments. In addition, individuals with oppositional behavior may resist work or school tasks that require self-application because of an unwillingness to conform to others' demands. These symptoms must be differentiated from the avoidance of school tasks seen in individuals with ADHD. DSM-IV goes on to state that ADHD should not be diagnosed if the symptoms are better accounted for by another mental disorder. Specifically, DSM-IV notes a substantial proportion of children referred to clinics with ADHD also have Oppositional Defiant Disorder or Conduct Disorder. There may also be a higher prevalence of Mood Disorders, Anxiety Disorders, Learning Disorders, and Communication Disorders in children with ADHD. One-half of all children with ADHD are comorbid for conduct disorder and/or opposition-defiant disorder (Landau & Burcham, 1995). A study conducted by Riccio, Hynd, Cohen, Hall and Molt (1994) assessed a group of subjects who had met the diagnostic criteria for central auditory processing disorder. Results indicated that the incidence of ADHD (50%) in this sample exceeds that found in a normal population.

Attention-Deficit Hyperactivity Disorder has been characterized as a pervasive disorder in that it affects all aspects of an individual's life. DSM-IV discusses associated features which may include low frustration tolerance, temper outbursts, bossiness, stubbornness, excessive and frequent insistence that requests be met, mood lability, demoralization, dysphoria, rejection by peers, and poor self-esteem. Academic achievement is often impaired and devalued, typically leading to conflict with the family and school authorities. Inadequate self-application to tasks that require sustained effort is often interpreted by others as indicating laziness, a poor sense of responsibility and oppositional behavior. Family relationships are often characterized by resentment and

antagonism, especially because variability in the individual's symptomatic status often leads parents to believe that all the troublesome behavior is willful. Individuals with ADHD may obtain less schooling than their peers and have poorer vocational achievement. It is often difficult to separate ADHD from other problems that the individual may be experiencing given the pervasiveness with which ADHD may be affecting their lives.

ADHD diagnosis is similar to the process for other disorders where there is no accepted diagnostic test. Generally, clinicians are required to rely on information supplied by parents or teachers in the form of a statement of the presenting problem. This initial description is followed by a detailed history of the child. As part of the history, parents are asked to provide information on the child's school history. Generally, a diagnosis of ADHD is made if the information obtained is consistent with the DSM-IV behavioral criteria, if the onset of symptoms is prior to age seven, and if some impairment from the symptoms is evident through problems in social, academic or occupational functioning.

One of the problems associated with the diagnosis of ADHD is that the diagnosis itself may be quite variable. For a diagnosis of ADHD, a child must exhibit at least eight symptoms from a list of fourteen symptoms. Cratty (1997: 72) believes "There is a lot of uncertainty as to which eight need to be diagnosed. For conduct disorders, there is also a list of thirteen different symptoms, and a child has to have only three. There is variability in that diagnosis as well." Similarly, Mercer (1997) argues:

Estimates of incidence or prevalence must be viewed with caution because of the assessment methods used to identify ADHD. Various

assessment procedures are used, such as direct observation, neurological exams, and rating scales. Different scales yield different results, and the person who completes the scale can also affect results (e.g. teachers tend to give lower ratings than parents do) (p.87).

In addition, there is a great diversity embedded within the ADHD diagnosis, since ADHD refers to a range of behavioral and cognitive characteristics (Shaywitz, Fletcher & Shaywitz, 1995). Shin (1998) argues that there is no simple way to diagnose ADHD because ADHD is complicated and requires an assessment which is “much like putting together a puzzle.”

A further complication in the diagnosis of ADHD is associated with the issues over the use of stimulant medication. “Without well-founded diagnostic criteria, there is an increased risk that stimulant medication will be used inappropriately” (Wong, 1998: 96). Wong (1998) believes that medication trials should be attempted only when professionals are convinced that the attention problem is serious and is likely to continue even in the face of available behavioral therapy.

#### Methods Utilized to Diagnose and Measure ADHD

There are a number of methods used in the diagnosis of ADHD. Some of these methods include rating scales, direct observation, interviews, Continuous Performance Tasks (CPTs), neuropsychological measures, and neurological measures.

Rating Scales. One of the most common methods for diagnosing ADHD utilizes standardized rating scales. Dykman, et al. (1993) identified 42 rating scales that had been used to describe or diagnose children with ADHD. Such rating scales have their advantages and limitations. One advantage is that they allow practitioners to determine

the degree to which a child exhibits certain characteristics relative to same-age and same-gender students. In addition, they collapse information across situation and time, and provide insight into concerns experienced by those individuals who work and live with a child. Rating scales are also very cost effective when compared to more direct methods. However, rating scales also have limitations to their usefulness. Specifically, results represent only someone else's opinion and may not be factual. They do not identify strengths that the student may have and utilize. Rating scales must also be interpreted with caution as they are unable to identify misperceptions caused by distortions in memory, misunderstanding of scale items, and informant bias. Results may also be influenced by cognitive, social, emotional, or educational characteristics of the rater (Landau & Burcham, 1995).

Rating scales also have their disadvantages. Landau and Burcham (1995) warn that rating scales should be interpreted with caution as they do not portray the child's actual behaviors but, instead, the informant's impression of that behavior. Distortions of memory, misunderstanding of scale items, informant bias, as well as the cognitive, social, emotional or educational characteristics of the rater can influence the results of such scales. Valentine (1995) goes further and states that the technical diagnosis and assessment of ADHD amounts to nothing more than asking teachers and parents for their opinion and for all practical purposes really asks "Is this child a problem to you?" Since rating scales rely on the honest, unbiased perception of a child's behavior by either the child's parent and/or teacher, the validity of these rating scales cannot be definitive. A study conducted by Francis (1993) found that of 456 children in grades 2, 4 and 6, 96.5% of them were identified as ADHD when using the Conner's Teachers Rating Scales,

7.46% when using the ADHD Rating Scales, and 6.36% when using both scales. In yet another study conducted by Cohen, Riccio, and Gonzalez (1994) it was suggested that prevalence rates varied depending on whether teacher ratings alone, parent ratings alone, or a combination were used. The researchers also found a qualitative difference in children referred to a clinic setting as opposed to those identified as having ADHD in a public school setting.

Lambert, Sandoval and Sassone (1978) conducted a study where parent, teacher, and physician groups were asked to identify hyperactive children in a sample of five thousand elementary school children. Approximately five percent were considered hyperactive by at least one of the groups, while only one percent was considered hyperactive by all three groups. In another study, using a rating scale, mothers and fathers agreed only about 32 percent of the time on whether their child was hyperactive, and parent versus teacher ratings were even less related, since parents and teachers agreed only about 13 percent of the time (McGuinness, 1985).

Furthermore, Reid (1995) found that, in most instances, the normative use of rating scales for identification of ADHD with culturally different individuals appears to be inappropriate because of 1) the cross cultural differences among raters, and 2) the fact that culturally different students are not adequately represented in the norm groups. These weaknesses may result in the overidentification of culturally different students.

Some of the most common rating scales frequently completed by parents and teachers in assessing ADHD are shown in Table 5.

Table 5

Commonly Used Behavioral Rating Scales in Child and Adolescent Populations

| NAME   | PUBLISHER                                       | COMMENTS   |
|--|---|--|
| Conners Teacher and Parent Rating Scales                   | Multihealth Systems                             | Parent scales and teacher scales. Multiple versions. |
| Child Behavior Checklist (Achenbach & Edelbrock)           | University of Vermont, Department of Psychiatry | Parent scales and teacher scales.                    |
| Attention Deficit Disorders Evaluation Scale               | Hawthorne Educational Services                  | Home version and school version                      |
| Attention Disorders with or Without Hyperactivity (ACTeRS) | Meritech, Inc.                                  | Parent form and teacher form. Spanish version.       |

Direct Observation. Direct observation allows the examiner to observe the child in his or her natural setting and to contrast the child's behaviors with that of same-gender classmates engaged in the same activity. One of the advantages of this method is that the data collected during the observation will not only establish if a problem exists but also suggest a realistic level of performance to serve as the intervention objective. This method requires the examiner to observe the child in multiple settings and situations. Structured observations in different settings can provide useful information to determine functional variables. This information is critical in developing interventions. Specific examples of structured observations include small versus large group activities, teacher-directed versus self-paced academic seatwork, highly structured versus informal classroom settings, and restricted academic versus free play activities. Thus, the disadvantage of this method is that the evaluation process can be time consuming.

Interviews. Interviews with parents and teachers are an effective means of building rapport and for problem identification in the diagnosis of ADHD. Interviews highlight specific areas of concern about home-related problems as well as school problems. They also permit the examiner to determine potential reinforcers that parents and teachers consider most salient for the child and allow for an assessment of resource allocation. Interviews also become an intricate component in the development of intervention plans. Interviews with teachers, parents, the referred child, and relevant others are extremely important in this assessment process. Interviews can help to obtain a history of relevant events, can specify perceptions about the primary problems, and can determine the assessment times and goals. The interview can also provide descriptive



information about the child in his or her interactions with different tasks and in different settings.

Continuous Performance Tests (CPT's). Various computer-driven methods to assess attention have recently received much attention in professional literature. Numerous versions of the Continuous Performance Task (CPT) have been marketed as a way to quantify attention abilities in a lab setting. The efficiency of such methods is appealing. However, there are several inherent limitations which should be kept in mind. The strongest disadvantage is one of ecological validity. Knowing a child's performance on one or more of these types of assessments provides little understanding of how the child functions in the classroom. Trommer, Hoepfner, Lorber and Armstrong (1988) compared the results of neurological testing and a continuous performance test administered to a group of children. Their data suggested that CPT's may yield both false negative and false positive results.

Neuropsychological Measures. Another method used to assess ADHD is direct performance based measurements also known as mental control tests. These assessment tools were originally designed as a quick way to evaluate brain injured patients at their bedside. They were quick and needed little or no materials. The objective was to verify whether the patient was able to concentrate on a simple task demanding some mental effort. The tests had a certain face validity, as they demanded concentration and effort. However, Whyte (1992) and others have shown that attention is not a unitary function, but, rather, can be broken into different components, each of which can be impaired selectively. Various assessment tools contend that they measure some or all aspects of attention (i.e., vigilance, capacity, shifting, etc.). These tools usually take the form of

various stimulus presentation paradigms and task performance criteria which result in a dependent measurement. The accuracy scores are often combined with timed measurements.

Neuropsychologists use these tests alone or in combination with each other to come up with direct measurements of attention. Landau and Burcham (1995) caution the use of neuropsychological measures by stating that the ecological validity of such measurement devices is questionable. As with CPT's, neuropsychological measures contribute little to an understanding of how the child functions in the classroom.

#### Neurological Research into Attentional Components of ADHD

One area focused on data related to attention which has made great strides is that of neurological research. Neurological studies have established that the attentional system makes it possible to screen irrelevant sensory input from the myriad of incoming stimuli, attend to meaningful stimuli, and maintain the flexibility to switch to alternative stimuli when conditions demand it. Thus, attention is directly related to planning for ongoing behavior. It is in this aspect of attention that the frontal lobes are crucial. Luria (1973), states that frontal lobe lesions violate the physiological basis underlying the regulation of the higher, specifically human, forms of attention. In their review, Stuss and Benson (1987) state that early research on monkeys with bilateral frontal lobe lesions suggested a deficit of memory but subsequent work suggested that the deficit was more parsimoniously interpreted as an attentional disorder. The frontal lobes appear to be most important in maintaining attention over time, organizing information into workable chunks, and preventing distractions (Brody and Pribram, 1978; Fuster and Bauer, 1974; Kojima and Goldman-Rakic, 1982; Pribram and Tubbs, 1967; Suzuki and Azuma, 1977).

In his review of clinical, neuropsychological, and electroencephalographic studies, Mattes (1980) speculated that the frontal lobes anterior and medial to the precentral motor cortex were dysfunctional in children with ADHD. Articles written providing data that supports this speculation include Gorenstein & Newman (1980); Gualtieri & Hicks (1985), and Chelune, Ferguson, Koon & Dickey (1986).

Hynd and his colleagues (1990) used MRI to assess the brains of children with dyslexia, children with ADHD, and normal control children. They found that children with ADHD did not demonstrate the typical right frontal asymmetry found in the control group. Children with both ADHD and dyslexia had significantly smaller right frontal widths when compared to the control group. Furthermore, children with ADHD had only equal symmetry. Similarly, Mostofsky, Reiss, Lockhart and Denckla (1998) used MRI methods to investigate cerebellar structure in ADHD boys and found abnormal inferior posterior vermal size suggesting that dysfunction within this region of the cerebellum may underlie clinical deficits seen in individuals with ADHD. Lou and his colleagues (1989) employed regional cerebral blood flow/computed tomography in examining brain metabolic activity in children with ADHD. They charted the distribution of a radioactive trace element in the brain using CT and pinpointed that it was the right striatum (a subcortical region involving the caudate) that was deficient metabolically. The lowered level of metabolic activity was normalized when methylphenidate was administered. Those areas identified project to the frontal lobes and participate in initiating and regulating motor activity. They hypothesized that children with ADHD cannot inhibit responses to stimuli; thus there is a failure to inhibit responses to novel environmental stimuli that are not the central focus of attention. Positron emission tomography (PET)

studies in adults with ADHD have further demonstrated a decrease in glucose utilization throughout the brain, a decrease more pronounced in the frontal lobe (Zametkin, et al, 1990). In addition, an investigation by Trommer, Hoepfner, Lorber and Armstrong (1988) implied a dysfunction of the frontal-striatal axis as the neuroanatomical basis of ADHD in children.

Research on the use of medication to treat Attention Deficit Hyperactivity Disorder also supports the contention that ADHD is neurological in nature. Byrne, Bawden, Harry, DeWolfe and Beattie (1998) found that after preschoolers received treatment with stimulant medication, they improved their behavior as shown with various rating scales as well as improved performance on direct measures of attention. Hynd, Voeller, Hern and Marshall (1991) explained the effectiveness of certain medications. They state that certain medications increase the amount of available catecholamines in the brain, thereby increasing the inhibitory effects of nerve cells served by the catecholamines. Catecholamines are neurotransmitters that control attentional systems. They are involved in neural circuits controlling motivation and motor behaviors including activity level, restlessness and responsivity which are frequently found to be deficient in children with ADHD.

In contrast to positive findings in neurological studies, there have also been problems associated with neurological studies of ADHD children. According to Wong (1998),

There is data suggesting that the utility of neurological tests of frontal lobe functioning in detecting ADHD may be limited. In a review of nine tests there were only two tests which predicted the

presence of ADHD. However, although scores on these two tests predicted the presence of ADHD, a normal score on the tests did not predict the absence of ADHD (p.82).

Although there are several promising areas of neurological research that are beginning to identify specific brain structures implicated in ADHD, a number of neurological tests for ADHD cannot be considered definitive in the diagnosis of this attention disorder.

## CHAPTER III

### Methods

#### Chapter Overview

The purpose of the present study was to evaluate the use of two different methods which are used to measure attention in children and adolescents and in turn, assist clinicians in making or refuting a diagnosis of Attention Deficit Hyperactivity Disorder. The two methods evaluated were: 1) rating scales (representative of indirect measures) and 2) performance based measures (representative of direct measures). The Behavior Assessment System for Children (Parent Rating Scale) was utilized as an example of the rating scale method. A collection of six performance based measures which claim to measure different aspects of attention were used as performance based measures of attention. These included the following measures: Digit Span, Cancellation of Reoccurring Target Figures, Knox Cube Test, Stroop Word and Color Test, and Trails Making B. Included are sections on participants, procedures, materials, research questions, and statistical analysis.

#### Participants

Thirty-six children between the ages of 8 and 14 participated in this study. Participants were assigned to one of two groups. Participants who had been referred through the Child Guidance Centers or through a public school in Tulsa, Oklahoma, for comprehensive evaluations were in the Referred Group. These children had been referred for comprehensive evaluations because of difficulties they were having in school including attention problems and were being evaluated for assistance in determining the

etiology of these problems. The children in the Comparison Group attended a public school in Tulsa and were selected because they were successful in school and, according to their parents, had no suspected disabilities. Participants in the Referred Group were 22 children in grades 2 to 7, ranging in ages from 8 to 13 years ( $M = 10.76$ ,  $SD = 1.87$ ). In the Referred Group, there were 2 females ranging in age from 8 to 9 years ( $M = 8.75$ ,  $SD = .35$ ) and 20 males ranging in age from 7 to 13 years ( $M = 10.92$ ,  $SD = 1.84$ ). Participants in the Comparison Group were 14 children in grades 2 to 8, ranging in ages from 8 to 14 years ( $M = 10.91$ ,  $SD = 1.87$ ). In the Comparison Group there were 5 females ranging in age from 9 to 13 years ( $M = 10.70$ ,  $SD = 1.84$ ) and 9 males ranging in age from 8 to 14 years ( $M = 11.02$ ,  $SD = 1.98$ ). Table 6 provides information about sex, age and BASC Attention Subscale Score of the participants in the Referred Group and the Comparison Group. It is noted that the mean BASC Attention Subscale Score in the Referred Group is similar to that found for a clinical sample of ADHD students (Reynolds & Kamphaus, 1992).

### Materials

Six performance based measures were used in this study. These purport to measure the following aspects of attention: vigilance, capacity, divided and focused attention. An overview of each of these measures is provided below.

Cancellation of Recurring Target Figures. Two of the scores which make up the Attention-Concentration Index come from this test. This cancellation task requires a child to cross out a target figure. Two pages of figures, one each of 140 numbers and nameable geometric forms (10 each repeated 14 times). At the top of each page appeared one of the numbers or forms (the target stimulus), and the child was instructed to “cross

Table 6

Description of Participants : Referred Group and Comparison Group

|                         | <u>n</u> | Mean Age | Age Range  | BASC Attention <sup>1</sup> |
|-------------------------|----------|----------|------------|-----------------------------|
| <b>Referred Group</b>   |          |          |            |                             |
| Males                   | 20       | 10.93    | 7.41-13.50 | 71.3                        |
| Female                  | 2        | 8.75     | 8.50-9.00  | 67.0                        |
| Totals                  | 22       | 10.72    | 7.41-13.50 | 70.9                        |
| <b>Comparison Group</b> |          |          |            |                             |
| Males                   | 9        | 11.01    | 8.00-13.83 | 49.7                        |
| Females                 | 5        | 10.70    | 9.17-13.17 | 46.6                        |
| Total                   | 14       | 10.90    | 8.00-13.83 | 48.6                        |

Note. <sup>1</sup>Subscale T score mean.



this out every time you see one, as fast as you can.” The target stimulus was not named. These instructions were used for both pages. The child is timed using a stopwatch. However, time is not a factor in the scoring of this task. When the child has completed each task, the number of errors are counted and compared to age normative information. Based on these age norms, a standard score is derived. According to Zomeran and Brouwer (1994), the advantage to a cancellation tasks approach when compared to others, (i.e., Continuous Performance Test) is that these tasks are self-paced; the subject can determine his or her own rate of working and speed/accuracy trade-offs. This facilitates generalization of test findings to real life situations.

Knox Cube Test. The KCT is a non-verbal mental test which alleges to measure visual attention span and short term memory of children and adults. Dr. Howard Knox developed this test in the course of constructing a test battery for evaluating mental impairment among foreign speaking adults (Stone & Wright, 1980). Knox was a physician with the U.S. Public Health Service and his test battery was used to evaluate immigrants arriving at Ellis Island. There have been several versions of the test developed by different researchers since then.

The Knox Cube Test task requires the child to watch and repeat the actions of the examiner. Four one-inch cubes are placed in between the examiner and the child. The examiner and the child each hold a cube. The child is given only the instructions “Do what I do.” The examiner then taps the top of the cubes in a specific sequence. The child is supposed to tap the cubes in the same sequence. The sequences gradually increase in length. The final score is the number of tapping series performed correctly. The number correct is compared to age normative information and a standard score is derived.

This test is easy to administer. It has the advantage that results are not influenced by language development and/or educational exposure. It is also independent of culturally dependent factors.

Trails Making Test. The children's version of the Trails Making Test consists of two parts. Part A consists of 15 circles printed on a sheet of paper. Within each circle is a number from 1-15. The subject is asked to connect the circles with a pencil line as quickly as possible, beginning with the number 1 and proceeding in a numerical sequence. Part B consists of 15 circles numbered 1-8 and letters A to G. The task in Part B is to connect the circles, in sequence, alternating between numbers and letters. This task requires immediate recognition of the symbolic significance of numbers and letters, ability to scan the page continuously to identify the next number or letter in sequence, flexibility in integrating the numerical and alphabetical series and completion of these requirements under the pressure of time. Only the score for Part B is used. This score is derived from the number of seconds required to complete the task. This time is compared to age normative information and a standard score is derived.

Stroop Color and Word Test. The Stroop Color and Word Test developed from early experimental psychologists' observations that it takes longer for literate adults to call out the color names of colored patches than to read words and takes even longer to read printed color names when the print ink is in a color different than the name of the color word. The subject is presented with a page of items (5 rows, 20 items each) under three conditions. In the first condition, the subject is to read color names printed in black ink on white paper. In the second condition, the subject is asked to identify the color of ink in which non-word items are printed. In the third condition, the subject is asked to

identify the color of words which are printed in ink that is different than the word itself (i.e., the word red printed in blue ink). This last task requires the subject to sort information from his or her environment and to selectively react to this information. The final raw score is the number of items a subject correctly answers within 45 seconds in the last condition. This raw score is compared to age normative information and then calculated into a standard score.

Digit Span. This test comes from the Wechsler Intelligence Scales for Children – Third Edition (WISC-III). It consists of two subtests, Digits Forward and Digits Backward. In this task, the examiner reads aloud a series of number sequences. For each Digits Forward item, the subject repeats the numbers in the same order as spoken. For each Digits Backward item, the subject says the numbers in reverse order. Each item consists of two trials with each trial consisting of the same number of digits but utilizing different numbers. A single score is derived from the number of items recalled correctly. This raw score is compared to age normative information where a scaled score is derived. This scaled score is converted to a standard score for comparison purposes.

The above six performance based measurements of attention can be used individually to assess different aspects of attention (i.e., capacity, vigilance, etc.). The individual tests have a high degree of face validity in that they directly measure each aspect of attention. However, as with all cognitive assessment tools, their downfall is that they cannot filter out other cognitive traits. For instance, Digit Span, which purports to measure auditory capacity, also has been shown to measure short-term memory.

Behavior Assessment System for Children. The developers of this rating scale purport that it measures distinct dimensions of behavior and emotions that are easily

linked to the criteria in DSM-IV. The parent rating scale used in this study consists of 130 items that ask about the frequency of certain observable adaptive and problem behaviors in community and home settings. The results produce scores on twelve different subscales including attention. On the Parent Rating Scale, seven items load on the Attention Problems Subscale. Other clinical subscales include Hyperactivity, Aggression, Anxiety, Atypicality, Conduct Problems, Depression, Somatization and Withdrawal. Examples of these items include "Has a short attention span", "Completes home work from start to finish without taking a break", and "Is easily distracted."

According to the manual, the BASC was designed to facilitate the differential diagnosis and educational classification of a variety of emotional and behavioral disorders of children and to aid in the design of treatment plans. Advantages of using this rating scale include 1) identification of positive attributes, 2) demonstrated high internal consistency and test-re-test reliability, 3) validity checks to gauge the veracity and consistency of informants, and 4) high relevance for federal regulations concerning the diagnosis of severe emotional disturbance in a school setting. The manual also acknowledges disadvantages including the fact that the BASC is susceptible to response sets and to personal biases, such as antipathies or halo effects, on the part of the respondent.

The BASC Manual specifically states that it was designed to be useful for diagnosing Attention Deficit Hyperactivity Disorder. It also states that, in addition to being essential to the diagnosis of ADHD, the Attention Problems subscale may be of clinical interest on its own. There is some evidence that attention deficit without hyperactivity can be diagnosed reliably (Shaughency & Hynd, 1989). Correlational

studies reported a comparison with the Child Behavior Checklist (Achenbach, 1991) in which a comparison of Attention Scales of both rating scales resulted in a correlation of 0.78. In looking at the Conner's Parent Rating Scales (Conners, 1989), the correlation between the Learning Problems Scale of the CPRS and the Attention Scale of the BASC was 0.58. When used with a sample population of children who were already diagnosed with ADHD, the BASC had a mean T Score of 65.7 on the Attention Scale and a standard deviation of 7.4 (Reynolds & Kamphaus, 1992). The manual suggests that the Parent Rating Scale profile is somewhat more differentiated than the Teacher Rating Scale profile, indicating that parents are capable of identifying ADHD symptoms. When looking only at the Attention Scale, correlation between the parent rating scale and the teacher rating scale is 0.62.

Table 7 lists the assessment tools used and the aspects of attention that they are used to measure.

### Procedures

After having the research design approved by the Oklahoma State University Internal Review Board (See Appendixes A and B), data was collected for a Referred Group and a Comparison Group. Participants were administered both the BASC and six performance based measures. It is noted that the referred group also completed additional measures as part of a comprehensive evaluation.

The results from the neuropsychological screening was compared to scores obtained on the Behavior Assessment System for Children – Parent Rating Scales (BASC) (Reynolds & Kamphaus, 1992) which served as an example of rating scales used to assess the characteristics of ADHD, primarily attention.

Table 7

Instruments: Attentional Components and Test Names

| Attentional Component         | Test Name  |
|-------------------------------|--|
| Auditory and Visual Capacity  | Digit Span, Knox Cube Test<br>BASC Attention subscale  |
| Vigilance                     | Cancellation 592 <sup>1</sup> , Cancellation Diamond <sup>2</sup><br>BASC Attention subscale |
| Divided and Focused Attention | Trails Making B, Stroop Word & Color Test<br>BASC Attention subscale                         |

Note. <sup>1</sup>Cancellation of reoccurring target figures 592, <sup>2</sup>Cancellation of reoccurring target Diamond.

## Research Questions

Question One. Is there a significant difference in scores on the Attention Subscale of the BASC between the referred group and the comparison group? If the BASC is a valid and reliable tool for measuring attention, it is predicted there should be a significant difference between the mean BASC Attention Subscale scores for these two groups. The group mean for the referred group should be elevated when compared to the group mean for the comparison group indicating the referred group as a whole has significant problems of attention and the comparison group does not. The literature indicates that the BASC successfully differentiated ADHD from non-ADHD children (Reynolds & Kamphaus, 1992). It would be important to know if the BASC could distinguish between these two groups of subjects since rating scales are often used as a method for assessing ADHD.

Question Two. Is there a significant difference in scores on any of the performance based measures between the comparison group and the referred group? If these performance based measures are valid and reliable tools for measuring attention, it is predicted that there should be a significant difference between these two groups. The group means on each of the performance based measures for the referred group should show significant difficulties with these tasks when compared to the comparison group. The literature indicates that these performance based measures have commonly been used to measure aspects of attention. It would be important to know if these performance based measures could distinguish between these two groups of subjects since they are also used in assessing attention.

Question Three. What is the relationship between scores on the Attention Subscale of the BASC and the performance based measures in the referred group? Since both methods are used to measure attention, it is predicted that difficulties identified by one method should also be identified by the second method. This comparison will provide information about whether indeed they are identifying the same individuals as having attention problems.

Question Four. What is the relationship between scores on the Attention Subscale of the BASC and the performance based measures in the comparison group? Hypothetically, neither method should identify any subjects in the comparison group as having attention difficulties.

Therefore, the basic questions are designed not to answer which method (performance based measures and/or BASC) is better at diagnosing ADHD, but instead to determine whether or not the selected methods of diagnosis are identifying the same individuals as having attention problems.

### Statistical Analysis

The first step in the analysis of the data was to determine the Mean's (M) and Standard Deviation's (SD) for the Referred Group for the six performance based measures and for the BASC Attention subscale. This same process was repeated for the Comparison Group.

Between group differences in scores were assessed using a two-tailed  $t$  test for independent means. The relationship between variables within each group was assessed by examining the correlation between scores within each group. This required that the BASC Attention Subscale scores, which are given as T Scores, be converted to Standard



Scores and reversed scored such that now low scores on both measures indicate poor performance on the standard scale ( $M = 100$ ,  $SD = 15$ ). In addition, the amount of agreement between the BASC Attention Subscale score and each of the performance based measures were analyzed based on a clinical cut-off of 1.5 standard deviations below the mean.

Essentially, four comparisons were made. The first research question was tested by examining differences between the Referred Group and the Comparison Group in scores on the BASC Attention subscale. The second research question was tested by examining differences between the Referred Group and the Comparison Group in scores on the performance based measures. The third research question was tested by examining BASC Attention subscale scores and the six performance based measures scores within the Referred Group. The fourth research question was tested by examining BASC Attention subscale scores and the six performance based measures scores within the Comparison Group.

## CHAPTER IV

### Results

#### Chapter Outline

This chapter presents and analyzes the data collected from both an referred group of children who were referred for a comprehensive assessment including an assessment of attention problems (Referred Group) and a comparison group of children who according to parental report had never been diagnosed with ADHD (Comparison Group) and were not currently reported as having any school related problems. This chapter also describes the statistical procedures used for analyzing the data and the subsequent findings for each of the four major research questions. The findings relate to the overall purpose of the study which was to determine if performance based measures method and a rating scale method were actually identifying the same individuals as having attention problems. For purposes of the present study, it was hypothesized that if performance based measures and a rating scale method were measuring attention, then they should identify the same individuals as having attention problems.

#### Research Questions

Question One. Is there a significant difference in scores on the Attention Subscale of the BASC between the referred group and the comparison group? If the BASC is a valid and reliable tool for measuring attention, it is predicted there should be a significant difference between the mean BASC Attention Subscale scores for these two groups. The group mean for the referred group should be elevated when compared to the

group mean for the comparison group indicating the referred group as a whole has significant problems of attention and the comparison group does not.

Results: The results for research question one indicate that there is a statistically significant differences in scores on the Attention Subscale of the BASC between the Comparison Group and the Referred Group, with the Referred Group ( $M = 70.91$ ,  $SD = 7.08$ ,  $n = 22$ ) scoring significantly higher than the Comparison Group ( $M = 48.57$ ,  $SD = 9.13$ ,  $n = 14$ ). The means, standard deviations, and results of the two-tailed  $t$  test are located in Table 8.

Question Two. Is there a significant difference in scores on any of the performance based measures between the comparison group and the referred group? If these performance based measures are valid and reliable tools for measuring attention, it is predicted that there should be a significant difference between these two groups. The group means on each of the performance based measures for the referred group should show significant difficulties with these tasks when compared to the comparison group.

Results: Results for question two indicate that there were no significant differences in scores between the Comparison Group and the Referred Group for the performance based measures Cancellation of Reoccurring Target Figures 592, Cancellation of Reoccurring Target Figures Diamond, and the Stroop Word and Color Test. However, there were significant differences in scores between the Comparison Group and the Referred Group for the performance based measures Digit Span, Knox Cube Test, and Trails Making B, with the Referred Group performing significantly worse than the Comparison Group on all three measures. The means, standard deviations, and results of the two-tailed  $t$  test are located in Table 9.

Table 8

BASC Scores: Referred and the Comparison Group Means, SDs, and significance tests

| Subscale                      | Score          |       |                  |       | t    | p     |
|-------------------------------|----------------|-------|------------------|-------|------|-------|
|                               | Referred Group |       | Comparison Group |       |      |       |
|                               | Mean           | SD    | Mean             | SD    |      |       |
| Hyperactivity                 | 58.50          | 15.69 | 43.14            | 11.87 | 3.13 | 0.00* |
| Aggression                    | 56.23          | 15.87 | 46.08            | 12.17 | 1.98 | 0.06  |
| Conduct Problems <sup>1</sup> | 64.36          | 18.39 | 44.92            | 9.78  | 4.08 | 0.00* |
| Anxiety                       | 51.36          | 12.16 | 47.23            | 11.00 | 1.01 | 0.32  |
| Depression <sup>1</sup>       | 58.50          | 19.94 | 44.08            | 8.18  | 2.99 | 0.01* |
| Somatization                  | 51.57          | 15.26 | 44.15            | 11.19 | 1.52 | 0.14  |
| Atypicality <sup>1</sup>      | 55.27          | 17.80 | 41.77            | 5.18  | 3.33 | 0.01* |
| Withdrawal                    | 49.73          | 12.63 | 48.23            | 10.03 | 0.36 | 0.72  |
| Attention                     | 70.91          | 7.08  | 48.57            | 9.13  | 8.25 | 0.00* |
| Externalizing                 | 61.45          | 17.69 | 44.46            | 12.30 | 3.05 | 0.00* |
| Internalizing                 | 55.52          | 17.45 | 43.61            | 9.42  | 2.26 | 0.03* |
| Behavioral Index              | 61.91          | 18.09 | 43.38            | 10.87 | 3.34 | 0.00* |

Note. Referred Group ( $n = 22$ ), Comparison Group ( $n = 14$ ), \* $p < 0.05$ , <sup>1</sup>t test with separate variance estimates.

Table 9

Performance based Measures: Referred and the Comparison Group Means, SDs, and Significance tests

| Scale                         | Score          |       |                  |       | t     | p     |
|-------------------------------|----------------|-------|------------------|-------|-------|-------|
|                               | Referred Group |       | Comparison Group |       |       |       |
|                               | Mean           | SD    | Mean             | SD    |       |       |
| Digit Span                    | 89.55          | 12.14 | 103.57           | 13.65 | -3.22 | 0.00* |
| Cancellation 592 <sup>1</sup> | 102.36         | 12.97 | 103.57           | 10.55 | -0.29 | 0.77  |
| Cancellation DIA <sup>2</sup> | 97.73          | 15.64 | 102.36           | 10.12 | -0.98 | 0.33  |
| Knox Cube Test                | 93.68          | 27.35 | 118.00           | 23.32 | -2.75 | 0.01* |
| Trails Making B <sup>3</sup>  | 92.36          | 15.16 | 105.21           | 8.83  | -2.87 | 0.00* |
| Stroop Test                   | 100.55         | 8.11  | 103.50           | 6.53  | -1.15 | 0.26  |

Note. Referred Group ( $n = 22$ ), Comparison ( $n = 14$ ), \* $p < 0.05$ , <sup>1</sup>Cancellation of reoccurring target figures 592, <sup>2</sup>Cancellation of reoccurring target DIA, <sup>3</sup>t test with separate variance estimates.

Question Three. What is the relationship between scores on the Attention Subscale of the BASC and the performance based measures in the referred group? Since both methods are used to measure attention, it is predicted that difficulties identified by one method should also be identified by the second method. This comparison will provide information about whether indeed they are identifying the same individuals as having attention problems.

Results: The BASC Attention subscale was not significantly correlated to any of the performance based measures within the Referred Group (see Table 10). Furthermore, the amount of agreement of each performance based measure with the BASC Attention Subscale score ranged from 14% to 50% (see Table 12).

Question Four. What is the relationship between scores on the Attention Subscale of the BASC and the performance based measures in the comparison group? Hypothetically, neither method should identify any subjects in the comparison group as having attention difficulties.

Results: The BASC Attention subscale was not significantly correlated to any of the performance based measures within the Comparison Group (see Table 11). There are significant differences between the scores on the BASC Attention subscale and each of the performance based measures in the Comparison Group. Furthermore, there was a high degree of agreement between the BASC Attention Subscale scores and each of the performance based measures, ranging from 93% to 100%, indicating that the majority of individuals in this group did not demonstrate attention difficulties on any measures (see Table 12).

Table 10

Referred Group: Correlations

| Measure                          | 1  | 2   | 3    | 4    | 5    | 6    | 7    |
|----------------------------------|----|-----|------|------|------|------|------|
| 1. BASC Attention <sup>1</sup>   | -- | .02 | -.39 | .42  | -.04 | -.09 | -.21 |
| 2. Digit Span                    |    | --  | .22  | .04  | .42* | -.04 | -.39 |
| 3. Cancellation 592 <sup>2</sup> |    |     | --   | -.18 | .29  | .46* | .08  |
| 4. Cancellation DIA <sup>3</sup> |    |     |      | --   | .06  | .38  | -.26 |
| 5. Knox Cube Test                |    |     |      |      | --   | .33  | -.19 |
| 6. Trails Making B               |    |     |      |      |      | --   | .26  |
| 7. Stroop Test                   |    |     |      |      |      |      | --   |

Note.  $n = 22$ ,  $*p < .05$ , <sup>1</sup>BASC Attention subscale scores were reverse scored and converted to standard scores, <sup>2</sup>Cancellation of reoccurring target figures 592, <sup>3</sup>Cancellation of reoccurring target DIA.

Table 11

Comparison Group: Correlations

| Measure                          | 1  | 2   | 3    | 4    | 5    | 6    | 7    |
|----------------------------------|----|-----|------|------|------|------|------|
| 1. BASC Attention <sup>1</sup>   | -- | .06 | -.23 | .22  | .07  | -.34 | -.16 |
| 2. Digit Span                    |    | --  | .01  | .29  | .29  | .30  | .35  |
| 3. Cancellation 592 <sup>2</sup> |    |     | --   | -.00 | -.38 | -.11 | .16  |
| 4. Cancellation DIA <sup>3</sup> |    |     |      | --   | .35  | -.08 | .47  |
| 5. Knox Cube Test                |    |     |      |      | --   | .19  | -.33 |
| 6. Trails Making B               |    |     |      |      |      | --   | .18  |
| 7. Stroop Test                   |    |     |      |      |      |      | --   |

Note.  $n = 14$ ,  $*p < .05$ , <sup>1</sup>BASC Attention subscale scores were reverse scored and converted to standard scores, <sup>2</sup>Cancellation of reoccurring target figures 592, <sup>3</sup>Cancellation of reoccurring target DIA.



Table 12

Agreement Between the BASC Attention Subscale and Performance based Measures

| Measure          | Referred Group |          | Comparison Group |          |
|------------------|----------------|----------|------------------|----------|
|                  | Agree          | Disagree | Agree            | Disagree |
| Digit Span       | 7 (32%)        | 15 (68%) | 14 (100%)        | 0 (0%)   |
| Cancellation 592 | 4 (18%)        | 18 (82%) | 13 (93%)         | 1 (7%)   |
| Cancellation DIA | 5 (23%)        | 17 (77%) | 14 (100%)        | 0 (0%)   |
| Knox Cube Test   | 11 (50%)       | 11 (50%) | 14 (100%)        | 0 (0%)   |
| Trails Making B  | 6 (27%)        | 16 (73%) | 14 (100%)        | 0 (0%)   |
| Stroop Test      | 3 (14%)        | 19 (86%) | 14 (100%)        | 0 (0%)   |

Note. Referred Group ( $n = 22$ ), Comparison ( $n = 14$ ), Clinical cut-off = 1.5 SD (T score = 65, standard score = 78).

### Demographic Variables

There was no significant difference ( $t(34) = -.28, p > .05$ ) in age between the Referred Group ( $M = 10.72, SD = 1.87, n = 22$ ) and the Comparison Group ( $M = 10.90, SD = 1.87, n = 14$ ).

## CHAPTER V

### Discussion

The purpose of the present study was to evaluate the use of two different methods which are used to measure attention in children and adolescents and in turn, assist clinicians in making or refuting a diagnosis of Attention Deficit Hyperactivity Disorder. The two methods evaluated were: 1) a parent completed behavioral rating scale and 2) six performance based assessment measures. The Behavior Assessment System for Children (Parent Rating Scale) was used along with the following six performance based measures: Digit Span, Cancellation of Reoccurring Target Figures, Knox Cube Test, Stroop Word and Color Test, and Trails Making B.

Results from this study indicate there are significant differences in scores on the Attention Subscale of the BASC between the Comparison Group and the Referred Group indicating that the BASC is differentiating between the Comparison Group and the Referred Group in the measurement of attention. Also, some of the performance based measures are also differentiating between the Comparison Group and the Referred Group in the measurement of attention. Digit Span, Knox Cube Test, and Trails Making B showed significant differences. These results indicate that Digit Span, Knox Cube Test, and Trails Making B are differentiating between the Comparison Group and the Referred Group in the measurement of attention. However, there were no significant differences in scores between the Comparison Group and the Referred Group when the Cancellation of Reoccurring Target Figures 592 and Diamond and the Stroop Word and Color Test were utilized.

Other comparisons indicate that there is no relationship between the scores on the BASC Attention subscale and each of the performance based measures in the Referred Group. This finding indicates that scores on the BASC Attention subscale and each of the performance based measures appear not to be identifying the same individuals as having attention problems. The same held true for the Comparison group. There was also no relationship between the scores on the BASC Attention subscale and each of the performance based measured. Further analysis showed questionable agreement between measurements in the referred group when a cut-off score is established. Knox Cube Test had the highest degree of agreement (50%) and Stroop Word and Color Test had the lowest degree of agreement (14%). In the comparison group, there was a high degree of agreement between measurements. Only one subject out of fourteen showed disagreement on all of the measures.

In the context of previous research, the hypotheses advanced in the present study both supported other research and refuted previous findings. Supportive documentation showed that attention is a difficult and complicated concept (Moray, 1969; Posner, 1975; Wong, 1998). The relationship between ADHD diagnosis and academic underachievement which is supported in the literature (Koppitz, 1977; Pennington, 1991; Jordan, 1994; Korkman & Personen, 1994; Marshall, 1997, et.al., 1997; Shin, 1998), was also noted based on the results in the present study. Similarly, the present study produced results which join the debate over the finding that ADHD may be due to a deficit in attention, a deficit in persistence, or a sensitivity to consequences (Douglas, 1989; Barkley, 1989; Reid, 1995). The present study also produced results which support previous findings that rating scales should be interpreted with caution since they do not

necessarily portray the child's actual behaviors, but may portray the informant's impression of that behavior (Francis, 1993; Cohen, Riccio & Gonzalez, 1994; Landau & Burcham, 1995; Valentine 1995). Specifically, the literature suggests a relatively small amount of shared variance between clinic test scores and behavior rating scales (e.g., 5% to 15%) in most studies (DuPaul, et al., 1992). The results of this study support these previous findings.

Other findings that were drawn from this study show that some relationships were evident among the performance based measures. Digit Span appears to be related to the Knox Cube test which would support the contention that they both measure the same component of attention. The literature suggests that they both measure a form of capacity.

Additionally, some of the other subscales on the BASC were able to differentiate between the referred group and the comparison group. Significant differences were found for the Hyperactivity, Conduct Problems, Depression, and Atypicality subscales. This supports the literature that describes a high comorbidity rate in those diagnosed with ADHD.

The implications of these findings to practitioners and clinicians would be that they should proceed with caution when making a diagnosis of ADHD based on a single source of information as is currently common practice. Furthermore, it is recommended that a multimethod assessment approach be used for diagnosis and treatment. Best Practices in School Psychology – Third Edition states that efforts should be guided at developing interventions for the specific behaviors moreso than on applying a label. Teachers, clinicians, and school counselors in every school district should have agreed-

upon plans, including goals and objectives, to address methods and measures utilized in specific tests for attention levels in all school aged children. Attention should be viewed as a complex construct which is multidimensional and which involves several components. Finally, there is a distinct need for clinicians and researchers to develop a unifying theory of attention in order to more accurately assess current ADHD diagnosis in children.

Until a unifying and multidimensional theory of attention is developed and both rating scales and performance based measure tests are used in conjunction with one another, numerous children will continue to be misdiagnosed with ADHD. As evidenced by the increased number of prescriptions for Ritalin, the drug of choice in treating ADHD in children, misdiagnosis of ADHD currently continues to be a problem demanding a solution.

There are limitations to the usefulness of the findings of this research study. A larger number of subjects would increase the likelihood that these findings could be generalized to a larger population. Also, results from comprehensive evaluations were not considered. It was noted that 50% of those subjects who had elevated attention scales also had other elevated scales lending support to the possibility that their attention problems could have arise due to other psychopathology. Additionally, the small sample size limited the statistical power of the analyses.

Directions for future research are indicated. Recommendations include the need to conduct further studies in order to see if the findings of the present study can be replicated. As mentioned replication of this study would be improved using a larger number of subjects. It is also recommended that additional research be conducted to

further investigate additional components of attention assessment in the diagnosis of ADHD and in using other examples of direct and indirect measures. Correlations seem to indicate they are measuring different aspects of attention and thus all seem important.

Specific to this study, further investigation appears warranted into determining the usefulness of the vigilance tests examined. The cancellation tests used (592 and Diamond) did not appear to be useful in distinguishing between the two groups. Also, further research may prove to be helpful in identifying rating scale items that may be reflective of more specific constructs of attention such as vigilance, capacity and filtering.

In conclusion, assessment of attention continues to warrant further study. Until such time as researchers, clinicians and practitioners can arrive at a unified quantifiable definition and agreed upon diagnostic procedures, it remains a vague and putative disorder confounded by variables not within the control of those professionals. Given the prevalence and pervasive affects of labeling children with any disorder, further efforts should be made toward this end.

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# Appendix A

OKLAHOMA STATE UNIVERSITY  
INSTITUTIONAL REVIEW BOARD  
HUMAN SUBJECTS REVIEW

Date: February 23, 1996

IRB#: ED-88-078

Proposal Title: COMPARISON OF PERFORMANCE BASED ASSESSMENT AND NATURAL  
OBSERVATION METHODS IN THE DIAGNOSIS OF ATTENTION DEFICIT HYPERACTIVITY  
DISORDER

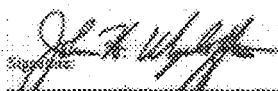
Principal Investigator(s): Paul Winters, Kelly Davis

Reviewed and Presented on: 2/23/96

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT  
NEXT MEETING, AS WELL AS ARE SUBJECT TO MONITORING AT ANY TIME DURING THE  
APPROVAL PERIOD.  
APPROVAL STATUS PERIOD VALID FOR DATA COLLECTION FOR A ONE CALENDAR YEAR  
PERIOD AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE  
SUBMITTED FOR BOARD APPROVAL.  
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Disapproval are as follows:



Chair of Institutional Review Board  
cc: Kelly Davis

Date: February 23, 1996

## Appendix B

OKLAHOMA STATE UNIVERSITY  
INSTITUTIONAL REVIEW BOARD

Date: May 23, 1999 IIRB #: IR-98-079

Proposal Title: "COMPARISON OF PERFORMANCE BASED ASSESSMENT AND NATURAL OBSERVATION METHODS IN THE DIAGNOSIS OF ATTENTION DEFICIT HYPERACTIVITY DISORDER"

Principal Investigator(s): Paul Warden  
Kelly Davis

Reviewed and Processed as: Continuation and Modification

Approval Status Recommended by Reviewer(s): Approved

Signature:



Carol Olson, Director of University Research Compliance

May 23, 1999

Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modification to the research project approved by the IRB must be submitted for approval. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Kelly J. Davis

Candidate for the Degree of

Doctor of Philosophy

Thesis: COMPARISON OF THE BEHAVIOR ASSESSMENT SYSTEM FOR  
CHILDREN AND PERFORMANCE BASED MEASURES OF ATTENTION

Major Field: Applied Behavioral Studies

Biographical:

Education: Graduated from Edison High School, Tulsa, Oklahoma in May, 1981; Received Bachelor of Science degree in Psychology from the University of Tulsa, Tulsa, Oklahoma in May, 1991. Completed the requirements for the Master of Science degree in Applied Behavioral Studies in Education in May, 1993. Completed the requirements for the Doctor of Philosophy in July, 2000.

Experience: Worked as a Research Assistant while attending the University of Tulsa. Completed an internship with rotations at a drop-out prevention program run by the state vocational department, an alternative school for Tulsa Public Schools, and a youth shelter run by Child Protective Services. Have been employed for the past five years as a state certified school psychologist at Union Public Schools in Tulsa, Oklahoma.

Professional Memberships: Acted as student liaison for the Oklahoma School Psychological Association. Past member of National Association of School Psychologists.